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THE HOW-TO HOMEBREW BEER MAGAZINE

SEPTEMBER 2020, VOL.26, NO.5

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by John Holl

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Twenty-five years ago, *Brew Your Own* magazine was created with the mission of helping homebrewers brew better beer. It's a big milestone, but what's the fun in celebrating alone? Instead, we invited five of our favorite craft breweries to bring their own anniversary beers to the party (which you can now clone, too!).

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by Stephen Stanley

60 FUNDAMENTALS OF STAINLESS STEEL CONICAL FERMENTERS

Conical fermenters provide a lot of options for homebrewers that other fermentation vessels don't. Explore the various uses, benefits, and best practices of stainless conicals from the man who helped popularize them in the homebrew market two decades ago.

by John Blichmann

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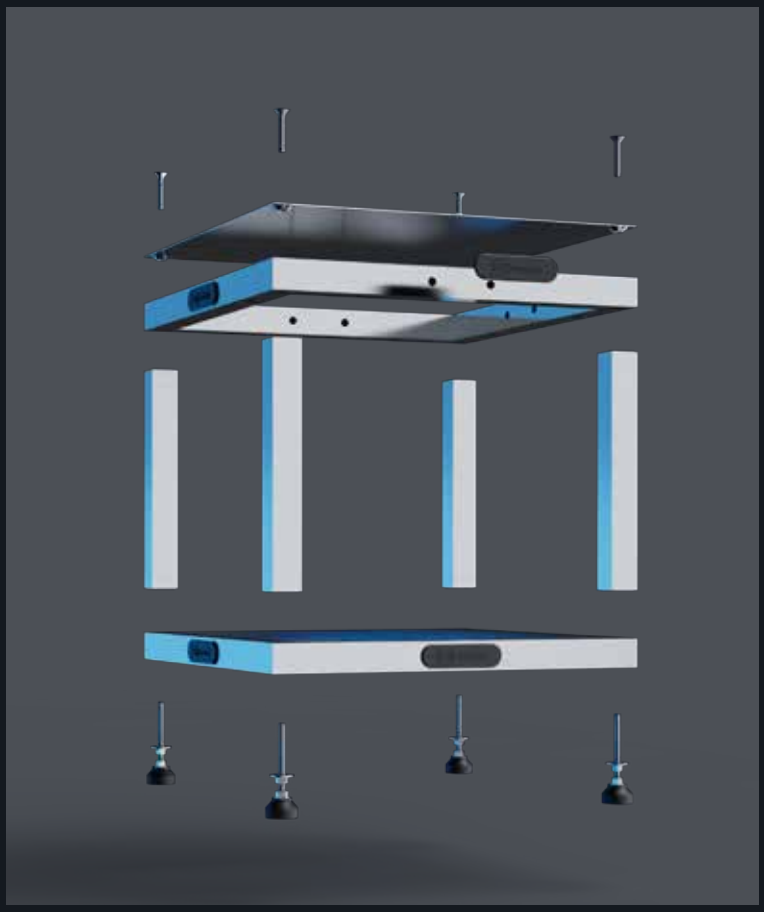

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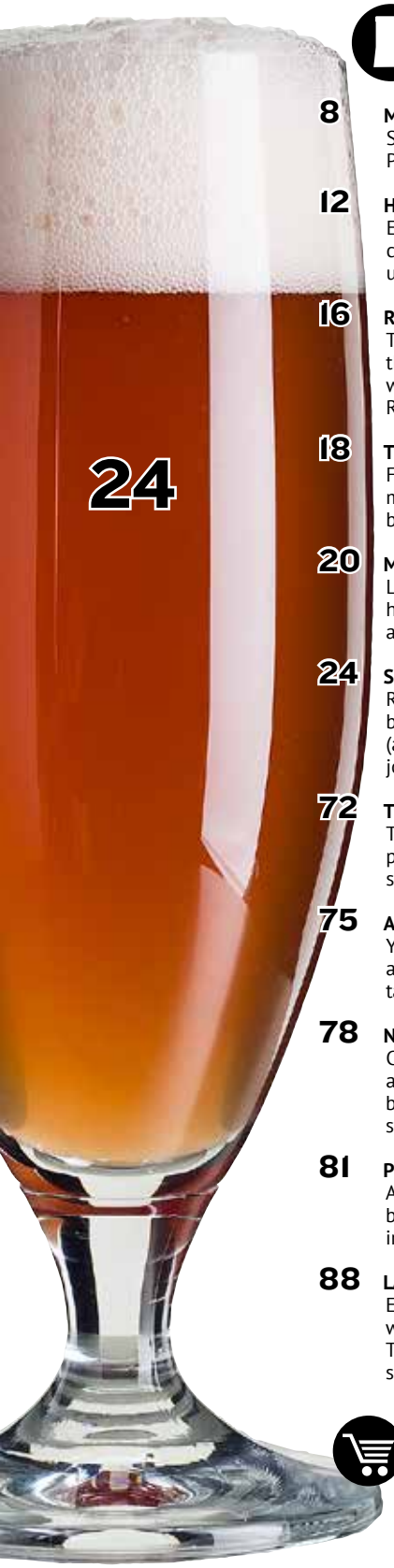

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RECIPE STANDARDIZATION

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.

Brew Your Own — THE HOW-TO HOMEBREW BEER MAGAZINE

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Charles A. Parker/Images Plus

Q Who was the most influential person to get you started down the brewing path?

In 1987 I was a college senior in Vermont having just returned from studying abroad during my junior year in Dublin, Ireland. In Dublin pints of Guinness and Smithwick's opened my eyes to beer that wasn't a macro lager. So when I got back to Vermont I wanted beer with some flavor and luckily Vermont's very first craft brewery, Catamount, had just started up production. I would carefully budget my beer purchases to allow for six packs of Catamount and also Sierra Nevada Pale Ale when I could find it. There was no turning back from full-flavored beer at that point. And not long after led to me starting to brew my own beer at home. So cheers to Catamount's founding brewer Stephen Mason and Sierra Nevada's founder Ken Grossman for jumpstarting my taste buds to want more from the beer in my glass back in the late 80s and giving me a desire to want to start brewing my own beer!

I'd have to say my dad. He bankrolled a Northern Brewer starter kit that we shared when I was a broke college student, and we did our first several batches together while I was home for the summer.

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American Trappists

Trappist beers have long been associated with tradition, excellence, and the monks who brew them in European monasteries. That changed in 2014 when Spencer Trappist Ale, the first Trappist beer brewed outside of European borders, was released by Spencer Brewery. Learn about the American Trappists. https://byo.com/article/american-trappists/

MEMBERS ONLY

Bring The Heat

There are many factors to consider when deciding between propane, natural gas, and electricity as a heat source for your homebrew. John Blichmann walks us through those considerations, plus the pros and cons of each. https://byo.com/article/bring-the-heat/

Brewing Water Adjustments

If you want to brew with water coming out of your tap, then you should probably get a water report from your local water district office or send a sample to get tested. Either way, you'll need to know how to read the report when it arrives. Learn some of the basics. https://byo.com/article/water-adjustments/

MEMBERS ONLY

Brewing With Rye

In case you didn't get enough advice on brewing with rye in this issue, we've got more helpful pointers from two professional brewers that handle this malt on a regular basis. For those that plan on trying to brew a recipe with rye, we recommend this read. https://byo.com/article/brewing-with-rye-tips-from-the-pros-2/

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MAIL

SPARGING WITH REVERSE OSMOSIS WATER

I have been using reverse osmosis (RO) water for all of my brews for a few years with fabulous results. This is due to the very high calcium content of our private well water. I used Bru'n Water to calculate my salt additions and have found its mash pH calculation spot on every time. The March-April 2020 cover story "Brewing with Reverse Osmosis Water" was very informative and an affirmation that my process is correct except for one portion. Mr. Strong says in his article that he acidifies all his RO water to a pH of 5.5. I brew on a 3 vessel e-HERMS (electric heat exchange recirculating mash system) setup and use straight RO water in my hot liquor tank to fly sparge with (also keeping the sparge temperature below 176 °F/80 °C, normally sparge with water at 168 °F/76 °C). It was my thought that RO water has no buffering capability so sparging with straight RO water would not cause an issue with tannin extraction.

Is there any additional information you can share to explain the need to acidify RO sparge water as indicated in the article?

Please keep up the good work to all of those involved with creating each magazine. I look forward to reading each issue.

Mike Sulock • *via email*

Story author Gordon Strong responds: "RO water indeed has no buffering capacity, as long as no minerals have been added to it. But it doesn't say what the pH of the water is. It's easy to assume that the pH of water is 7, but that's rarely the case. RO water will grab CO_2 from the air and the pH will change over time. So, working with my RO water, I measured what it would take to move the pH to a certain 5.5, which is what I talk about in the article. People should measure and test their own water to develop a repeatable scheme (which is what I did).

"If you are brewing with RO water, your mash has little buffering capacity and your sparge water has little buffering capacity, so the pH can change without much resistance. If the mash is around pH 5.1 and the sparge water is higher, the more you sparge, the more your mash will increase in pH.

"I was a little confused by talk about the buffering capacity of the sparge water, since it's the mash we're concerned about. If you

contributors

John Blichmann is the Owner and Founder of Blichmann Engineering, a design and manufacturing firm of brewing and wine-making products. He has more than 20 years of experience in product design (both mass-production and custom), testing, manufacturing, service, sales, marketing, and management, all gained while he worked at Caterpillar in a variety of positions and locations. He ultimately "retired" as an engineering supervisor to focus on the design of high-quality brewing equipment. Blichmann has been an avid homebrewer since 1991, a Beer Judge Certification Program judge, a regular *BYO* writer, and also speaks at different *BYO* events including the upcoming BYO Boot Camp in Denver, Colorado March 25–27, 2021 (see pages 68-71 for details).

In this issue, starting on page 60, John describes the advantages of stainless steel conical fermenters.

Stephen Stanley's first homebrewing challenge was to reproduce Kloster Weltenberger's Barok Dunkel after a trip to Germany. He's still working on it ten years later. He is a founding member and Education Chair of the Aurora City Brew Club in Aurora, Colorado. Steve is a Lean Six Sigma Black Belt, an engineer, and a process geek. His love is German beers, from the classic Pilsners to the sour wheat beers of northeastern Germany. A native Kentuckian, Stephen won a silver medal from the Great American Beer Festival for his Kentucky common with Wade Malsen, then Head Brewer of Ironworks Brewery.

In his first article for *BYO* starting on page 54, Steve shares practical insights into "seasoning" beer with brewing salts at or after packaging, and how to set up your own trials at home.

Dave Clark is a connoisseur of all things homebrew and craft beer. A former professional brewer with Hoppin' Frog Brewery of Akron, Ohio, Dave is a nationally-ranked member of the Beer Judge Certification Program and a Certified Cicerone. He has worked in all facets of the beer world from production to sales to marketing. Now a full-time writer, Dave authors stories about homebrew and craft beer, as well as music. A performing musician and songwriter, Dave believes there is a natural synergy between music and beer. Dave lives in Phoenix, Arizona with his wife, daughter, and six-tap kegerator that he keeps stocked full of his homebrew. He especially loves the fall season when his favorite style, Märzen, is readily available. Check out Dave's blog at www.brewsician.com.

On page 42 of this issue, Dave helps *BYO* celebrate 25 years of publication with anniversary clone recipes from five craft brewery favorites.

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MAIL

mix two solutions with no buffering capacity with different pH values, the combined solution will have a pH in between those. So if the sparge water is above pH 6, you can add enough that it will eventually raise the mash above 6, which is what we're trying to avoid. But it depends on the actual pH values and the amount you sparge.

"It's not a certainty that this will happen when you brew, but using my method will remove any chance that it could happen. One less thing to worry about."

BUFFALO MILK CHEESE

I saw an article *Brew Your Own* published on cheesemaking online and I'm interested in making quark and other types of cheese from buffalo milk. I can find cultures, but they are very expensive. If I got a culture, is there a way to "grow" it, so that I have a larger supply?

Kevin Groom • *via email*

Quark from buffalo milk sounds tasty! We passed your question on to Pamela Zorn, a frequent speaker on making cheeses at our events, to weigh in on the subject. Here's what she had to say: "Quark is a very simple cheese that can be made with just whole milk and some buttermilk. Heat the milk to 165 °F (74 °C), cover and let cool to 90 °F (32 °C). Stir in a ½ cup of LIVE buttermilk. Cover and let it sit overnight. The next day, strain it through a fine cheesecloth until you get the thickness you want. Eat it within five days if you don't salt it. If you add salt you have about 10 days.

"If cultures are difficult to come by, and they can be, buy your favorite type of cheese that you would like to copy/make, and mix it with warm milk that you are using to make cheese until it is a smooth paste. Then mix that in to your buffalo milk that you have used for that recipe. The cheese is your live culture."

BUCKWHEAT CORRECTION

In the "Heirloom and Alternative Grains" story from the July-August 2020 issue, buckwheat was erroneously described as a grass (differentiating it from most of the grains discussed). While buckwheat is indeed different from most grains, it is actually classified as a broadleaf annual plant, not a grass.

Thanks go out to a couple of sharp-eyed readers for pointing this out!

WRITE TO *BYO*

Have a question about something you've seen in *BYO*? Want to show off your latest DIY homebrewing gear or recipe? Write to us at: edit@byo.com, find us on Facebook: www.facebook.com/BrewYourOwn, Instagram: @brewyourownmag, or reach out to us on Twitter: @BrewYourOwn.

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THE OBVIOUS CHOICE FOR BEVERAGE FERMENTATION

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BEGINNER'S BLOCK

BY DAVE GREEN

THE ESTER FAMILY

Esters . . . sometimes as a brewer you may be on the hunt to increase the esters in your final beer. You may want to coax more banana flavor from a Bavarian wheat strain of yeast, or more peach character from that Conan strain of yeast used in your New England IPA. Both of these characteristics fall into the ester family of compounds. Most esters in beer are yeast-derived compounds that are perceived as fruit-like or flower-like flavors/aromas. This may be perfect for some styles, but you don't want banana or peach flavors in your Munich helles. So today let's explore what esters are and how to control them in your beer.

IT ALL STARTS WITH CHEMISTRY

Simply put, esters that we find in beer are a result of combining an acid molecule with an alcohol molecule. Esters are a huge class of compounds and the structure of esters can appear wildly different, some with rings, some single long chains, some with multiple branches. I'm hoping you've heard of polyesters? The classes of esters in beer are fairly volatile, meaning that when you drink a beer, they can more easily enter your nasal cavity to be smelled . . . just like hop oils. Once there, your olfactory senses can detect different ester classes in a huge array of descriptors . . . apple, pineapple, wintergreen, nail polish, lavender, cream, banana, honey, grape, cherry . . . the list goes on.

CONTROLLING ESTERS — YEAST SELECTION

Yeast selection is going to be the main driving force controlling ester production in beer. The reason is that most esters are produced inside yeast cells. Esterification is the name of combining an acid molecule and an alcohol molecule to create an ester and is performed by yeast enzymes. Various yeast strains have been carefully selected over hundreds of years because they may be good at certain pathways, like Bavarian wheat strains of yeast are good at creating the banana-smelling isoamyl acetate by linking acetyl CoA and isoamyl alcohol. Other strains have been selected in a similar fashion because they are not good at performing this task, like Bavarian lager strains.

CONTROLLING ESTERS — FERMENTATION CONDITIONS

So the key drivers here are fermentation temperature and the pressure applied to the yeast in the wort. To step through these two factors, generally speaking, warmer fermentation temperatures promote more ester production. This is a generalization and some disparities have been known to occur. The vast majority of homebrewers don't need to worry about fermentation pressure . . . only if you are fermenting under pressure. One of the recent crazes in the homebrew world is to use something called a spunding valve, attached to the vent port of a fermenter in order to allow fermentation to occur under pressure — this should only be done in vessels like Corny kegs or working pressure-rated unitanks. In general, the more head pressure in the fermentation vessel, the less ester formation. Open fermentations would be used to promote ester formation, like for an English bitter or Bavarian wheat. One important thing to note is that ale yeasts create most of their esters in the first 36 hours of active fermentation. Lager yeast can continue to create esters for weeks. So those are the timeframes you most want to focus on controlling temperature and pressure.

CONTROLLING ESTERS — WORT COMPOSITION

The wort you present to the yeast will also affect ester production. Aeration/oxygenation levels, zinc availability, and something known as the beer's FAN (free amino nitrogen) levels are the three most widely noted. When it comes to oxygenation levels, generally more oxygen leads to less ester production. Also, the addition of yeast nutrients with zinc will not only improve yeast performance, but the zinc has also shown to increase ester production. Finally the FAN level can also be manipulated to control ester formation. Using more low-nitrogen adjuncts, like corn or rice, can lower the ester formation in the beer.

One thing many more experienced homebrewers might be scratching their heads about is the omission of yeast pitch rate here. Typically homebrewers associate higher pitch rates with cleaner fermentations (less esters) and vice versa. But what multiple studies have shown is that there is not a clear-cut nor a linear correlation here. Sometimes overpitching can lead to increased ester levels, but so can underpitching in other situations. The key is to find a pitch rate that works for you and that strain in a recipe.

Some final thoughts: Just because one strain produces high levels of esters in one set of conditions, doesn't mean another strain will mirror that. Also some esters can form spontaneously as well, but this pathway is much slower. This happens during long-term aging. Esters can also be broken down by enzymes called esterases. Esterases prefer certain classes of esters over others, so the ester composition will change over time as a beer ages. Some ester levels will slowly increase with aging beer while others go into decline.

THE HOP DROPPER

PAUL SCHÜSSLER • WIESBADEN, GERMANY

I recently purchased a unitank from Ss Brewtech. If you have this fermentation tank or a similar one with a tri-clamp connection on the lid, you can build your own Hop Dropper. Since oxidation is such a concern with any beer I plan to dry hop, here is my solution. It's a sluice that allows you to flush your dry hops with CO_2 before they drop into the unitank. It is important to distinguish whether you use a pressure-rated tank or a non-pressure-rated tank. In the first case you can flush the CO_2 from the tank itself when the beer is carbonated. Otherwise you have to flush the sluice with external CO_2. You can use my construction in both cases. It is kept very simple and consists of the following parts: 3-in. butterfly valve, (2) 3-in. gaskets, (2) 3-in. clamps, a 3-in. sight glass or a 3-in. tri-clamp pipe, and a 3-in. tri-clamp cap with pressure relief valve (PRV). I use the 3-in. tri-clamp cap with PRV that came with my unitank. If you have another fermenter with a 1.5-in. opening, you will need a 3-in. to 1.5-in. tri-clamp reducer.

If you are not using a pressure-resistant fermenter, you can still use the Hop Dropper. Simply add 0.1–0.2 bar (2-3 psi) for rinsing, e.g. via the blow-off arm into the fermenter. Meanwhile there are some variations of the Hop Dropper. My version is very simple and effective at the same time because the hops are really flushed from bottom to top to expel as much O_2 as possible.

For instructions on how I operate my hop dropper, visit byo.com/articles/the-hop-dropper

WHAT'S NEW

TAPCOOLER COUNTER PRESSURE BOTTLE FILLER

Fill bottles directly from your draft faucet with the new Tapcooler Counter Pressure Bottle Filler. Fit the Tapcooler into any forward-sealing faucet and slowly fill bottles by pressure release. The fill tube on the Tapcooler is telescoping, allowing it to reach the bottom of both short and tall bottles. Hook up a CO_2 line and you can purge empty bottles and the headspace, prolonging the life of your beer. With many optional configurations available through accessories, the Tapcooler can fit just about any home draft system. Learn more at Great Fermentations' website. https://shop.greatfermentations.com/category/tapcooler-bottle-filler-and-accessories

LALBREW VERDANT IPA

Lallemand has a new strain selected for its sensory characteristics. It results in increased mouthfeel and fresh fruit aromatics. This strain can be used for the production of modern IPA styles with tropical fruit qualities when paired with hops of equivalent characteristics and late and dry hopping regimens. Verdant IPA strain is recommended to be fermented between 64–73 °F (18–23 °C), it is a medium to high flocculator, can ferment up to 10% ABV, and is a medium to high attenuator. Learn more at their website. https://www.lallemandbrewing.com/en/united-states/products/brewing-yeast/

QUALITY LABS FOR SMALL BREWERS

Released by Brewers Publications, *Quality Labs for Small Brewers,* will walk you step-by-step through the process of establishing and writing a quality program for your brewery. Dive beyond the numbers and build an understanding of a small brewer's most important measurements and how to analyze them. These routines will help pinpoint any risks or areas of improvement and ensure that only quality beer reaches the customer. https://www.brewerspublications.com/products/quality-labs-for-small-brewers

Photo courtesy of Northwest Canning

ANOTHER CAN SHORTAGE?

In the May-June 2020 issue of *Brew Your Own* magazine we reported about an impending crowler can shortage as supplies for this packaging format surged due to the closure of bars, restaurants, and other draft-related venues (on-premise sales). With many of these businesses remaining closed or at limited capacity, the swell off-premise sales continue to test long-term the manufacturing capacity of cans. The latest indications are that the 16-oz. can format as well as the slim-can packaging are both being pushed to their limit. Hard seltzer sales are continuing in the upward direction, which is driving the slim-can shortage, while the 16-oz. shortage is driven by the craft beer segment. The 16-oz. shortage is expected to disproportionally affect the smaller and newer breweries. Meanwhile supplies of crowler cans continues to be short with one supplier cited in a story by Brewbound.com as shifting from sales by the half pallet (1,200 cans) to sales by the box (120 cans).

We decided to chat with a few craft brewers from our area. John Kimmich, owner of The Alchemist brewery in Stowe, Vermont, whose 16-oz. can format of their esteemed Heady Topper was one of the first craft breweries to package their beers in this size, was concerned but optimistic. "Our team at The Alchemist is very organized, and very steady, so we are able to place our orders well in advance. Our CFO, Lara Lonon, has done an amazing job of maintaining our supply chains and accommodating longer lead times."

A much newer brewery on the scene is Black Flannel Brewing located in Essex, Vermont, which opened up this summer. Speaking with their Head of Brewing Operations Dan Sartwell, there hasn't been much in the way of supply chain worries at this point, but he mentioned that a can shortage may greatly impact them. Until brewery taprooms and restaurants can fully reopen, breweries of all sizes continue to lean on bottles and cans to sell the remaining volume of beer. Currently, Ball Corporation, one of the leading manufacturers of aluminum cans for the beer industry, is in the process of building two new facilities to increase their output to meet the growing demand. Hopefully craft breweries large and small will have their demands met. John added "Worry doesn't get you very far in this business, or in life in general. We try to mitigate any worries by keeping an eye out for any potential disruptions and addressing them before they happen."

SPIKE

Ben Caya
Owner, Spike Brewing

PURSUE WHAT'S POSSIBLE

When I started Spike ten years ago, I couldn't have predicted that one day we'd be an industry leader in the brewing equipment market. What began as a simple basement project is now a bona fide national brand with 25 employees and a 25,000 square foot facility, and it all started with a little drive and ingenuity. I see the same passion in the brewing community every day, reminding me of what got Spike started in the first place. And as we reflect on our roots, we enter our second decade with a new look, a clear mission and an unwavering commitment to our customers. Because whether you'd like to go pro or just make an awesome homebrew, we're here to help.

SPIKEBREWING.COM/POSSIBLE

REPLICATOR

BY MICHAEL BURY

DEAR REPLICATOR, I'm a stout and porter fan through and through. My love affair started with Guinness when I was a younger man. But these styles seem to have shifted in the last decade with the new dessert-style stouts just being over the top for me. I prefer balance and subtlety in my stouts and porters. I picked up Highland Brewing Co.'s Oatmeal Porter on a recent visit to my local beer store. After finishing the six-pack, I went back to pick up a case. By the time I went back for a refill, it was gone from stock. I really want to give this one a go . . . I've been inspired. Could you help me out?

Brian Cusp
Charlottesville, Virginia

Thanks for the request! I'm always curious to see what requests arrive at my inbox and the reasons behind them but between last issue and this one, we have a back-to-back special on Asheville breweries apparently.

Highland Brewing Company opened their doors in December 1994 under the guidance of Oscar Wong. It was the first brewery in "sleepy" Asheville, North Carolina since Prohibition was repealed in 1933. Wong, aka "The Godfather of Asheville Beer," retired early from a successful career in engineering and his entrepreneurial spirit manifested itself. He opened Highland as a "hobby" in the basement of Barley's Taproom in downtown Asheville. Aptly named, Highland initially focused on Irish and Scottish styles of beer that paid homage to those populations, who settled in the Appalachian region of North Carolina. Gaelic Ale was the first example of this although it also has firm roots in Americanized styles, i.e., hoppier than its Old-World siblings.

Like many breweries early on, the hardware of the operation was reclaimed dairy equipment retrofitted to spec. It could produce 6,500-BBL per year in 12,000 sq. ft. (1,115 sq. m). With consistency and a pioneering nature at the heart of the business, it steadily grew and began to have several devotees. Today, Highland's 50-BBL brewhouse churns out batches four times a day, five days a week in order to fill their cellar's 27 fermenters, many of which are 200-BBL capacity. In terms of packaging, they own state-of-the-art equipment that allows them to bottle 320 bottles per minute and 257 twelve-ounce (355-mL) cans per minute. That's 4–5 servings per second! But when they want to slow down and investigate a new beer or brew a collaborative batch, they switch to a 3-BBL pilot system for exploratory work.

It's that same human curiosity that Leah Wong Ashburn, Oscar's daughter who took over as President/CEO in 2015, has displayed and that ultimately manifested in two major areas of improvement: Environmental sustainability and a rebranding of the business. The former's hallmark contribution is a 324 kW DC solar array, the USA's 6th largest (22nd largest worldwide), which can produce more electricity than the brewery can use on a sunny day, and resides on the roof. If you desire to view it, there's a great view from Highland's rooftop bar, which is something to behold.

Opened in 2016, the rooftop bar can accommodate 300 individuals, and provides expansive views of the neighboring mountains and vistas. The decking is made from natural, untreated cypress (which can withstand sun and rain) from the property. Harkening back to Oscar's engineering days, the brewery has a fabrication shop that reduces not only new purchases but also waste in general. Highland's keg washer comes from Bell's Brewery and their brewhouse has its roots at Firestone Walker Brewing Co.

However, it was Highland's rebranding that took more fortitude. For a company to look outward and accept criticism, both conservative and positive, is a feat many aren't willing to make. In early 2017, Ashburn felt it was time to address the feedback that they had received; Highland was a pioneering brewery that was innovative, sustainable, and very consistent, yet their current portfolio of beers (IPAs and experimental one offs) didn't match the image of their mascot Scotty. They proactively reached out to their fans, customers, and employees for feedback and direction using social media and Nielson surveys. The ultimate changes were suggested by Helms Workshop, whose resume included other brewery branding work with names such as Modern Times, Boulevard Brewing Co., and Spencer Brewery. The label design features a stylized profile of the Blue Ridge Mountains that surround the brewery and western North Carolina. The new brand look pays homage to those mountains while the compass speaks to their pioneering spirit and the trailblazing they've done and will continue to do: All with the knowledge that they know where they're going. In 2020 Oscar Wong was awarded the Brewers Association Recognition Award for all he has done, not only for Asheville but also the entire US craft brewing community.

Highland Brewing Company's Oatmeal Porter is more akin to an American porter than a British porter with oatmeal. It's big, bold, and roasty. Both in the nose and in the flavor, it's bittersweet chocolate and earthy coffee first with restrained grainy malt and subtle, yet distinctive, citrusy and resinous hops. Clean fermentation provides no esters to allow the roasted malt to shine forth. It's well attenuated as the semi-dry finish can attest with chocolate lingering for multiple minutes . . . decadent without the sugar. Despite the upfront roasted character, there's absolutely no astringency whatsoever coupled with a moderate, silky body as well as carbonation. Let this description guide your brew day towards this classic yet unique oatmeal porter.

HIGHLAND BREWING CO.'S OATMEAL PORTER CLONE

(5 gallons/19 L, all-grain)
OG = 1.059 FG = 1.014
IBU = 37 SRM = 31 ABV = 5.9 %

INGREDIENTS

8 lbs. (3.63 kg) 2-row pale malt
2.25 lbs. (1 kg) Munich malt
1 lb. (0.45 kg) crystal malt (40 °L)
0.5 lb. (0.23 kg) crystal malt (60 °L)
0.5 lb. (0.23 kg) chocolate malt
0.25 lb. (113 g) black malt
0.25 lb. (113 g) flaked oats
10 AAU Chinook hops (60 min.)
(1 oz./28 g at 10% alpha acids)
1 AAU Willamette hops (0 min.)
(0.25 oz./7 g at 4.1% alpha acids)
1.4 AAU Cascade hops (0 min.)
(0.25 oz./7 g at 5.5% alpha acids)
Wyeast 1056 (American Ale), White Labs WLP001 (California Ale), or SafAle US-05 yeast
¾ cup corn sugar (if priming)

STEP BY STEP

Mill the grains, then mix with 4 gallons (15.1 L) of 169 °F (76 °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) if desired.

Vorlauf until your runnings are clear before directing them to your boil kettle. Batch or fly sparge the mash and run-off to obtain 6.5 gallons (25 L) of wort. Sparging for this beer takes 2 hours at full volume but should be quicker at home. Boil for 60 minutes, adding hops at the indicated times left in the boil. At 15 minutes left in boil, add either Irish moss or Whirlfloc as kettle fining agents.

After the boil, add the final addition of hops and whirlpool for 15 minutes before rapidly chilling the wort to 62 °F (17 °C). Pitch yeast. Fermentation begins at 62 °F (17 °C) but is raised to 70 °F (21 °C) for a diacetyl rest near the end of active fermentation.

Once primary fermentation is complete and the beer has settled, which can be hastened by cold crashing to 32 °F (0 °C), bottle or keg the beer and carbonate to approximately 2.5 volumes.

HIGHLAND BREWING CO.'S OATMEAL PORTER CLONE

(5 gallons/19 L, extract with grains)
OG = 1.060 FG = 1.015
IBU = 37 SRM = 30 ABV = 5.9%

INGREDIENTS

4.5 lbs. (2 kg) extra light dried malt extract
1 lb. (0.45 kg) Munich dried malt extract
1 lb. (0.45 kg) crystal malt (40 °L)
0.5 lb. (0.23 kg) crystal malt (60 °L)
0.5 lb. (0.23 kg) chocolate malt
0.25 lb. (113 g) black malt
0.25 lb. (113 g) flaked oats
10 AAU Chinook hops (60 min.)
(1 oz./28 g at 10% alpha acids)
1 AAU Willamette hops (0 min.)
(0.25 oz./7 g at 4.1% alpha acids)
1.4 AAU Cascade hops (0 min.)
(0.25 oz./7 g at 5.5% alpha acids)
Wyeast 1056 (American Ale), White Labs WLP001 (California Ale), or SafAle US-05 yeast
¾ cup corn sugar (if priming)

STEP BY STEP

Bring 6.5 gallons (25 L) of water to roughly 150 °F (66 °C). Steep all the specialty malts in a muslin bag for 15 minutes before removing and draining. Add both extracts, with stirring, before heating to a boil. Boil for 60 minutes, adding hops at the indicated times left in the boil. At 15 minutes left in boil, add either Irish moss or Whirlfloc as fining agents.

After the boil, add the whirlpool hops indicated and whirlpool for 15 minutes before rapidly chilling the wort to 62 °F (17 °C). Pitch yeast. Fermentation begins at 62 °F (17 °C) but is raised to 70 °F (21 °C) for a diacetyl rest near the end of active fermentation.

Once primary fermentation is complete, and the beer has settled, which can be hastened by cold crashing to 32 °F (0 °C), bottle or keg the beer and carbonate to approximately 2.5 volumes.

TIPS FOR SUCCESS

The largest hurdle to brewing this beer is avoiding the harsh, astringent character that can come from the use of roasted malts. Also, if your mash pH is too low, you'll end up with a thin, lifeless brew with the nuances of chocolate malt. Aim for a mash pH slightly higher than the normally acceptable range, 5.4–5.5, to circumvent both problems.

Secondly, you'll want to make a yeast starter if using one of the liquid strains. Although the brew isn't of the high-octane variety, without a proper pitch you'll probably end up with slight under-attenuation and/or subtle off-flavors developing. A clean fermentation to allow the chocolate and coffee notes to shine is key here. BYO

BY DAWSON RASPUZZI

AWARD-WINNING FRUIT BREWS

Brewing unique fruited beers

Fruit beers don't have to be restrained to base beer styles like blondes and wheat ales. Take it from these two pros who both won Great American Beer Festival awards in 2019 for their full-flavored fruit styles, including a kettle soured ale and a fruited saison.

We find that overly acidic fruits usually need a canvas with a bit more body to handle all of the sourness.

Drew Genitempo is a former homebrewer and the current Lead Brewer at St. Elmo Brewing Co. in Austin, Texas. In 2019, St. Elmo's Roxanne (a kettle soured ale with pink guava) won a gold medal at the Great American Beer Festival in the Fruited American-Style Sour Ale category. His inspiration to brew progressive styles (fruited kettle sours, included) stems from ongoing curiosity, experimentation, and a background in science.

We brew a number of kettle soured fruit beers, and with most of them our aim is finding a relationship between the fruit attributes and base beer that allows for flavor and drinkability to be maximized. It would be so much easier to just add the exact same amount of fruit to every sour base — but it all depends on what fruit(s) you're adding and to what base. Depending on the type and amount added, you could end up with a beer that is overly sour or overly sweet.

There are several questions we ask ourselves before we write the recipe: What will the base beer taste like? Does it have the body to take on the characteristics of a more expressive fruit? Do we want the beer to lean more acidic or more sweet? Will it give us the color we want? We've tried to hone in a single base beer for these fruited kettle sours, but there is a bit of variability from recipe to recipe. We find that overly acidic fruits usually need a canvas with a bit more body to handle all of the sourness. For those beers, flaked oats and flaked barley are your friend.

At our scale, puree makes the most sense. We can get a quality product shipped to us quickly and ready to add to the beer. Additionally, the purees are aseptic, giving us peace of mind that we don't contaminate the beer when adding it to the fermenter. Furthermore, the aroma and flavor is much more consistent than most other options.

We've found that whole, fresh fruit is a bit tedious to process and the results are fairly inconsistent. We haven't experimented with extract in any fruited kettle sour. However, we have used them in other styles of beer. The aroma is quite potent, but rather artificial. If you were going to use them in kettle sours, I would recommend using them cautiously.

The question of "when to add" depends on the target flavor of the finished beer and the fruit being used. Specific fruit flavors will be fermented out completely if you add too early during fermentation (specifically, berries). For a majority of our sours (and other styles), we add the puree once the beer is done fermenting and cold-conditioned. It's much easier to control the flavor intensity of the fruit by adding a specified puree amount once the yeast is off the beer. However, adding a small amount during the tail end of fermentation can give an extra element of complexity from the yeast-fruit sugar interaction. Getting the correct amount and timing for that specific addition is something we've been experimenting with, as well. Once added, we rouse the beer with CO_2 for a couple of days to extract as much fruit flavor, aroma, and color as possible.

My personal favorite fruits to brew with are tropical fruits, specifically mango and passion fruit. The interplay of flavors from these fruits is amazing! Additionally, they work well with today's heavily sought-after hops. So, using these outside of the fruited kettle sour category (e.g. IPA, pale ales, blondes) can create more nuances in flavor, as well.

A last piece of advice for homebrewers — regardless of what form of fruit you decide to use, smell and taste the fruit first before adding it to the beer!

Grant Heuer is the Head Brewer for Gezellig Brewing Company in Newton, Iowa. He has been brewing professionally for over eight years and most recently won two silver medals at the 2019 Great American Beer Festival, including one for All The Goodness (a saison with passion fruit, pineapple, and Gewürztraminer grapes) in the Belgian-Style Fruit Beer Category. Before going pro, Grant was an award-winning homebrewer for many years.

All The Goodness was really just a lot of things coming together that had been on my to-do list at Gezellig. I've had good luck with the passion fruit and pineapple combo before and I'd been dying to play with more beer/wine hybrid beers. Saison was the perfect base for this project. The saison was a pretty stripped down version of one I might normally brew. Because I knew we'd be fruiting it I lowered the bittering hop addition, kept the grain bill simple with just a little bit of malted rye and flaked oats, and ran the yeast cooler than I might otherwise.

I knew when we schemed up the beer that it was likely to be one of our Great American Beer Festival entries, so I wanted it to be very fruit-forward with just enough saison character from Omega's Saisonstein™ peeking through. The grape juice addition worked out great as the flavors meshed well and the acidity of the juice helped the other fruits pop.

The passion fruit and pineapple were both purees from Oregon Fruit. The grape juice was shipped frozen to us from a supplier in the Pacific Northwest. At the very tail end of fermentation we filled our yeast brink with the various fruits and pumped them all in with CO_2. We had the beer on the fruit for about 10 days before moving it over to our brite tank.

Adding fruit at the tail end of fermentation certainly has its advantages. You can harvest the yeast cake prior, you can be fairly confident you're scrubbing most oxygen picked up in the addition process, you hopefully blow off less fruit aromatics, and you can capture the CO_2 that the new fermentation creates. I wouldn't be super nervous about feeding it in a little earlier if I was in a time crunch. I'd probably add some yeast or *Brett* if I added the fruit a fair bit after fermentation was done and the yeast was dumped.

If you're making a fruited beer just for you, have fun with it. Split it on different yeasts, fruits, *Bretts*, etc. If you're hunting homebrew medals, make something bold and unique while coloring within the category lines. BYO

HELP ME, MR. WIZARD

BY ASHTON LEWIS

OXIDATION RATES

Also: Creating the haze, and pressure fermenting in a conical

Q WHILE READING AN ARTICLE IN A RECENT ISSUE OF *BYO* I WAS LEFT WITH A QUESTION ABOUT HOW LONG IT TAKES OXYGEN TO CAUSE OXIDATION. I KNOW IT DEPENDS ON TEMPERATURE, BUT GIVE ME SOME RANGES. FOR EXAMPLE, WHEN PACKAGING BOTTLE-CONDITIONED BEER THERE IS SOME OXYGEN EXPOSURE BUT THE YEAST RAPIDLY CONSUME ANY OXYGEN THEY CAN. IS THE BEER OXIDIZED BEFORE THE YEAST CAN ACT OR DOES THE YEAST CONSUME THE OXYGEN BEFORE THE UNDESIRED REACTIONS HAVE TIME TO TAKE PLACE? I COLD CRASH MY BEER (WITH A CO_2 SOURCE FOR SUCKBACK) AND BOTTLE WHILE STILL QUITE COLD (40–45 °F/4–7 °C). THIS WOULD PRESUMABLY SLOW ANY OXIDATION REACTIONS BUT IT ALSO SLOWS THE YEAST METABOLISM. WHICH ONE WINS THE RACE AS THE BOTTLED BEER WARMS UP OR DOES IT AFFECT BOTH EQUALLY?

RICHARD SWENT
PALO ALTO, CALIFORNIA

The best way to appreciate the speed of oxidation is to perform a simple trial.

Photo courtesy of Scott Janish

Oxidation, as seen in the beer on the right, can lead to a darkening of the beer, negative flavor and aroma impacts, hop aroma loss, and can occur very quickly in beer if mishandled.

A This is a terrific question and is well suited for a terrifically short answer. Beer oxidation can occur shockingly fast, especially if a beer is the sort to easily show off oxidized aromas. And the rate of oxidation doubles when the storage temperature of beer is increased by about 15 °F (8 °C); for example, beer stored at 39 °F (4 °C) that retains 90% of its freshness after 30 days will have a similar level of oxidation in 15 days when stored at 54 °F (12 °C). Yeast can prolong freshness, but the notion that yeast quickly consume oxygen is not true if the yeast is old and tired, especially if the cell density in the package is low.

The best way to appreciate the speed of oxidation is to perform a simple trial. Grab two or three bottles of a subtle beer, such as Budweiser. Open one bottle, gently fan some air into the headspace to help move the carbon dioxide blanket out of the bottle, recap, and give the bottle a few shakes to help dissolve the headspace gas into the beer. If you want to see how yeast may slow oxidation, shoot in a milliliter of slurry (assuming 1 mL of slurry contains one billion cells, this will give you 2.8 million cells/mL, which is a healthy density). Incubate the sample(s) in a warm environment for 24 hours, transfer to the refrigerator where the control beer is stored, and do a side-by-side tasting in 2–3 hours after the beers are both the same temperature. You should be able to easily differentiate the control from the experimental beer without yeast (not sure about the yeasted sample) and detect the tell-tale signs of oxidation in the experimental sample.

The method described above is pretty extreme, but not uncommon. Growlers, unfortunately, are a great example of mistreated beer because the manner in which they are often filled is sufficiently abusive to oxidize beer within hours of filling. I personally dislike growlers for multiple reasons, but the effect they often have on beer freshness is my #1 complaint about them.

Filling bottles with flat beer is a challenge and should be done with special care. Adding a fresh dose of yeast can help if the fermentation may

have been stressful or the beer was aged. Commercial bottle filling (or growler filling using a proper filling device) is a different story because bottle fillers are designed to purge air from the bottle, counterpressure-fill beer into the bottle, and then gently release pressure after filling. A properly filled bottle will be quiet after the fill tube is removed and the beer can be fobbed (intentionally foamed) by knocking the bottle with something like a plastic screwdriver handle or by squirting a small volume of water onto the surface of the beer before capping on foam. Commercial bottling lines are indeed equipped with water jetters or bottle knockers before the capper so that beer is capped on foam. Another thing that makes a good bottling operation better is the use of oxygen barrier caps that have special liners to absorb oxygen that is either in the bottle headspace after filling or diffusing into the headspace through the crown seal during storage.

Q I AM ABOUT TO RACK MY NEW ENGLAND IPA TO THE SECONDARY. SHOULD I LET IT SIT FOR A FEW DAYS BEFORE I KEG? HOW DO I MAKE SURE IT'S HAZY? I AM A NEWLY "RETURNING" BREWER AND THIS IS MY FOURTH BATCH SINCE RETURNING AFTER 25 YEARS, AND IS MY TENTH BATCH OVERALL. IT'S ALSO MY FIRST NEW ENGLAND STYLE. I LOVE THE HAZIES OUT THERE.

BOB HAMM
HOT SPRINGS VILLAGE, ARKANSAS

A Welcome back to the world of homebrewing after your quarter-century hiatus! Not sure where you are in the process of brewing your current batch of New England IPA and hope this answer helps clear up a few things in your quest for unclarity. My basic advice is to give your beer a few days in your secondary to allow fermentation to complete and those hops that you probably tossed in towards the last couple days of fermentation to settle, and then transfer to your keg where you can cool, carbonate, and enjoy.

Hazy IPAs have really exploded as a style over the last five years and there are many twists and tricks brewers use to give these brews their cloudy look. The good news is that brewers can produce these brews by following a few relatively simple steps that will result in solid examples of the style. After the basics are mastered, tweaks can be made to fine-tune appearance, aroma, mouthfeel, foam stability and cling, and yield. But since you are still getting your brewing legs back in shape, it may be best by starting with just a small list of key pointers to consider. And for other readers, I am going to assume that you are beginning from scratch with a new brew.

Let's begin by loosely defining the style before jumping into the weeds about how to brew a solid New England IPA. Not to get caught up in the numbers game on this as the Brewers Association (BA) now has four style categories designated as "Juicy or Hazy [fill in the blank]," but in general terms, most of these beers, excluding doubles and imperials, have original gravities in the 1.048–1.065 (12–16 °Plato) range, have a very pale, blond/straw color, are low in perceived bitterness, have lots of hop aroma (especially citrus, ripe tropical fruit, and stone fruit notes falling under the giant umbrella named "juicy"), often have a creamy/silky palate, expressive aromas from yeast esters, and sufficiently high carbonation to fit with the body and to puff up into a white and wispy foam.

A good, all-around New England IPA can be brewed incorporating the following pointers:

- Low carbonate water with a 2:1 ratio of chloride-to-sulfate is frequently cited as a great water balance. If you are using reverse osmosis (RO) water, aim for about 150 ppm calcium from a combination of calcium chloride and calcium sulfate. Adding 3.1 grams calcium chloride and 1.7 grams of calcium sulfate to 10 liters of RO will give you 150 ppm calcium, 96 ppm sulfate, and 195 ppm chloride. Water is important, but don't get too hung up on worrying about the chemistry until you need to.
- Keep the grist bill simple. 80% pale malt, 10% flaked oats, and 10% flaked wheat works well. As with water, add complexity or process tweaks if the finished beer needs help in the grist bill department. Depending on your mashing method, rice hulls definitely help with wort collection.
- Don't add too much hop bitterness to your wort during boiling; a modest addition at the beginning of the boil lays down a bit of bitterness on the blank canvas and helps suppress foaming during the boil. After the boil, knock the wort temperature down to about 176 °F (80 °C) before adding your aroma hops to hot wort. The reduced temperature will help keep isomerization to a minimum and allows for big additions for aroma. And consider adding about a third of your aroma hops to the hot wort and the remaining two thirds as dry hop additions.
- Use a yeast strain that is known for the style. There are a handful out there that work well, such as Wyeast's London Ale III and SafAle's S–04 or Imperial's Juice just to name a few. Choosing something with a proven track record is a great start. One of the keys to this style is hop biotransformation and this is largely a function of yeast strain.
- A good dry-hopping schedule is to add a third of your aroma hops about 24 hours after vigorous fermentation begins, and the last third 48 hours later. A more advanced approach can be taken by timing your additions based on specific gravity, but this requires sampling and is not a requirement for making a good example.
- Only add hops that smell good. If you have hops that seem off in terms of aroma quality or if they have aromas that you don't like, don't use them. Hops are an agricultural product and vary by growing location and crop year. The concept of *terroir* may seem esoteric, but it's real.
- Allow your beer to settle well before packaging into bottle or keg, and, like most other beer styles, do be concerned about oxidation.

If all goes well, you will end up with a great beer. But what

about the haze? I have talked to lots of commercial brewers about this style and the consensus among the group I have polled is that few brewers are adding mono-tasker ingredients whose only purpose is haze. Some brewers are happy enough with a great tasting brew and don't obsess about the haze. The basic guide earlier in the answer will definitely end up with a cloudy brew.

In the world of commercial brewing, consistency is pretty important, especially for packaging breweries, so haze stability is a thing. And it's a perplexing conundrum because cloudy beer is inherently unstable. Why? Because haze particles tend to be more dense than beer and gravity never takes a day off. The interesting thing about this topic is that the vast majority of the hazy volume on the market is centrifuged before packaging. In other words, the haze is not from yeast and it is not from "chunky stuff" floating about in the beer. The cloudy appearance of this style is the product of protein and polyphenol (tannin) interactions, and it seems that a significant portion of these haze particles are not very dense and tend to stay bobbing about in their hoppy homes. Although most hazies contain somewhere between 10–30% flaked grain adjuncts that do bring protein to the party, it appears that the main haze ingredient is the big boost of polyphenols that comes with the massive hop additions commonly used in these brews.

Brewing, and more broadly cooking, marries science with art and the vision of the brewer drives the outcome towards this idea. My view on the haze part of this style is that the turbidity of the beer is secondary to all other attributes. The list of tips above touch on water flavor and pH balance, color, mouthfeel, foam, hop bitterness, hop aroma, and yeast expression. New England IPAs were not developed to look cloudy; the emphasis was on beer flavor and the haze thing came along for the ride. This is your fourth brew since your sixth brew 25 years ago and you are best advised to focus on your technique and beer flavor before looks. One step at a time, Bob. Fact of the day: A lousy-tasting beer rarely improves by altering its appearance!

Q I'VE JUST BOUGHT A 20-L (5.25-GALLON) CONICAL BOTTOM, PRESSURE FERMENTER AND I AM KEEN TO TRY IT OUT. I PRIMARILY BREW ALL-GRAIN LAGERS WITH THE ODD ALE AND DO SO IN 10-L (2.6-GALLON) BATCHES USING CARBOYS. I LIKE VARIETY IN MY BEER AND SO KEEP BATCHES SMALL. MY QUESTIONS ARE: 1) AT WHAT FERMENTING TEMPERATURE AND FOR HOW LONG? BECAUSE OF OUR HOT CLIMATE I WILL STILL NEED TO FERMENT IN A COOLED ENVIRONMENT DURING OUR SUMMERS. 2) IS THE HOPPING RATE THE SAME FOR PRESSURE FERMENTING AS FOR ATMOSPHERIC FERMENTING? PLEASE CONSIDER THAT I ALSO HOT CUBE (NO-CHILL METHOD) THE BEER PRIOR TO FERMENTING — CAN'T AFFORD TO WASTE WATER IN AUSTRALIA. 3) WHAT IS THE BEST WAY TO DRY HOP A PRESSURE-FERMENTED BREW? 4) HOW LONG WILL I NEED TO LAGER THE BEER?

TERRY LE LIEVRE
WARRAGUL, VICTORIA, AUSTRALIA

A Thanks for the question from down under, Terry! Although the fermenter you describe is pressure rated and has a conical bottom, you can use it as you normally do with your carboys. A few advantages of your new fermenter is that it shields your beer from light, does not break like glass, allows for beer transfers using valves situated on the bottom and/or side of the cone without racking, permits trub removal and yeast cropping from the bottom, and it can be pressurized. Yes, pressurized fermentations and the use of spunding valves has recently become the thing, but these techniques, and the ability to practice them, is certainly nothing new. The vast majority of small-scale, commercial brewers around the globe with stainless steel unitank fermenters have always been able to pressure ferment and, depending on the pressure rating of the fermenter, naturally carbonate to some degree. And most of these brewers ferment their brews without any over-pressure and are happy to have closed vessels that make for handy tanks. Without further chatter, let's jump into your questions.

I am assuming your fermenter is neither insulated nor equipped with cooling jackets. The lack of insulation means that the beer temperature will not be much different during fermentation than what you have with your carboys. The two variables that have the greatest influence on the temperature inside of a fermenter during fermentation are the area contacted by beer, as this defines where heat flows between the environment and your beer, and the material properties of the heat transfer surface. As fermentation volume increases, the ratio of heat transfer surface area and beer volume usually decreases since beer fermenters typically have shapes that proportionally grow with vessel size. Your 20-L (5.25-gallon) stainless fermenter most likely has a bit less surface area per beer volume than your 10-L (2.6-gallon) carboy.

The second vessel variable influencing beer temperature during fermentation is the resistance of the wall to heat flow, which is a function of the material (glass versus stainless), the material thickness, and the cleanliness of the surface. Glass is a pretty good insulating material and its thermal conductivity coefficient (k) is about 1.0 W/K*m, whereas the k of Type 304 stainless steel (the most likely material to fabricate your new fermenter) is around 14 W/K*m. The other key part of heat transfer rate is material thickness, and carboys often have glass walls that are ~5 mm thick compared to 1.5 mm for small stainless steel. The bottom line is that your new fermenter, when clean and ready for use, moves heat across its surface at about 50 times the rate of your glass carboy. Without knowing more about your current conditions it's hard to offer specific suggestions, but if you can set your ambient

temperature to around 68–72 °F (20–22 °C), you should be in good shape for most ale strains and certain lager strains. Fermentis yeast has some nice sensory and performance data that support the use of their SafLager W-34/70 up to 68 °F (20°C).

Hopping rate is one of those variables that may or may not change much with pressurized fermentations. "It depends" is a frustrating answer for folks looking for clear information, but this is the answer to your hopping question. If your current brews have a large volume of liquid that flows out of your carboys during fermentation, you are losing hop bitterness with this blow off. And if you ferment 10-L (2.6-gallon) batches in 20-L (5.25-gallon) fermenters, there may be a good amount of hop compounds stuck to the fermenter wall. Pressurized fermentations often foam less, but not always since carbon dioxide does escape from the fermenter after the set pressure has been achieved, and less foaming usually translates to less bitterness losses. This is something you can tweak with small recipe adjustments as required.

Dry hopping can be a challenge with pressurized fermentations. The easiest way to dry hop is to start your fermentation with no pressure, add your dry hops midway through the ferment, and then attach your spunding valve. If you want to ferment under pressure from start to finish, you need to use a method that allows you to add hops without causing rapid foaming that is guaranteed to happen if you simply dump pellet hops into the top of your fermenter. Perhaps the easiest way to dry hop beer in a pressurized fermentation is to transfer 1–2 L (1–2 qts.) of fermenting beer to a clean 4-L (4-qt.) container and slowly add your dry hop addition while allowing the beer to foam and settle during the process. Allow this to sit for about 30 minutes once all of the hops are added to ensure that all of the hop bits are fully hydrated. Now you can gently de-pressurize your fermenter, quickly pour in the hop slurry, close the fermenter back up, re-pressurize the headspace, and allow the beer to finish fermenting. There are certainly other ways to do this and you should consider other options if this is not to your liking. Whatever you do, be careful of dry hop geysers!

And finally lagering duration: This is one of those things that depends on what you want to accomplish. In my opinion, once the goals of lagering, such as diacetyl and acetaldehyde reduction, yeast sedimentation, and carbonation are accomplished, it's time to move on. No reason to lager just for the sake of counting days on a calendar. You should be able to ferment and age most ales with original gravities less than 1.066 (16 °Plato) in about 14 days, after which time you can rack to bottle or keg. Most lagers in the same gravity range will take 21–28 days before packaging. And if you have beers that require more time because of something specific, then use more time. One of the advantages of pressurized fermentations is that lagering times can often be shortened without significantly altering beer flavor. I hope this information is helpful to brew great beers with your new equipment!

BY GORDON STRONG

ROGGENBIER

A rye twist on a dunkelweizen

Rye is a hearty grain, and adds a unique grainy and spicy character to beer, as it does to foods.

ROGGENBIER
BY THE NUMBERS

OG:	1.046–1.056
FG:	1.010–1.014
SRM:	14–19
IBU:	10–20
ABV:	4.5–6.0%

Photo by Charles A. Parker/Images Plus

Roggenbier was once one of the most popular specialty beer styles in homebrew competitions. Before it was added to the 2004 Beer Judge Certification Program (BJCP) Style Guidelines, it dominated the Specialty Beer category. It was like the black IPA of its time; you often saw it on the Best of Show table. When it was made part of the German Wheat and Rye category, I started seeing it less often. In 2015, the BJCP moved it to the Historical Beer category recognizing the fact that commercial examples had disappeared and it was infrequently brewed.

Rye is a hearty grain, and adds a unique grainy and spicy character to beer, as it does to foods. It's also a hardy grain, growing in difficult conditions and being used by many impoverished people. So, it's like the grain from the tough side of town, where you have to be a fighter to survive. I can respect a grain like that. Plus it makes a damn fine whiskey, but I digress.

Adding rye to beer does not make it a roggenbier, despite the name literally meaning "rye beer" in German. The BJCP recognizes this by making roggenbier one of the 27A Historical Beer styles, while there is style 31A Alternative Grain Beer for any other beer containing rye, except rye IPA, which is one of the 21B Specialty IPA styles. Roggenbier is best thought of as a dunkelweizen (dunkles weissbier) using rye instead of wheat.

HISTORY

The use of rye to make beer likely has a long history, including in Bavaria before the Reinheitsgebot (Beer Purity Law) of 1516 outlawed the use of malted grains other than barley in beer. This reserved wheat and rye for use in breads, while allowing a royal exception to brewing wheat beers. However, rye beers did not continue in this manner. So, don't assume there is any historical tie between modern rye beers and those that predate the Reinheitsgebot.

Michael Jackson in *Beer Companion* (1997) has three full pages on rye beers but mostly discusses Finnish sahti. He showcases Schierlinger Roggenbier as the classic example. He doesn't mention the style in his earlier books, but that isn't surprising as Schierlinger first launched the beer in 1988. He later features it in the *Great Beer Guide, and The Pocket Guide to Beer*; it must have made a memorable impression on him.

Jackson said Schierlinger told him that they produced a hefeweizen but wanted to add a dark beer to their portfolio. Instead of a dunkelweizen, they chose to make it more distinctive by using a dark grain (rye). The brewery could find no historical recipes, so created their own instead. But what about the Reinheitsgebot? Well, it's not your daddy's law anymore. Let's take a slight detour to review what happened.

When Germany unified as a country in 1871, Bavaria demanded that the Reinheitsgebot be adopted as the law of the land. It survived both World Wars, and later was part of West German law. However, in 1987 the European Union ruled it was anti-competitive, so rules were relaxed for imports. German Reunification in 1990 introduced East German beers, some of which used sugar. Germany adopted the Provisional Beer Law (*Vorläufiges Biergesetz*) in 1993 to replace the Reinheitsgebot.

The *Biergesetz* mentions yeast (along with barley malt, water, and hops), and allows other forms of hops (like extracts), as well as stabilizers and fining agents, if filtered out of the final beer. Bottom-fermenting beers are more restricted, closely following the Reinheitsgebot, but top-fermenting beers can use other malted cereal grains (but not corn or rice). Unmalted adjuncts are forbidden. Pure sugars can be used for coloring and flavoring. Many breweries

voluntarily follow the Reinheitsgebot as a marketing point.

The history of roggenbier as a modern style is therefore only traceable to 1988, despite fanciful stories of Middle Age brewing. It remains a minor style in Germany (Wolfgang Kunze, author of *Technology Brewing & Malting*, comments that rye beers have only local significance), and it seems that way currently among breweries outside of Germany and in the homebrewing community.

SENSORY PROFILE

To understand roggenbier, first you have to know how to recognize the flavor and aroma of rye. First, let's be clear. Rye doesn't taste like caraway. So, if you like rye bread, be sure you are separating the flavor of the rye from any caraway seeds present. This is sometimes made more difficult because rye is described as "spicy" — but that spice isn't caraway.

Various sources describe rye differently. It's been characterized as earthy, spicy (not like cinnamon or clove, more like pepper), slightly sour, dry, a bit astringent, sharp, peppery, grainy, spicebush, black pepper, sharp nose, dry/spicy, and floral. Jackson says rye is the most assertive of cereal grains, and has a fruity, slightly bitter, spicy, oily, sometimes almost pepperminty note. Rye has more acidity than barley, which might give some acidity but people shouldn't think that sourness in rye bread is from the rye — it's more likely from the sourdough-like starter. Rye malts are usually darker than barley malts and tend to produce beer with a definite bread- or bread crust-like taste. Roggenbier is a riff on a dunkelweizen so it shares many of the same characteristics, especially the yeast. The banana and clove yeast aroma and flavor are present, but the richer, grainier, and spicier rye is noticeable. Cloudy yeast, a tall and persistent head, and spritzy carbonation are classic. The color is often a reddish-brown color, not really brown or darker. The bitterness is restrained to get out of the way of the yeast and malt.

Rye can have a gummy character, so the body tends to be more full than other wheat beers. The rye can add a bit of bitterness and dryness on its own, so

ROGGENBIER

(5 gallons/19 L, all-grain)
OG = 1.050 FG = 1.012
IBU = 18 SRM = 17 ABV = 5%

INGREDIENTS

7 lbs. (3.2 kg) German rye malt
2.5 lbs. (1.13 kg) Vienna malt
2.5 lbs. (1.13 kg) caramel wheat malt (50 °L)
2 oz. (57 g) Carafa® Special II malt
1 lb. (454 g) rice hulls
4 AAU Perle hops (60 min.) (0.5 oz./14 g at 8% alpha acids)
4 AAU Perle hops (5 min.) (0.5 oz./14 g at 8% alpha acids)
Wyeast 3068 (Weihenstephan Weizen), White Labs WLP300 (Hefeweizen Ale), or SafAle WB-06 yeast
⅞ cup corn sugar (if priming)

STEP BY STEP

This recipe uses reverse osmosis (RO) water. Add 1 tsp. of calcium chloride to the mash. This recipe uses a double decoction mash. Use enough water to have a moderately thick mash, 1.5 qts./lb. (3.1 L/kg). Stir the decoctions frequently to avoid scorching the grain.

Mash in the rye, Vienna, and wheat malts at 95 °F (35 °C); hold the mash at this temperature for 10 minutes. Pull the first thick decoction (about ⅓ of the mash), bring to a boil (resting for 10 minutes at 122 °F/50 °C and 10 minutes at 158 °F/70 °C; boil for 10 minutes); leave the main mash at 95 °F (35 °C) during this process. Remix the mashes to hit 122 °F (50 °C). Pull the second thick decoction (again, about ⅓ of the mash), heat to 147 °F (64 °C) for 20 minutes, boil for 10 minutes, leaving the main mash at 122 °F (50 °C) during this process. Remix the mashes to hit 158 °F (70 °C). Add the rice hulls, mixing fully, then rest for 15 minutes.

Add the Carafa® malt. Begin recirculating slowly and raise temperature to 168 °F (76 °C) and recirculate for 15 minutes. Sparge very slowly and collect 6.5 gallons (24.5 L) of wort. Cutting the mash bed in a tight crosshatch pattern will encourage runoff. Boil the wort for 90 minutes, adding hops at the times indicated in the recipe.

Chill the wort to 59 °F (15 °C), pitch the yeast, and ferment until complete, allowing the temperature to rise to no more than 64 °F (18 °C) during fermentation. Rack the beer, prime and bottle condition, or keg and force carbonate.

ROGGENBIER

(5 gallons/19 L, extract with grains)
OG = 1.050 FG = 1.012
IBU = 18 SRM = 17 ABV = 5%

INGREDIENTS

6.6 lbs. (3 kg) rye liquid malt extract
2 oz. (57 g) Carafa® Special II malt
4 AAU Perle hops (60 min.) (0.5 oz./14 g at 8% alpha acids)
4 AAU Perle hops (5 min.) (0.5 oz./14 g at 8% alpha acids)
Wyeast 3068 (Weihenstephan Weizen), White Labs WLP300 (Hefeweizen Ale), or SafAle WB-06 yeast
⅞ cup corn sugar (if priming)

STEP BY STEP

This recipe is not the same as the all-grain recipe; the available rye extracts I have found tend to have between 20–25% rye, which is a half to a third as much as needed for a roggenbier. But it will be easier to use, and have some rye flavor. The rye extracts all seem to have some level of rye, crystal, and base malt so that can be used as a substitute for the grains except the coloring malt.

Add the Carafa® malt in a mesh bag and steep in 6.5 gallons (24.5 L) of water in the brew kettle as it heats to 158 °F (70 °C). Remove and rinse grains gently. Turn off the heat and add the malt extract and stir thoroughly to dissolve completely. Turn the heat back on and bring to a boil. Boil the wort for 60 minutes, adding hops at the times indicated.

Follow the all-grain recipe for chilling and fermentation instructions.

that tends to counteract the body a touch. The balance should remain malty not bitter, however. Freshness matters with all beers made with weizen yeast. Sometimes I think people who describe the beer as having acidity have gotten old samples. The beer should be enjoyed fresh and young, just like bread.

BREWING INGREDIENTS AND METHODS

To make a roggenbier you must use rye malt. Not flaked rye, not raw rye — malted rye. Rye is a huskless grain, like wheat, which makes it difficult to work with. But according to Kunze it is very high in pentosan (a polysaccharide of five-carbon sugars). This causes it to have a viscosity about two or three times more than barley, as it holds more water — think dietary fiber drinks. So, gummy malt plus no husks means you absolutely need lautering aids. Rice hulls to the rescue.

I've already warned you about the use of caraway seeds or flavoring. Don't do it. Don't feel the urge to overstate any spicy or slightly tart qualities by artificially boosting them. Allow the ingredients to speak for themselves. Rye never would appear in a lager, so make this as a top-fermented beer. Don't add spices. Jackson's description of Schierlinger said they used 60 percent rye malt, pale and crystal malt in equal parts for the remainder, and a little bit of a darker dehusked malt for color but not flavor. A double decoction mash is used. He said the beer was 20–23 SRM, 1.048 starting gravity (SG), 5% ABV, implying a final gravity (FG) of 1.010. He mentions two additions of Perle hops, but no IBU levels. Wheat beer yeast is used, and the beer is primed with unfermented wort (*speise*).

Later descriptions of the Thurn und Taxis version talked about 1.055 SG, 5.4% ABV, implied FG 1.014. Paulaner version is identified as 1.050, 5.3% ABV, implied FG 1.010. Randy Mosher in *Radical Brewing* says that you can create a decent version by taking an existing dunkelweizen recipe, swapping in rye malt for half the wheat malt, and increasing the crystal malt.

There is some additional interesting information for process. The mashing process developed by Schierlinger was patented, in order to properly degrade the gummy qualities of the malt, while enhancing the rye bread-like aroma and flavor. The patent suggests a grist of 50% rye malt, 40% barley malt, and 10% wheat malt for best flavor and aroma results. Darker-colored rye malts produce more aroma and flavor.

The patent says the beer can be made with a double or triple decoction mashing process with the first decoction pulled at 122 °F (50 °C) and the main mash remaining at this temperature. The decoction is heated to 147 °F (64 °C) then 162 °F (72 °C) then boiled. The mashes are remixed to hit 147 °F (64 °C) then a second decoction is drawn and brought to a boil. The mashes are remixed to hit 162 °F (72 °C). This is a standard double decoction method advocated by brewing scientist Ludwig Narziss.

The patent describes a finding that wort viscosity can be reduced by using a double decoction method with the following parameters: Mash in between 86–104 °F (30–40 °C); hold the mash at this temperature; pull the first decoction, boil; remix to hit 122–131 °F (50–55 °C); pull the second decoction, heat to 140–149 °F (60–65 °C) for 20–40 minutes, boil; remix to hit 158–176 °F (70–80 °C). The long rests at low mash-in temperatures (optimally 95 °F/35 °C) and between 122–131 °F (50–55 °C) help reduce viscosity without degrading foam. It also says the first decoction should be rested at 122 °F (50 °C) and 158 °F (70 °C) for 10 minutes each. Skipping rests around 140 °F (60 °C) is preferred. What I glean from the patent is that rests at 95/122/158 °F (35/50/70 °C) are desirable. So if you're step mashing, aim to rest at those temperatures. I know from brewing wheat beers that decoction mashing improves the mouthfeel, so it isn't surprising it is part of this process.

There are many ways to make a decent dunkelweizen, if you are going to start by modifying an existing recipe. Shoot for 50–60% rye malt instead of wheat. For the remainder, a mix of pale malts (Pils, Vienna, Munich), dark Munich, wheat, crystal-type malts (barley, wheat, or rye), and debittered dark malts can be used. I've made good versions with wheat malt and dark Munich only, and I've also used lighter versions with wheat malt, Pils malt, caramel wheat, and Carafa®-type malts. Choices are pretty good for malt types. Weyermann, for instance, has rye malt (3.3 °L), CaraRye®, chocolate rye (250 °L), chocolate wheat (400 °L), caramel wheat, CaraWheat® (50 °L), dark wheat (17 °L), and pale wheat (2.2 °L). Briess also makes rye malts, including a liquid malt extract with a blend of rye, crystal, and pale malts.

For the remainder of the ingredients, treat it like a dunkelweizen. German hops, in low amounts. Relatively neutral water with a little calcium chloride. German weizen yeast, fermented at cool temperatures. Fermentation by-products are said to interfere with the rye aroma, so cooler (59–72 °F/15–22 °C) temperatures are recommended. Serve it fresh and young.

HOMEBREW EXAMPLE

First, I'll use a mix of rye malt, caramel wheat malt, and barley malt in the grist; I'd normally use Vienna or Munich in a dunkelweizen, so I'll pick Vienna here for its toasty notes. A touch of debittered dark malt will adjust the color, but the mashing process will also increase the color. I'm using nearly 60% rye malt so I'll also be using rice hulls for lautering.

I'm balancing the beer to be somewhat like the original Schierlinger, a 5% ABV beer. I'll shoot for 18 IBUs since there will be some malty sweetness to balance. I'll go with Perle hops; I had been thinking Spalt, but it's similar. Other German or Czech noble hops would work too; this isn't a hoppy beer and you don't want them to clash with the yeast.

A cool fermentation with my favorite weizen strain Wyeast 3068 should give a nice yeast character. Alternatives are White Labs WLP300 or SafAle WB-06. I like to start these fermentations at 59 °F (15 °C) and let the temperature rise during fermentation but not get too hot.

I'm using the patented mash process as explained in the article. If this is too much for you, you can try a single infusion at 149 °F (65 °C) and expect a long, slow lauter. A step mash at the lower temperature rests as explained in the article is better, but I think a decoction will help break down the gummy elements of the mash. If you use a simpler mash program, consider a shallower mash and cut the bed to encourage runoff. Go slow, be patient, and definitely use rice hulls (possibly more than I specify if you get a stuck sparge). BYO

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12:00 – 12:30 PM	Q&A WITH NANO VENDORS			
12:30 – 1:30 PM	Contract Brewing & Alternating Proprietorships	Create A Month's Worth Of Brewery Social Media Posts In 1 Work Day	5 Ways To Reduce Brewery Risk	Small-Scale Sour Beer Brewing
1:30 – 2:00 PM	NANO TRENDS PANEL			
2:00 – 3:00 PM	Keys To Successful Brewery Branding	Balancing Being Owner & Head Brewer	Keys To Better Brewery Financial Forecasting	Brewing Water Treatments
3:00 – 3:30 PM	Q&A WITH NANO VENDORS			
3:30 – 4:00 PM	NANO TOPIC ROUNDTABLE #1			
4:00 – 5:00 PM	What Every Brewery Needs To Know About Trademarks	Setting Up Commercial Accounts For Ingredients, Equipment & More	Reusing Yeast Best Practices	Keys to Training Taproom Staff
5:00 – 5:30 PM	Q&A WITH NANO VENDORS			

NanoCon Online Day #2 • Saturday, November 7, 2020

11:00 AM – 12:00 PM	Legal Checklist For Your Brewery Launch	Equipment TLC: Regular Maintenance & Upkeep	Maximize Virtual Experiences To Create New Revenue Streams	Brewery Insurance Claims Case Studies: Lessons Learned
12:00 – 12:30 PM	NANO VENDOR Q&A			
12:30 – 1:30 PM	NANO TOPIC ROUNDTABLE #2			
1:30 – 2:00 PM	COVID-19 BREWERY STRATEGY PANEL			
2:00 – 3:00 PM	Understanding & Using Biotransformation	The Financials Behind Packaging Decisions	Develop A Better Brewery Marketing Plan	Create A "Go To Market" Strategy For Your Brewery
3:00 – 3:30 PM	NANO VENDOR Q&A			
3:30 – 4:00 PM	NANO TOPIC ROUNDTABLE #3			
4:00 – 5:00 PM	Customer Expectations In The Covid-Era Taproom	Brewing Techniques For Hot Styles	Planning Your Taproom Draught System	Top 5 Legal Mistakes To Avoid As A Brewery

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Fruit beer techniques and design strategies

by Brad Smith

Brewing with fruit can add amazing depth, flavor, and aroma to your beer, but fruits also present significant challenges. Selecting the correct fruit, understanding its fermented flavor profile, the practical considerations of fermenting fruit, and getting the right overall flavor balance is difficult but also rewarding when you get it right.

Back in 2015 I authored a *BYO* article on fruit beers that explained some of the challenges of brewing with real fruit. In the intervening years, I've dived into making meads, wines, and ciders as well as beer with fruit and gained a more in-depth understanding of fruit including both design and practical considerations.

So in this article, I will share a more in-depth treatment of fruit from a recipe design perspective as well as a practical brewing perspective, which should help you brew some truly fantastic fruit beers!

FRUIT BEER CHALLENGES

To begin, let's discuss the fundamentals of fruit beer flavor and balance. When you enjoy fresh fruit like a mango or blueberry you taste a combination of the simple sugars in the fruit and also its flavor compounds including acidity and tannins. It is the combination of the sugar and flavors that you associate with a fruit. Fruits also have aromatic esters you smell as you taste the fruit. Your brain matches the pattern of flavors and aroma almost instantly and tells you "that's a mango" or "that's a blueberry."

The challenge with fermented fruit is that all of the sugars in the fruit are completely fermentable. The two main sugars in fruit are fructose and glucose, often in roughly a 50–50% split. While glucose ferments faster, given enough time the fructose will also ferment out leaving almost no residual sweetness from the fruit.

So the sugary sweetness literally disappears, which means a large flavor component of fruit is no longer in your beer. To further compound things, fermentation often strips the fruit of its aroma. The net result is that your brain tastes the fruit beer, senses none of the sweetness or aroma it expects, and fails to register the fruit as a mango or blueberry anymore.

A final complexity is that adding fruit to a beer generally will thin the body of the beer out. This seems counterintuitive, but if you consider the fact that fruit is almost completely composed of sugar and water it starts to make sense. The sugar will ferment down to alcohol, which has an original gravity below 1.000, and the rest is water. So adding a large amount of fruit can significantly lower the final gravity (FG), also lowering the body and upsetting the malt-balance of the beer.

FRUIT BEER STRATEGIES

Given the challenges outlined earlier, what are some ways we can create great fruit beers that still maintain a proper fruit flavor balance? The technique you choose depends very much on the effect you are trying to achieve.

For example, many lighter beers lend themselves to a sweeter overall full fruit balance. To achieve this you would want to use either fruit extract or backsweetening, which are both described later. These techniques preserve the sweetness of the fruits and complement beers with very light profiles such as wheat beer, light lagers, and light ales.

In contrast, a more complex beer like a stout or porter will do better with fruits that are higher in acidity and tannins, which provide structure that is strong enough to still influence the flavor in these already flavorful beers. In this case you can still use certain extracts, but can also be successful fermenting out the fruit even without backsweetening.

The three basic techniques for adding fruit flavor to beer are flavor extracts, backsweetening, and fermenting fruit.

FRUIT FLAVOR EXTRACT

The easiest method to add fruit flavor to your beer is to use a fruit flavor extract or artificial flavoring. These are available from many homebrew suppliers and are typically a concentrated artificial fruit flavor in liquid form. Typically only a few ounces (10s of mL) are needed for a homebrew batch, and it will add both color and flavor to your beer. Another technique some brewers use is to add very small extract additions as top notes to accentuate the aroma of a beer in which the primary fruit character comes from other fruit addition methods discussed later.

Since extracts are not fermented, they can be added to a finished beer "to taste." This is a major advantage over fermented fruit, as you can adjust the amount of extract to exactly match the amount of fruit flavor you want in your beer. Also, fruit extracts often include artificial sweeteners and color so they can restore some sweetness and color from the fruit to give you a better flavor balance than fermented fruit.

To estimate how much extract is needed, first pour a small sample size of 100 mL of your finished beer and then add a measured amount of extract, starting with perhaps 5 drops (0.25 mL) of extract. If that does not provide enough flavor, add drops until you get to your desired level, or start with a new sample and cut down the number of drops if the flavor was stronger than desired. Each drop is approximately 0.05 mL.

Once you achieve the correct flavor balance, pour one more sample and dose it to your measured rate to verify. Then scale the amounts up to your batch size. So if you had 100 mL of sample beer, you need to scale by a factor of 190 to match a 19-L (5-gallon) batch. So a dose level of 0.25 mL in 100 mL of beer would scale up to be (0.25 x 190) = 47.5 mL (1.6 oz.) in a 19-L (5-gallon) batch. In this scenario, to achieve the same flavor balance for the whole batch I would add 1.6 oz. (47.5 mL) of extract.

The only downside of using fruit flavor extracts is the flavor itself. While some extracts are nearly indistinguishable from backsweetening, many people can tell the difference between a beverage made from extract and real fruit. Some people say the artificial flavorings have a more soda-pop or artificial flavor than real fruit. Keep in mind that some extracts are better than others.

BACKSWEETENING WITH FRUIT JUICE

A second simple method to add fruit flavor to your beer is backsweetening. This technique, widely used in cider and mead production, involves first *stabilizing* your beer by adding sulfites and sorbates, which together work to inhibit further fermentation. After the beer has been stabilized, you add fruit juice to achieve your desired fruit flavor. Because sulfites and sorbates inhibit fermentation, the sugar you added in the fruit will not ferment and you will be left with the complete sweetened fruit flavor in the finished beer as well as the fruity aroma. As a result this can be a great technique if your goal is a sweet fruit beer that captures the entire flavor of your fruit.

To backsweeten your beer, you first add a small amount of potassium metabisulfite to your finished beer after fermentation is complete. While you can actually measure your free sulfites using a test kit and adjust to achieve a lower sulfite level, most

brewers just add a sufficient amount to prevent fermentation. Roughly 100–200 ppm will inhibit fermentation. Each ½ tsp. of potassium metabisulfite adds about 100 ppm of sulfite for a 5-gallon (19-L) batch.

After the sulfite, then add potassium sorbate (also called sorbates). Potassium sorbate is used at a 125–200 ppm dose rate, which is roughly 0.5 to 0.75 grams per gallon. This works out to 2.5–3.75 grams for a 5-gallon (19-L) batch. The combination of the sulfite and sorbates is sufficient in most cases to inhibit fermentation.

Backsweetening is typically done on finished beer, so as with flavor extracts you can backsweeten your beer "to taste." This is most easily done with fruit juice. My preference is for pure (unsweetened) juice if you can find it, but in the case of very acidic fruits like cranberries, some sweetening can help. Much as with fruit extract, you start with a premeasured amount of finished beer and then add varying amounts of the fruit juice until you achieve the flavor balance you want before scaling up.

You can also backsweeten with whole fruit by adding the fruit to the finished beer, but you do run a slight risk of kicking off additional fermentation from wild yeast or bacteria. Stabilizing your beer with sulfites and sorbates will help to inhibit this, but it might be a good idea to bump up the sulfites/sorbates levels to reduce the risk of infection from the fruit. Steeping your whole fruit in the beer for a few days is usually sufficient to impart most of the fruit flavor. I prefer to use a grain bag to make it easier to separate the fruit at the end of steeping.

Finally, I do need to mention that the addition of sulfites and sorbates to inhibit fermentation when backsweetening always involves some risk of future fermentation. While stabilizing your beer significantly inhibits new yeast cell growth, it does not kill off the yeast cells themselves, and also sulfite levels will drop as your beer ages. For this reason you should not bottle your backsweetened beers, and instead they should be maintained in a keg where you can release pressure if needed.

DESIGN CONSIDERATIONS IN FERMENTING FRUIT

Fermenting fruit with the beer is the most challenging option, but it can also be the most rewarding. The first thing to consider when fermenting fruit with the beer is that, unlike using flavor extract or backsweetening, fermenting your fruit will result in almost all of the sugars in the fruit being fermented into alcohol, which will significantly change the perceived flavor of the fruit. So no matter how much fruit you add it won't result in the same flavor profile of the original fruit.

As mentioned earlier, the CO_2 action of the fermentation will drive a lot of the fruit aromatics out. This is especially true if you add the fruit to the primary fermentation, but some loss of aromatics will occur even if you add your fruit to the secondary. If you are working with a fruit that is light and aromatic then adding to the secondary is probably a better approach.

The main counter to loss of aromatics and sugar balance is something mead and winemakers call "structure." Technically, structure is the major elements of a beverage that can be assessed when tasting the final product. These include things like acidity, tannins, body, sweetness, and alcohol. Each of these becomes very important when creating a balanced fruit beer.

Let's first look at acidity and tannins, as these form the backbone of most fermented fruit beers. Acidity, which drives the pH down, will make your beer appear tart, sour, and in some cases lighter or drier in flavor. At extreme levels it can truly make your beer sour. However, acidity counters sweetness, so it can be used to add structure to your beer.

Tannins, which are polyphenols

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The flavor and structure of fruits with a low pH, high acidity, and lots of tannins, such as black currants, will carry forward into the finished beer even if added during primary fermentation.

found in many fruits or fruit skins like grapes, berries, and currants are a powerful component of fruit beers and create fuller lasting flavors that don't ferment away. Tannins, in a word, create structure in your beer.

Sweetness obviously comes from residual sugars or unfermented starches in your finished beer. In most beers it comes from malt though some adjuncts like lactose can also add sweetness. Sweetness often works hand in hand with body, which is the perceived mouthfeel of the beer and not surprisingly a beer with more residual starches and a higher finishing gravity will be perceived as both sweet and full of body.

Acidity and tannins tend to create structure in your beer, but sweetness and body are the counterpoint to them. The key is to balance your acidity/tannin level with the sweetness and body of the beer. If I ferment a fruit like black currants, with their high level of both tannins and acidity, then I will also need a high level of residual sweetness and body to balance the beer. Achieving this balance is really what designing fruit beers is all about.

Alcohol is a bit more complex. Excessive alcohol levels will lower your final gravity, which reduces the perceived body of the beer. However you can counter some of the bite of alcohol with increased structure from tannins and acidity, so a highly structured beer can stand up to more alcohol.

Because fruit is almost all sugar and water, you do need to design any fruit beer to have a bit more body, residual sweetness, and higher final gravity than you would for a normal beer. Keep in mind the fruit addition will always lower your final gravity. This can be done in a number of ways — for example wheat beers are a popular base because the wheat provides proteins that give the beer a bit more body without adding a lot of flavor. You can select lower attenuation yeasts to raise the final gravity. You can use more adjuncts or specialty malts that are not as fermentable to add body and raise the FG as well.

I want to mention how to properly measure the sugar content of your fruit or juice. For juice, simply drop a hydrometer in a sample of the juice and measure the gravity in either specific gravity, °Plato, or °Brix. Once you have the sugar density, enter that into your software along with the fruit volume. For whole fruit, extract some of the fruit juice and follow the same process to measure its sugar content. For hard fruits you can often look up the sugar percentage, which corresponds directly to its Brix value.

WHICH FRUITS TO USE

Now that we've discussed the basics of structure we can have a meaningful discussion about various fruits and how well they hold up in a fermented beer. As always, this decision is heavily influenced by the style and flavor profile you are trying to create. The main factors to look at when evaluating a fruit are the acidity, tannins, and aroma, and how it fits in with your beer style.

Many fruits that we enjoy have very low levels of tannins and acidity. For example many soft, sweet fruits like peaches, plums, apricots, sweet cherries, nectarines, strawberries, watermelon, pineapple, mangos, and other tropical fruits have relatively low levels of acidity and almost no tannins. These fruits will not provide any real structure to your beer, so your strawberry beer may completely lose any strawberry flavor once the sweetness and aroma ferments away. They are most appropriately used in a very light beer like a wheat or lager where some of the flavor might survive fermentation. These fruits should also be used in the secondary, as they tend to have more aromatics. Some, like apricots, hold up better than others.

I've personally started using fruits in my beer that have real structure – either high levels of acidity or tannins. Two of the most extreme examples are black currants and cranberries. Both of these have a very low pH, very high levels of acid, and a large amount of tannins, so they will come through even in something like a stout, though your beer needs to have enough residual sweetness and body to counter the sourness and strength of these fruits.

Other well-structured fruits include raspberries, blackberries, boysenberries, loganberries, gooseberries, sour cherries and red currants. Acidic citrus fruits like limes and lemons can also work, though they are quite sour and can overwhelm the beer. These fruits have enough structure to survive fermentation and in larger quantities can also be used for dark, rich styles like porter and stout. These structured fruits can be used in the primary, which creates a more aged-wine, less aromatic profile than using fruits in the secondary.

In between you have moderately structured fruits like apples, red grapes, pears, and blueberries. Some of these, like blueberries and grapes, have most of their tannins concentrated in the skin, so you need to keep the skins intact. Others, like apples, have huge varietal variation. The most prized apples for cidermaking, for example, the rare Kingston Black variety, have both high acidity and high tannins. Unfortunately, many of these varieties were dropped during Prohibition and are no longer grown in the US.

PRACTICAL CONSIDERATIONS

How much fruit to use is largely driven by the beer style and choice of fruit. Light fruits with little acidity or tannins are best used in large quantities in the secondary of very light profile beers to maximize aroma and flavor. You will also need a high dose rate of around 3–5 lbs. per gallon (0.35–0.6 kg/L) to generate much fruity flavor. Because of the high fruit usage you will also need a base beer with some body to it.

Moderately structured fruits can be used in a wider variety of styles at a dosage rate of 2–4 pounds per gallon (0.25–0.5 kg/L). Again, you would use a higher dose of fruit with a darker beer, and you still need a base beer with good body to provide residual sweetness to counter the alcohol and thinning effects of the fruit addition. Many of these like tart cherries can also be added in the primary if you are looking for a more aged flavor, though this will strip most of the

fruit aroma.

Highly structured fruits like currants and cranberries are used more sparingly, perhaps 1–3 pounds per gallon (0.12–0.35 kg/L). Using too much will drive the acidity of the beer way up and create a sour beer, and excess tannins can also create bitter teabag flavors. Again, very dark or high-body beers can hold up to more structure. I prefer to use these fruits in the primary, as the acidity and tannins will carry forward into the finished beer and aroma is not as important on these fruits.

If you are brewing with large amounts of fruit in the primary I recommend adding a small amount of pectic enzyme. Pectic enzyme aids in breaking down the pectins in the fruit and the release of aromatics, particularly fruits like grapes and apples, and can also aid in extraction of tannins from fruit skins. For a fruit beer a typical dose rate is around 1.25 tsp. per 5 gallons (19 L).

Another important consideration is what form of fruit you are using. Fruit juice, by far, is the easiest to add to your beer and many excellent fruit juices are available for just about any type of fruit. You do need to take care to select only fruit juices that are free of preservatives, as juice with preservatives will inhibit fermentation.

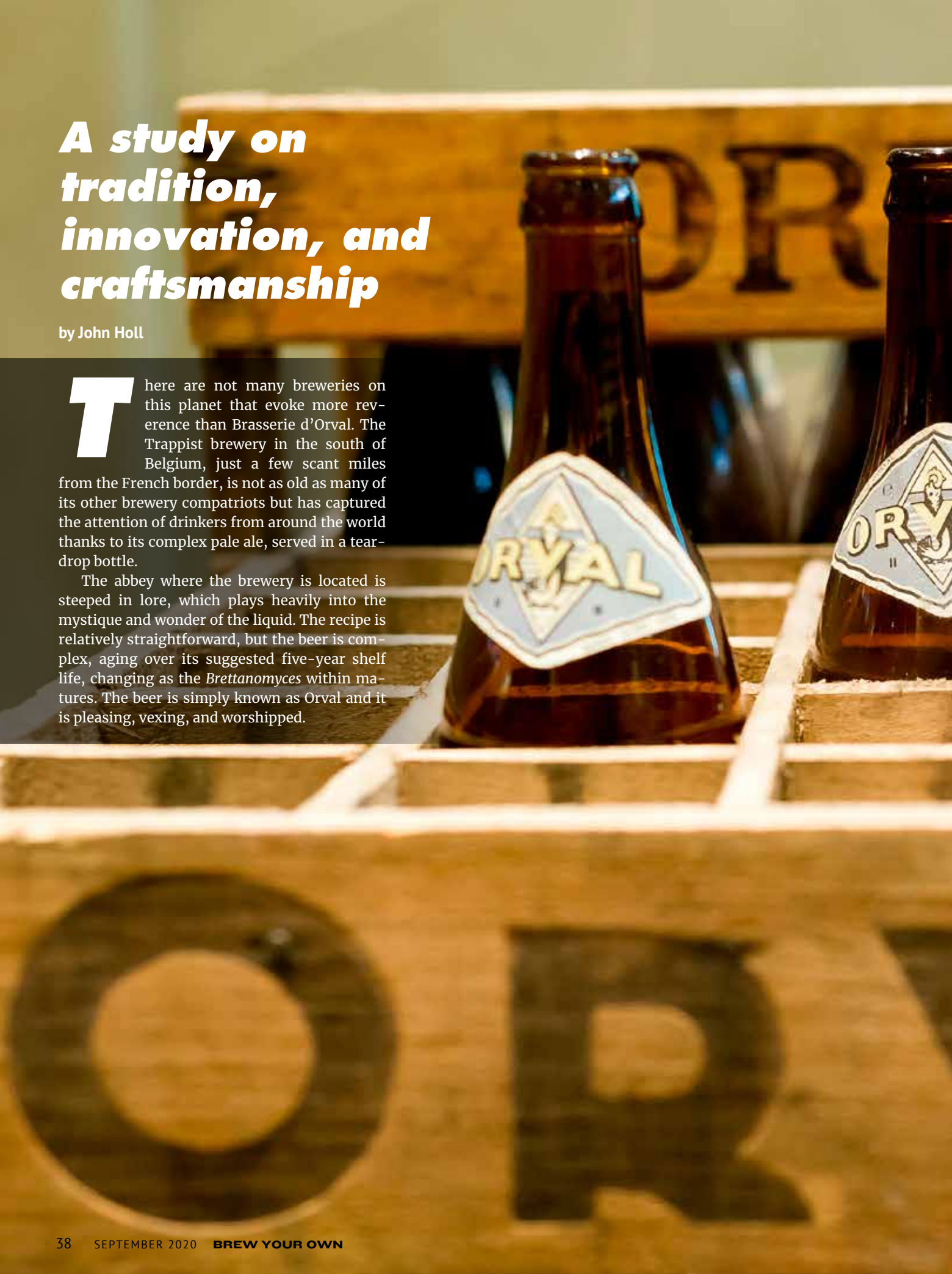
While many brewers use them, most fruit puree is extremely difficult to separate once you get it into the fermenter, which is the reason I stopped using it. An exception to this is the Amoretti Craft Purees, which are filtered and super concentrated to avoid this issue. Another option is canned fruit wine base, which works well and can be added to a grain bag for easy separation.

Whole fruit provides the best fresh fruit flavor. Wash the fruit first and dry it. If you are working with soft fruit you can often cut it up and add it directly to the fermenter. Cellular fruits like berries are more easily fermented if you freeze them first to open up the cell walls. Clean it, freeze it, and then thaw it out before using. I also highly recommend using a grain bag to contain the fruit and make it easier to separate after fermentation. Most whole fruit I will leave in the primary or secondary for about a week or until the fruit starts to turn white. You also need to "punch down" the fruit or turn it over once to twice a day to prevent dry fruit from sitting on the top of the fermenter and developing mold.

The final topic I want to cover is blending. A significant disadvantage of using fruit in the fermenter is that you may not get the amount of fruit right the first time, as you are often guessing as to the proper flavor balance between acidity, tannins, sourness, body, sweetness, and alcohol when creating a new recipe. So if your fruit beer balance did not come out perfect, why not blend it with another beer? You can brew another beer to precisely blend in or even resort to backsweetening or fruit extract if you need a flavor boost. BYO

A study on tradition, innovation, and craftsmanship

by John Holl



There are not many breweries on this planet that evoke more reverence than Brasserie d'Orval. The Trappist brewery in the south of Belgium, just a few scant miles from the French border, is not as old as many of its other brewery compatriots but has captured the attention of drinkers from around the world thanks to its complex pale ale, served in a teardrop bottle.

The abbey where the brewery is located is steeped in lore, which plays heavily into the mystique and wonder of the liquid. The recipe is relatively straightforward, but the beer is complex, aging over its suggested five-year shelf life, changing as the *Brettanomyces* within matures. The beer is simply known as Orval and it is pleasing, vexing, and worshipped.

Photo by Shutterstock.com

Photo by Shutterstock.com

Orval is one of the most revered beers, traditionally served in the Trappist brewery's chalice glass.

Homebrewers will attempt to recreate this beer themselves and professional breweries like Goose Island have spent years working on clones or homages to the beer. Some are successful, but like any copy there is always something missing. It lacks the spirituality.

Finding the real deal on store shelves or behind bartops and then enjoying in a chalice is an escape from the ordinary, and a study on tradition, innovation, and craftsmanship.

While beer and wine were made at the abbey going back to the 1600s, the current brewery was commissioned in 1931 and began shipping beer the following year. There have been upgrades to the system over the decades, but the space is a shrine to the time, it is not overly large and in the tradition with its Trappist roots, is modest. There are artistic flourishes around the copper kettles, like stained glass and mosaic work, but the rest of the brewery is the tangle of pipes, hoses, and machinery found the world over. The ingredients used are the very same that are found around the world.

It is the final result that helps Orval stand apart from the rest. The style can be called a Belgian pale ale and as I discovered during a visit to the brewery late last year it is a combination, according to my guide, that includes Pilsner and caramel malt that comes from the United States and Great Britain, and the hops (pellets are used in the boil and whole cone for dry hopping) come from France, Slovenia, and Germany (Hallertau, Strisselspalt, and Styrian Golding). Each batch uses about 3,300 pounds (1,500 kg) of candi syrup in a 7,400-gallon (280-hL) batch.

The water comes from the grounds of the abbey.

"We have no problem with water here," my guide for the day, Claude Roulant, said.

To talk about Orval is to talk of the water, specifically the legend of Mathilda of Tuscany, who was said to have visited the grounds when she dropped her wedding ring into a pond. It was returned, the story says (which is also depicted on the beer's label) by a trout, to which the woman exclaimed "Truly this place is a Val d'Or." She dedicated the necessary funds to help build the monastery.

To walk the grounds of the monastery, which dates back to 1070, is a step back in time, and a humbling experience. Indeed its grand structures are visited by tens of thousands of people each year who come for reflection or history. The brewery is only opened a few times per year to visitors, and other tours must be made by appointment.

The brewery, Trappist in designation, employs fewer than 40 workers and only mashes in six times per week — four times on Tuesday and two times on Wednesday, my guide said. Last year the brewery made around 47,500 barrels. In all, 85% of Orval produced remains in Belgium. The rest is divided up among the other countries that import it. The brewer, Anne Francoise Pyparert, declined an interview.

Much about the overall brewing process is standard. It's a 90-minute boil before the sugar is added. But there is a two-step fermentation process, where *Brettanomyces bruxellensis* is introduced along with a house yeast that helps to define the beer.

The first fermentation happens for a period of four days where the beer is held between 59–72 °F (15–22 °C). It is then transferred to horizontal tanks where it is held for up to three weeks.

During this time, each tank has nine bags, each weighing 26.5 lbs. (12 kg), of dry hops added.

Later, it is worth pointing out, that when the bags are removed they are dried completely and then used as fuel. "Nothing goes to waste here," my guide said, noting that spent grain is sent to local dairy farms that produced more than 300 tons of cheese last year.

The beer is then adjusted for strength depending on its destination country (in Belgium it is served at 6.2% ABV and in the United States at 6.9% ABV) and bottled or kegged for local consumption. "One last drop of sugar and a drop of *Brettanomyces*" is added to each bottle before it is sealed for bottle conditioning. Orval is best consumed within five years of being packaged and ideally is enjoyed at cellar temperature.

In my experience as a reporter, I've found that many Belgian breweries are cagey about talking specifics about a beer in their portfolio. That a tour guide at Orval was so readily giving up much about the process and ingredients demonstrates that while they take their craft seriously, they are not overly concerned that it will be replicated by others.

There is no tasting room at the brewery itself, but a restaurant a short stroll down the road from the abbey, the A l'Ange Gardien, is the closest place to have a chalice of the beer and the only place to drink Orval Vert, the smaller ABV version of the beer that is brewed for the monks.

Orval Vert is available on draft only at 4.2% ABV and is served in a chalice that has green lettering, rather than blue or gold. Where traditional Orval changes over time and can be hoppy or bursting with juicy fruit notes, or spicy and leathery from the *Brettanomyces*, green Orval is snappy, hop-forward, with lemony citrus and hay.

There are recipes inspired by Orval that exist and that can likely bring great joy to the homebrewer and imbiber (such as the one we've provided to the right), but there is a strong argument to be made that Orval is best left to tradition and, if possible, enjoyed at the source.

ODE TO VAL D'OR

(5 gallons/19 L, all-grain)
OG = 1.056 FG = 1.002
IBU = 33 SRM = 9 ABV = 6.9%

Orval pours orange-brown with a big, rocky head. The very spritzy levels of carbonation with a slight sour note and distinctive Brett *character make the beer feel prickly on the tongue. Orval is dry and has little hop bitterness or flavor, although it is the only Trappist ale to be dry hopped. This recipe creates a beer similar to the Orval beer distributed to the US with a higher ABV.*

INGREDIENTS

8.5 lbs. (3.8 kg) Pilsner malt
1.3 lbs. (0.6 kg) English light crystal malt (40 °L)
2.2 lbs. (1 kg) candi syrup (1 °L)
4.4 AAU Hallertau-Hersbrücker hops (60 min.) (1.1 oz./31 g of 4% alpha acids)
3.3 AAU Styrian Goldings hops (60 min.) (0.66 oz./19 g of 5% alpha acids)
2.5 AAU Styrian Goldings hops (15 min.) (0.5 oz./14 g of 5% alpha acids)
0.3 oz. (8 g) Strisselspalt whole cone hops (dry hop)
0.25 oz. (7 g) Hallertau-Hersbrücker whole cone hops (dry hop)
¼ tsp. yeast nutrients
White Labs WLP510 (Bastogne Belgian Ale) or Wyeast 3522 (Belgian Ardennes) or LalBrew Abbaye Belgian Ale yeast
Wyeast 3112 (Brettanomyces bruxellensis) or White Labs WLP650 (Brettanomyces bruxellensis) yeast
1 cup corn sugar (if priming)

STEP BY STEP

Heat 3.6 gallons (13.5 L) of water to 163 °F (73 °C), stir in crushed grains and mash at 150 °F (65 °C). Mash for 60 minutes raise grain bed temperature to 162 °F (72 °C). Hold for 15 minutes. Recirculate until wort is clear, then begin running wort off to kettle. Sparge with 170 °F (77 °C) water to collect roughly 7 gallons (26.5 L). Boil wort for 90 minutes, adding hops as indicated. Add yeast nutrients with 15 minutes left in boil and candi syrup at the end of boil. Cool wort down to 59 °F (15 °C), aerate, and pitch the Belgian yeast strain. Fermentation temperature can be slowly raised up to 72 °F (22 °C) to finish. Rack to secondary when active fermentation is complete and add *Brettanomyces* and dry hops. Let condition for 3 weeks at 59 °F (15 °C) before bottling. Condition warm for 3 weeks in bottles before serving.

ODE TO VAL D'OR

(5 gallons/19 L, extract with grains)
OG = 1.056 FG = 1.002
IBU = 33 SRM = 9 ABV = 6.9%

INGREDIENTS

4 lbs. (1.8 kg) Pilsen dried malt extract
1.3 lbs. (0.6 kg) English light crystal malt (40 °L)
2.2 lbs. (1 kg) candi syrup (1 °L)
4.4 AAU Hallertau-Hersbrücker hops (60 min.) (1.1 oz./31 g of 4% alpha acids)
3.3 AAU Styrian Goldings hops (60 min.) (0.66 oz./19 g of 5% alpha acids)
2.5 AAU Styrian Goldings hops (15 min.) (0.5 oz./14 g of 5% alpha acids)
0.3 oz. (8 g) Strisselspalt whole cone hops (dry hop)
0.25 oz. (7 g) Hallertau-Hersbrücker whole cone hops (dry hop)
¼ tsp. yeast nutrients
White Labs WLP510 (Bastogne Belgian Ale) or Wyeast 3522 (Belgian Ardennes) or LalBrew Abbaye Belgian Ale yeast
Wyeast 3112 (Brettanomyces bruxellensis) or White Labs WLP650 (Brettanomyces bruxellensis) yeast
1 cup corn sugar (if priming)

STEP BY STEP

Heat 5 gallons (19 L) of water to 163 °F (73 °C). Steep crushed grains in a grain bag as the water heats. When the temperature hits 170 °F (77 °C) remove the grains. Off heat, stir in dried malt extract until it is fully dissolved. Turn heat back on and bring wort to a boil. Add the first charge of hops and begin the 60-minute boil. Follow the rest of the all-grain recipe, being sure to top off to 5 gallons (19 L) after chilling the wort.

Photo by Charles A. Parker/Images Plus

CELEBRATING MILESTONES

5 anniversary clones from 5 special breweries

by Dave Clark

The year was 1995. Toy Story, Apollo 13, and Batman Forever dominated the big screen. Hootie and the Blowfish, TLC, and Better Than Ezra were climbing the Billboard charts. The OJ Simpson trial dominated headlines. Craft beer big guns like AleSmith, Allagash, and Bear Republic were founded. And a magazine named *Brew Your Own* was established with the intent of helping people brew better beer at home.

So much has happened in the past 25 years! As our magazine celebrates its silver anniversary, we reflect upon how much has changed in the beer world. Startup breweries became icons, craft beer went mainstream, and IPAs became a requisite part of any tap lineup. Most importantly, breweries continued to open at a record pace, with the number of operating breweries now north of 7,000 in the United States.

Anniversaries are meant to be celebrated. While some people take a trip of a lifetime or splurge on luxury items, the beer world typically recognizes anniversaries by brewing big, unique, and interesting celebratory beers. There's no better way for us to celebrate than with a story that features five iconic breweries and the recipes they are toasting with on their own anniversaries.

The highly awarded and beloved brewery in Greensboro, Vermont, Hill Farmstead, is celebrating a decade in business with a unique take on a traditional Pilsner. Florian Kuplent's Urban Chestnut Brewery in St. Louis, Missouri, is celebrating its anniversary by concocting an American-style hazy IPA, quite a departure for the German-centric brewery.

Craft beer legend Mitch Steele of Atlanta, Georgia's New Realm is going big with Radegast, a monster-sized triple IPA, to celebrate his brewery's second anniversary. Boulder, Colorado's Avery Brewing, with an assist from Leopold Brothers Distilling, created a unique take on their famed Mephistopheles imperial stout to help celebrate the 20th anniversary of Colorado's Big Beers, Belgians, and Barleywines festival.

The elder statesman on the block, and cornerstone of the craft beer movement, Sierra Nevada Brewing Company, turned 40 in 2020, and celebrated in style with Hoppy Anniversary Ale. This classic IPA from the Chico, California brewery showcases the classic hops that ushered in a new generation of brewing four decades ago. After learning more about these legendary breweries, you can try your hand at replicating their celebratory beers at home and then fill your glass to toast your next big anniversary!

A Way of Life: The Hill Farmstead Story

Hill Farmstead is so much more than just a brewery. It's a destination for many and it's a way of life for Owner/Brewmaster Shaun Hill.

An eighth-generation member of the Hill family that founded the town where the brewery resides (Greensboro, Vermont), Shaun Hill brought to fruition the brewery he envisioned as an 18-year old who was searching for his life's calling.

"I started homebrewing at age fifteen as a science fair project," said Hill. "I realized that one way I can live and work here in this beautiful land we call home was to open a brewery."

The vision he saw as an 18 year-old took him not only off the farm, but eventually out of the country altogether. After learning his craft working at several Vermont breweries, Hill went international honing his skills and winning multiple World Beer Cup medals with popular Nørrebro Bryghus in Copenhagen, Denmark.

"While still in Denmark, I wrote a business plan and raised money from friends. When I returned to Vermont in 2009, I started this brewery with just $60,000 and a goal of focusing on pale ale, IPA, and mixed-fermented beer," said Hill.

BEST BREWERY IN THE WORLD

Hill Farmstead has won the distinguished "Best Brewery in the World" award from RateBeer.com multiple times, including each of the past four years. With that kind of attention, a substantial increase in brewery foot traffic was inevitable.

"The idea was never to get big," said Hill. "After the RateBeer awards, the scale started to tip and the amount of people coming became more than capacity could handle. When it became commonplace for people to wait outside in the freezing weather just to get in, I knew I had to do something. So we expanded onsite to be as large as the land trust we're a part of would allow."

A TALE OF TWO BREWERIES

If Hill Farmstead Brewery is the culmination of many years of travel and insight, blending new brewing horizons with the history of 220 years of Hill heritage, it can also be considered two breweries in one, both physically and philosophically.

Traditional styles are all well-received staples; brewed in one part of the brewery. Hill Farmstead also gets a great detail of attention — and international renown — for their "wild side," which is crafted on the other side of the facility.

"The 'wild side' is where we can take more chances," said Hill. "We still use science and general brewing principles as usual, but we take it further than traditional brewing. For example, we may split a batch and employ different ingredients or techniques to learn what happens when you do things differently. We are willing to take more chances and learn as we go. There's more room for learning and fun."

Even with all of the experimenting, the very first beer Hill Farmstead brewed, Edward Pale Ale, has always been the brewery's biggest seller. The beer's signature hazy appearance is a byproduct of the house yeast strain and being unfiltered. "It's the true definition of pale ale — it's 5% ABV and hop-forward, featuring Simcoe®, Chinook, and Centennial hops. Funny thing is, I had to defend the haziness of the beer for a long time. Many of our fans were initially skeptical, until they tried it, of course."

CELEBRATING TEN YEARS

After ten years of overcoming obstacles, beating the odds, and establishing itself as one of America's (or, the world's, we should say) finest craft breweries, it was time to celebrate. Of course, world events put an indefinite hold on those celebration plans, but Hill and his team are determined to make sure that celebration happens when the time is right.

To that end, he and his team are hard at work creating special beers to celebrate the 10-year milestone, highlighted by several imperial stouts and a playful, reimagining of their Pilsner, Mary.

"For nearly a decade, I have wanted to see what would happen if we placed a lager, after primary fermentation, into some empty wine barrels that formerly held one of our Farmstead ales," said Hill. "I imagine that this might be similar to how lager *could* have tasted long before robust sanitation practices were in place."

Taking one of the world's most traditional beer styles and giving it a special Hill Farmstead twist, Hill first brews a traditional Pilsner, before aging the beer in a French oak barrel that previously housed *Arthur*, one of Hill Farmstead's mix-fermented saisons.

"We have produced several versions of clean, wood-conditioned Mary," said Hill. "This anniversary version attempts to tease out the intersection of a brewer's intention (process, technology, sanitation) and the extent to which surrendering to nature (flora, the unknown) deviates and occasionally leads us to a pleasant and familiar outcome — in this case: American wild ale."

HILL FARMSTEAD BREWERY'S OLD WORLD, WILD MARY PILSNER CLONE

(5 gallons/19 L, all-grain)
OG = 1.048 FG = 1.010
IBU = 42 SRM = 3 ABV = 4.9%

According to Shaun Hill, Owner of Hill Farmstead Brewery, "This is an unreleased beer (at press time) that we internally refer to as Old World, Wild Mary. The base beer is our German-style Pilsner, Mary, aged in oak barrels that previously held our farmhouse ale, Arthur."

INGREDIENTS

8.8 lbs. (4 kg) European Pilsner malt
0.3 lb. (130 g) malted wheat
0.5 lb. (220 g) acidulated malt
8 AAU Perle hops (60 min.)
(1 oz./28g at 8% alpha acids)
4.4 AAU Hallertau Mittelfrüh (15 min.)
(1.1 oz./32g at 4% alpha acids)
2.3 oz. (65 g) Hallertau Hersbrucker hops (0 min.)
SafLager 34/70 or Wyeast 2124 (Bohemian Lager)
The Yeast Bay TYB184 (Brettanomyces bruxellensis) or Omega Yeast OYL-201 (Brettanomyces bruxellensis)
5.3 oz. (150 g) dextrose (if bottling)
Safale US-05 or LalBrew CBC-1 (if bottling)

STEP BY STEP

Utilize a thin mash (~1.7 qts./lb. or 3.5 L/kg) to minimize the sparging volume. While this will produce weaker first wort, it will aid in less tannin extraction and help prevent contaminating the wort with potentially unsavory last runnings. Target a mash temperature of 148 °F (65 °C). Mash in with 4.1 gallons (15.5 L) of water. If using reverse osmosis water, add 1 tsp. of calcium chloride to achieve 50 ppm of calcium. Rest for 60 minutes. Measure mash pH at 20 minutes and adjust with food-grade acid (lactic, citric, phosphoric) as necessary to hit a target of 5.2 to 5.3.

When mashing is complete, recirculate (vorlauf) at least ten minutes until beer is very clear. (For the advanced homebrewer, adjusting and monitoring mash and boil pH will be paramount in producing the best beer).

After collecting first wort, sparge with 3.4 gallons (13 L) of water at 170 °F (77 °C) and collect 6.6 gallons (25 L) of wort into the boil kettle. Pay attention to the last runnings! Density (gravity) should never fall below 1.010 (2.5 °P) and should taste pleasant. If last runnings become husky or tannic, cut the sparge and stop collecting wort. Water can be added directly to the kettle in order to reach desired volume.

Boil for 90 minutes, adding hops as indicated. At the end of the boil, cut the flame and let rest for 5 minutes. Whirlpool with the Hallertau Hersbrucker hops. After about 20 minutes of whirlpool, rapidly chill the wort to 45–50 °F (7–10 °C). Transfer wort to the fermenter and pitch the lager yeast (at least two packets of dry yeast or, if liquid yeast, prepare a healthy starter and ensure activity and viability), oxygenate well. Ideal fermentation is at 45–50 °F (7–10 °C). A prolonged 24–48 hour lag is common at this temperature.

When fermentation appears to have ceased after 2 to 3 weeks, transfer the beer to a secondary vessel (a neutral oak barrel would be preferred), and inoculate with *Brettanomyces*. Do not be concerned with a temperature rise or diacetyl rest.

The beer should condition at 50–54 °F (10–12 °C) for several months in a neutral barrel (if possible). When ready for packaging, boil 5.3 oz. (150 g) of dextrose in 1 cup of water. Cool to room temperature, then very slowly sprinkle in 0.07 oz. (2 g) of a dry, neutral yeast. Add this sugar and yeast cocktail to your bottling bucket. This should produce 3 volumes of carbonation conditioned at room temperature. Open your first bottle in one month. Or, keg and carbonate to 3.0 v/v.

HILL FARMSTEAD BREWERY'S OLD WORLD, WILD MARY PILSNER CLONE

(5 gallons/19 L, extract only)
OG = 1.048 FG = 1.010
IBU = 42 SRM = 3 ABV = 4.9%

INGREDIENTS

5.3 lbs. (2.4 kg) Pilsen dried malt extract
8 AAU Perle hops (60 min.)
(1 oz./28g at 8% alpha acids)
4.4 AAU Hallertau Mittelfrüh (15 min.)
(1.1 oz./32g at 4% alpha acids)
2.3 oz. (65 g) Hallertau Hersbrucker hops (0 min.)
SafLager 34/70 or Wyeast 2124 (Bohemian Lager)
The Yeast Bay TYB184 (Brettanomyces bruxellensis) or Omega Yeast OYL-201 (Brettanomyces bruxellensis)
5.3 oz. (150 g) dextrose (if bottling)
Safale US-05 or LalBrew CBC-1 (if bottling)

STEP BY STEP

Heat 3 gallons (11.4 L) of water to 150–160 °F (65.5–71 °C). Add malt extract off heat while stirring until all extract is dissolved. Return pot to the heat Boil for 60 minutes, adding the hops as indicated. Using lactic acid or phosphoric acid, adjust pH to 5.1–5.2 near the end of the boil.

Follow the remainder of the all-grain recipe, making sure to top up the fermenter to 5 gallons (19 L) before pitching yeast.

The Best of Both Worlds: Urban Chestnut Brewing

Urban Chestnut Brewing Co. (UCBC) may be an interesting name for a brewery, but to German-born Brewmaster/Co-Founder Florian Kuplent, it makes perfect sense.

"Urban" pays tribute to craft beer enthusiasts who are actively building and supporting the artisan-based communities in which they live — including their favorite craft breweries. "Chestnut" is a symbol of the tradition and heritage of his homeland's beer. Many Bavarian brewers have used chestnut trees to shade their beer cellars and biergartens for centuries.

Modern craft and classic brewing styles intersect in UCBC's philosophy known as *Beer Divergency*. The brewery's *Revolution* series explores modern American craft styles while the *Reverence* Series pays tribute to classic European styles and methods. Recently, a third series has emerged showcasing small batches of Bavarian brewed/imported beers via the *Hallertauer* Series, brewed in Kuplent's German UCBC outpost in the heart of the famous Bavarian Hallertau hop growing region.

A LONG AND WINDING ROAD

Long before opening his popular breweries in St. Louis, Missouri, Kuplent got his start in Germany delivering beer and working on the bottling line at a small brewery called Brauerei Erharting. With a natural interest in the fields of biology and chemistry, Kuplent developed an immediate interest in learning about all facets of the brewing process. He became the brewery's first apprentice in decades, where he honed skills beyond brewing, including working in their onsite malthouse. This gave young Kuplent the confidence to pursue a career in the brewing industry, first by enrolling as a student at the Bavarian College of Food and Beverage Science, and later at the prestigious Technical University of Munich-Weihenstephan, famous for its brewing programs, where he earned a Master's degree in malting and brewing science.

Armed with classroom and real-life experience, Kuplent's brewing travels became global, with stops in America, England, and Belgium before spending several years working for beer giant Anheuser-Busch, first in New Jersey, then in St. Louis.

Kuplent and his US-born wife decided to call St. Louis home. With brewery ownership on his mind, he finally took the plunge and founded Urban Chestnut in 2010 with business partner David Wolfe.

WE'RE OPEN! TIME TO EXPAND

With success came challenges. Brewing both traditional German styles along with modern craft favorites, UCBC's demand was soon outpacing production. Enter UCBC 2.0. "The first couple years, we kept doubling our sales volume and quickly realized we were going to have issues producing beer in our original 10,000-square-foot building," said Kuplent.

A 60,000-square-foot building in the entertainment district known as "The Grove" was soon purchased to meet demand. A short while later, a space opened up near the new production brewery that the partners eyed as a potential pilot brewery. Brewing small batch "test" beers, the Urban Research Brewery (known as The U.R.B.) creates online surveys where fans provide feedback about the test beers, giving them a voice in the future of the business. The U.R.B. has become a true hit with the local community.

While IPAs remain all the rage across America, UCBC does 70–75% of their business in lagers. An unfiltered helles, UCBC Zwickel, is their #1 seller.

Kuplent's connections in his homeland led to UCBC going international. Acquiring the brewing assets of a small, defunct brewery in Wolnzach, a town in the Hallertau region of Bavaria — the very region from which the brewery sources a majority of its hops — allowed Kuplent to open an outpost in his homeland.

HALLERTAU HAZE

This fall marks the company's tenth anniversary and it plans to celebrate with a beer that is quite the departure from what fans have come to expect.

"Most people see us as a German brewery, focused mostly on lagers, so brewing a hazy IPA is an interesting angle," said Kuplent.

Not just any hazy IPA, UCBC's hazy will consist of a variety of hops all originating from the Hallertau region, hops traditionally not found in IPAs. The relationships forged with the maltsters and hop farmers of Kuplent's homeland have paid huge dividends when it comes to the success of UCBC.

"Working with the farmers and hop merchants is interesting and it allows us opportunities not all breweries have access to," said Kuplent. "It's a huge part of what we're all about; working with the people close to the ingredients.

These hops will allow Kuplent to create a special anniversary beer that intersects modern American craft and classic European brewing.

"These hop varieties are fruitier than traditional classic German herbal, spicy hops. We're using Mandarina, Blanc, and Huell Melon hops, even dry hopping with these varieties. It brings out a unique characteristic that combines the best of US and German brewing," said Kuplent.

Urban Chestnut Brewing Co. (10th Anniversary)

URBAN CHESTNUT BREWING CO.'S HALLERTAU HAZE CLONE

(5 gallons/19 L, all-grain)
OG = 1.050 FG = 1.011
IBU = 25 SRM = 5 ABV = 5.2%

A departure for a brewery known for its lagers, this groundbreaking hazy IPA, designed for Urban Chestnut's tenth anniversary, uses the best of Old World brewing tradition and modern craft innovation, and is brewed using 100% German hops and kveik yeast.

INGREDIENTS

9 lbs. (4.1 kg) American 2-row pale ale malt
1.1 lbs. (0.5 kg) German wheat malt
0.1 lb. (45 g) Carahell® malt (11 °L)
1.5 AAU Hallertau Merkur hops (75 min.) (0.13 oz./3.7 g at 11.4% alpha acids)
8.4 AAU Mandarina Bavaria hops (0 min.) (1.1 oz./30 g at 8% alpha acids)
8.4 AAU Hallertau Blanc hops (0 min.) (0.88 oz./25 g at 9.5% alpha acids)
2.65 oz. (75 g) Hallertau Blanc hops (dry hop)
1.76 oz. (50 g) Huell Melon hops (dry hop)
1.76 oz. (50 g) Hallertau Mandarina hops (dry hop)
½ tsp. yeast nutrient
White Labs WLP520 (Sigmund Kveik), Omega yeast 061 (Voss Kveik), LalBrew Voss yeast, or The Yeast Bay WLP4045 (Sigmund's Voss Kveik)
¾ cup corn sugar (if priming)

STEP BY STEP

Mash with 3.7 gallons (14 L) of water. Add 1 tsp. of gypsum and start your mash at 140 °F (60 °C). Raise temperature immediately to 153 °F (67 °C) and hold for 45 minutes. Next, raise temperature to 170 °F (78 °C) for mashout and recirculation. Begin collecting your wort and sparge with 176 °F (80 °C) water acidulated to a pH as close to 5.2 as possible.

Boil for 75 minutes, adding the bittering hop addition at the beginning of the boil. With 45 minutes to go, add 1 tsp. of gypsum to the boil. (Since some calcium ions get "consumed" during mashing, adding more during the boil assures a proper level required during fermentation.) Add ½ tsp. of yeast nutrient with 10 minutes to go in the boil.

Add flameout hop additions then whirlpool for 20 minutes. When settled, chill rapidly to 72 °F (22 °C) and oxygenate thoroughly. Ferment up to 75 °F (24 °C). Once attenuation is 50% complete, allow temperature to free rise to 79 °F (26 °C) for diacetyl rest and fermentation completion. When final gravity is reached, add the dry hops. 24 hours after dry hopping, chill to 41 °F (5 °C). Hold at this temperature for one day, then drop temperature to 34 °F (1 °C) for a 10-day maturation period. Keg and carbonate to 2.5 v/v or prime and bottle condition.

URBAN CHESTNUT BREWING CO.'S HALLERTAU HAZE CLONE

(5 gallons/19 L, extract with grains)
OG = 1.050 FG = 1.011
IBU = 25 SRM = 5 ABV = 5.2%

INGREDIENTS

4.5 lbs. (2 kg) extra light dried malt extract
1 lb. (0.45 kg) wheat dried malt extract
0.1 lb. (45 g) Carahell® malt (11 °L)
1.5 AAU Hallertau Merkur hops (75 min.) (0.13 oz./3.7 g at 11.4% alpha acids)
8.4 AAU Mandarina Bavaria hops (0 min.) (1.1 oz./30 g at 8% alpha acids)
8.4 AAU Hallertau Blanc hops (0 min.) (0.88 oz./25 g at 9.5% alpha acids)
2.65 oz. (75 g) Hallertau Blanc hops (dry hop)
1.76 oz. (50 g) Huell Melon hops (dry hop)
1.76 oz. (50 g) Hallertau Mandarina hops (dry hop)
½ tsp. yeast nutrient
White Labs WLP520 (Sigmund Kveik), Omega yeast 061 (Voss Kveik), LalBrew Voss yeast, or The Yeast Bay WLP4045 (Sigmund's Voss Kveik)
¾ cup corn sugar (if priming)

STEP BY STEP

Bring 3 gallons (11.4 L) of water to 160 °F (71 °C). Remove from heat and add your grains to a grain bag and submerge. Allow grains to steep for 20 minutes then remove grain bag and rinse with warm water. Slowly stir in the extract until fully dissolved. Bring wort to a boil and boil for 60 minutes, adding the hop additions as indicated.

Follow the remainder of the all-grain recipe, making sure to top up the fermenter to 5 gallons (19 L) before pitching yeast.

TIPS FOR SUCCESS:

Fermentation temperatures in the mid- to upper-70s °F (24–26 °C) is on the cool end for kveik strains, which are often fermented in the 90s °F (mid-30s °C) and warmer. Florian Kuplent says there are a couple of reasons he does this, which he acknowledges is based on "gut feel" and experience, not scientific data to back it up. "I prefer to control fermentation and like to not overly stress yeast — high temps seem to do that more. (And) with a lower fermentation temperature the fermentation is less vigorous, which removes fewer volatiles (aroma compounds we look for in the beer)." That said, you will notice yeast manufacturers suggest the optimal temperature to ferment this strain (depending on which manufacturer's yeast you use) ranges from around 70–100 °F (21–38 °C), so you have the option to turn up the heat.

For Legendary Brewmaster Mitch Steele, It's A New Realm

For a man who has the ultimate brewing resume, there was just one thing left to do: Build a brewery from scratch. Mitch Steele's impressive experience includes several years managing new beer formulations at Anheuser-Busch to his tenure as Brewmaster during the meteoric rise of Stone Brewing Company. The idea of brewery ownership became a reality when Steele met future partners Carey Falcone and Bob Powers. Together, the three would create New Realm Brewing Company in Atlanta, Georgia.

CEO Carey Falcone had been in the beer business his whole life, part of a family-owned beer distributorship near Scranton, Pennsylvania. He later got a job with Anheuser-Busch, a common denominator between the three future partners. Chief Commercial Officer Bob Powers was a sales expert with the large brewing conglomerate. Steele didn't know Falcone or Powers during their tenure at AB. When Falcone and Powers reached out to Steele, he initially declined; happy with his role as Stone's Brewmaster. The two persisted, and eventually Steele considered the opportunity. The rest, as they say, is history.

RACKING UP AIRLINE MILES

Making this work was no small feat, considering that Steele was living clear across the country in Temecula, California. Not wanting to uproot his daughter who was getting settled in her new high school, Steele did the impossible and commuted cross-country for three long years. Upon his daughter's graduation, Steele packed up and moved his family to Atlanta.

Originally, the working plan for New Realm was to open in Asheville, North Carolina. The team struggled to find the right property at the right terms, forcing them to expand their search. Falcone had been living in Atlanta for several years and found the perfect location. Upon first glance, Steele knew he could build his dream brewery in that spot. Centrally located with a great view of the Atlanta skyline and a rooftop bar, it was too good to pass up. Plans changed, and New Realm was heading to Atlanta.

A BREWERY IS BORN

Redefining the term "trial by fire," the unofficial grand opening was New Year's Eve of 2017 and the official public opening happened January 8, 2018 — the day of the college football championship. The game featured Georgia playing Alabama at the new Mercedes Benz stadium in Atlanta, meaning that every bar in the state would be packed wall-to-wall that day. The openings were successful and New Realm has been going strong ever since.

Gaining an immediate following, the writing was on the wall for a production facility to handle growing demand. The initial 20-barrel facility could only produce between 10–15,000 barrels per year.

Around that time, Green Flash's outpost in Virginia Beach, Virginia went into bank possession, and it had everything the team was looking for in a production brewery. Basically, all the equipment — as well as a brewing team — was already in place. The New Realm team bought the contents of the brewery, leased the building, and just like that, they had their production facility.

RADEGAST TRIPLE IPA

Brewing popular styles such as porter, Pilsner, pale ale, IPA, and hazy IPAs, New Realm found immediate success. But a bigger beer was on Steele's mind, a beer he thought would be a perfect "celebratory" beer — a triple IPA he called Radegast (a name attributed to a Middle Ages Czech god of hospitality). Steele is known for making some heavy hitting IPAs, having been a huge part of behemoths such as Stone Ruination 10 and Heretic's Evil 3, both triple IPAs.

During his relentless cross-country travels, he spent a lot of time at Refuge Brewing of Temecula, California. He befriended brewery Co-Owner Curt Kucera who offered Steele the opportunity to brew pilot batches for his future brewery on Refuge's five-barrel system with their Head Brewer Dan Kelly. Steele jumped at the chance, and the third batch he brewed was the prototype for the beer that later became Radegast Triple IPA.

Using the Chico yeast strain, careful attention to fermentation is key to achieve the lofty 11.5% ABV of this massive beer. Overpitching the yeast at a rate of 30 million cells per milliliter helps to ensure less yeast growth and, as a result, less fusel alcohols that can result in "alcohol burn."

The dry hop blend changes every year to showcase different hop varietals. "The massive dry hopping additions help to balance the alcohol heat and take the edge off," said Steele.

From its start as a pilot batch at Refuge Brewing to its current status as New Realm's esteemed anniversary beer, Radegast Triple IPA is a hop lover's dream.

New Realm Brewing Co. (2nd Anniversary)

NEW REALM BREWING CO.'S RADEGAST TRIPLE IPA CLONE

(5 gallons/19 L, all-grain)
OG = 1.098 FG = 1.009
IBU = 100+ SRM = 5 ABV = 11.5%

Named after the Czech god of hospitality, Mitch Steele's Radegast IPA was first created with friends at Refuge Brewing in Temecula, California before becoming the annual anniversary beer at his brewery, New Realm of Atlanta, Georgia.

INGREDIENTS

17 lbs. (7.71 kg) American 2-row pale malt
1 lb. 12 oz. (0.8 kg) dextrose corn sugar
18 AAU Warrior hops (60 min.) (1.2 oz./34 g at 15% alpha acids)
38.4 AAU Citra® hops (0 min.) (3.2 oz./91 g at 12% alpha acids)
48 AAU El Dorado® hops (0 min.) (3.2 oz./91 g at 15% alpha acids)
19.6 AAU Mosaic® hops (0 min.) (1.6 oz./45 g at 12.25% alpha acids)
3.2 oz. (91 g) Falconer's Flight® hops (dry hop)
3.2 oz. (91 g) Citra® hops (dry hop)
3.2 oz. (91 g) El Dorado® hops (dry hop)
1 Whirlfloc tablet
½ tsp. yeast nutrient
Wyeast 1056 (American Ale), White Labs WLP001 (California Ale), or SafAle US-05 yeast
⅔ cup corn sugar (if priming)

STEP BY STEP

Using a thin mash to maximize enzymatic activity and fermentability (roughly 4:1 water-to-grain by weight), mash for 75 minutes at 150 °F (65.5 °C). A mash pH between 5.2–5.7 is ideal. A ¼ tsp. addition of phosphoric acid should get your mash in range if using reverse osmosis water. After mash is complete, raise temperature to 168–170 °F (76–77 °C) for mashout and recirculation. Begin collecting your wort and sparge with 170 °F (77 °C) water with a pH as close to 5.2 as possible.

Boil for 60 minutes, adding the Warrior hop addition at the beginning of the boil. Add ½ tsp. of yeast nutrient with 10 minutes to go in the boil, as well as a Whirlfloc tablet to produce a clearer finished beer.

At the end of the boil, whirlpool for 10 minutes after adding the flameout hops. Chill rapidly to 68 °F (20 °C) and oxygenate thoroughly. It's important to keep your fermentation temperature from rising in order to avoid fusel alcohol production. After 7 days of primary fermentation, reduce temperature to 60 °F (16 °C) and add your dry hops. After day 10, add Biofine® or another clarifying agent if you want a clearer finished beer, then chill to 32 °F (0 °C). Hold at this temperature for another two weeks, then keg and carbonate to 2.3 v/v or prime and bottle condition.

NEW REALM BREWING CO.'S RADEGAST TRIPLE IPA CLONE

(5 gallons/19 L, extract only)
OG = 1.098 FG = 1.009
IBU = 100+ SRM = 5 ABV = 11.5%

INGREDIENTS

9.2 lbs. (4.2 kg) extra light dried malt extract (DME)
1 lb. 12 oz. (0.8 kg) dextrose corn sugar
18 AAU Warrior hops (60 min.) (1.2 oz./34 g at 15% alpha acids)
38.4 AAU Citra® hops (0 min.) (3.2 oz./91 g at 12% alpha acids)
48 AAU El Dorado® hops (0 min.) (3.2 oz./91 g at 15% alpha acids)
19.6 AAU Mosaic® hops (0 min.) (1.6 oz./45 g at 12.25% alpha acids)
3.2 oz. (91 g) Falconer's Flight® hops (dry hop)
3.2 oz. (91 g) Citra® hops (dry hop)
3.2 oz. (91 g) El Dorado® hops (dry hop)
1 Whirlfloc tablet
½ tsp. yeast nutrient
Wyeast 1056 (American Ale), White Labs WLP001 (California Ale), or SafAle US-05 yeast
⅔ cup corn sugar (if priming)

STEP BY STEP

Use 3 gallons (11.4 L) of clean water and heat to around 150–160 °F (65.5–71 °C). Take the pot off the flame and slowly add the DME while stirring continuously until all extract is dissolved. The exact temperature is not all that important since there is no mashing, but keeping it in this range will help avoid boil over when putting in the DME. Once dissolved, return pot to the heat and bring to a boil. Boil for 60 minutes, adding the hops as indicated.

In the meantime, prepare 2–2.5 gallons (7.6–9.5 L) of water to add to your wort to top up after boil is complete. To be safe, it's best to boil that water, then chill it, to ensure elimination of any contaminants in the water.

Add ½ tsp. of yeast nutrient with 10 minutes to go in the boil, as well as a Whirlfloc tablet to produce a clearer finished beer.

At the end of the boil, whirlpool for 10 minutes after adding the flameout hops. Chill rapidly to 68 °F (20 °C) and oxygenate thoroughly. It's important to keep your fermentation temperature from rising in order to avoid fusel alcohol production. After 7 days of primary fermentation, reduce temperature to 60 °F (16 °C) and add your dry hops. After day 10, add Biofine® or another clarifying agent if you want a clearer finished beer, then chill to 32 °F (0 °C). Hold at this temperature for another two weeks, then keg and carbonate to 2.3 v/v or prime and bottle condition.

Avery Brewing Company: Go Big Or Go Home

Avery Brewing Company of Boulder, Colorado has built its reputation by producing eccentric beers that often defy styles and categories. Blending ingenuity, creativity, and boldness, Avery is a brewery founded on passion and hard work.

An avid homebrewer, in 1993 27-year-old Adam Avery passed on law school and somehow convinced his father, Larry, to contribute his life savings and start a brewery despite having no professional experience. Renting a small space in the back of an industrial alley, they started making beers that they packaged in bombers.

A BREWERY AHEAD OF ITS TIME

With craft beer still in its developmental stages, Avery Brewing bottled the state's first IPA in 1996. Viewed by some as "too hoppy" at the time, the mostly unchanged beer is now considered an iconic commercial example for the style. Go figure.

Despite being a small brewery in a less-than-ideal warehouse, Avery continued to brew beers he thought people would like, expanding his brand's reach into several states. The beer was well received, but wasn't exactly breaking any sales records.

About four years into the business, with future prospects looking somewhere between questionable and bleak, Avery decided he was going to brew a beer that *he* liked. Creating a 9% ABV monster of a beer (for the time), Hog Heaven Barleywine was his answer to Sierra Nevada's Bigfoot. Sure, Avery liked it, but interestingly, so did countless others. Avery Brewing had made its mark almost by accident.

With more people taking notice — and buying its beer — Avery Brewing began to grow. By 1999, Adam Avery could finally hire people so he wasn't working 18 hours every day. The confidence he gained from the success of Hog Heaven spawned other big beers. First came The Reverend Belgian Quadrupel and Salvation Belgian Golden Ale, and later The Beast and Mephistopheles' Stout. Barrel aging sour and non-sour beers followed.

GOING BIG

However, continuous expansion was not always ideal. One small industrial space turned into six, but the spaces weren't all attached to each other. They were cobbled together with packaging lines installed over other businesses, with most of the fermenters outside, using flexible hoses to move wort and beer back and forth. Brewery personnel cleaned tanks outdoors in snowstorms, just trying to keep up with demand. In springtime, they battled wasp nests lodged around the outdoor tanks. Professional brewing isn't always as glamorous as everyone thinks.

In 2015, Avery built a dream brewery in northern Boulder with a full restaurant and thirty taps. According to Barrel Herder Andy Parker, the brewery is now stocked with every technological advancement in the brewing world, which means more options for experimentation and even more consistent flagships.

"Over 125 different projects go on tap each year. And on the production side, we have this really cool thing called a *roof*. You don't know how valuable a roof is in your working day until you don't have one for a decade," said Parker.

Interestingly, while Avery Brewing continues to garner praise from experts of the craft beer world for their experimentation, the more traditional White Rascal Belgian-style white ale and IPA continue to be the company's two best sellers. Avery has created a loyal following of ultra beer geeks and mainstream craft lovers, a difficult feat to accomplish in the modern craft beer universe.

MEPHISTOPHELES 2.0

Avery Brewing Company has an extensive history of making unique beers for its own anniversaries. But this anniversary beer was different.

"We made fifteen 'one-off' beers between 2003 and 2018 to celebrate another year in the beer business," said Parker. "This particular beer is about the friends we make in this industry. Back in 2000, beer event organizer Laura Lodge saw an opportunity. She created the now legendary Big Beers, Belgians, and Barleywines festival made to highlight the early iterations of 'extreme' beer."

Twenty years later, Lodge asked Avery to make a special beer for the 20th anniversary of the festival.

"I contacted Todd Leopold of Leopold Brothers Distilling to see if he might have something interesting. If he had a great barrel, we felt confident that we'd be able to match it up with the right beer. I didn't know it at the time, but they were also celebrating their 20th Anniversary. And it just so happened that they had just emptied the only barrel of the whiskey they made for the occasion. A Tennessee-style whiskey, steeped with freshly charred sugar maple chips in Bourbon distillate and aged for nine years. Leopold offered us that single barrel for this project. I love it when a plan comes together."

For Parker, it was a no-brainer to age Mephistopheles' in the barrel.

"It tasted like a chocolate cake with a caramel drizzle, yet it was over 17% ABV with less ethanol heat than a 9% ABV IPA. Chuggable, even. Dangerous," said Parker.

AVERY BREWING CO.'S 20TH ANNIVERSARY MEPHISTOPHELES' STOUT CLONE

(5 gallons/19 L, all-grain)
OG = 1.102 FG = 1.020
IBU = 45 SRM = 70+ ABV = 11%

A "devil" of a beer, this iteration of Mephistopheles' was made specifically for the 20th anniversary 2020 Big Beers, Belgians, and Barleywines festival. This decadent imperial stout was aged in a 20th Anniversary Leopold Brothers' whiskey barrel. While the actual beer rang in at 17% and required some tools most homebrewers don't have access to, this is a scaled down, homebrewer-friendly version provided by Avery Barrel Herder, Andy Parker.

INGREDIENTS

11 lbs. (5 kg) American 2-row pale malt
1.63 lbs. (0.74 kg) Special B malt
1.44 lbs. (0.65 kg) roasted barley
1.06 lbs. (0.49 kg) black malt
0.88 lb. (0.39 kg) aromatic malt
2.25 lbs. (1.02 kg) golden dried malt extract (DME)
2 lbs. (0.91 kg) dextrose corn sugar
12.2 AAU Sterling hops (60 min.) (2 oz./56 g at 6.1% alpha acids)
1 oz. (28 g) Apollo hops (0 min.)
1 package oak cubes
~1 oz. (28 g) maple chips, charred
~1 cup Bourbon
Wyeast 3787 (Trappist Style High Gravity), or White Labs WLP530 (Abbey Ale), or LalBrew Abbaye Belgian Ale yeast
¾ cup corn sugar (if priming)

STEP BY STEP

The maple chips may be found in the grilling section of your hardware store. A propane torch can be used to scorch the exterior. You are just looking to caramelize the sap in the maple, not to turn them into charcoal. Soak the oak cubes and charred maple chips in Bourbon — just enough to cover. They should be soaked a minimum of two weeks, more if possible. If you can get your hands on a small used Bourbon barrel, then skip the oak cubes but still soak the maple chips.

On brew day, add 1 tsp. of $CaCl_2$ and ⅛ tsp. of $CaSO_4$ (gypsum) along with ¼ tsp. of 10% phosphoric acid. Employing a thick mash (1.5 qts./lb. or 2.5 L/kg), achieve a mash temperature of 153 °F (67 °C) and hold for 60 minutes or until fully converted. After mash is complete, raise temperature to 168–170 °F (76–77 °C) for mashout and a 10-minute recirculation. Begin collecting your wort and sparge with 170 °F (76 °C) water with a pH at or near 5.2. Sparge with enough water to collect roughly 6.5 gallons (24.6 L) of wort.

Boil for 60 minutes, adding the first hop addition, dextrose, and DME at the start of the boil. With 30 minutes remaining, add another teaspoon of $CaCl_2$. The first and most important reason to add this is to make sure there is enough calcium in the wort for yeast health, knowing that you will lose some of your original addition in the mash. Secondly, the $CaCl_2$ addition will round out the flavors and bring out the grain/malt character desired in the beer. With 10 minutes remaining, add a ½ tsp. of yeast nutrient. One Whirlfloc tablet can also be added at this time to help with beer clarity, although the beer will be opaque black. At knockout, add the Apollo hops.

After conducting a 10-minute whirlpool, chill rapidly to 66 °F (19 °C). Oxygenate thoroughly and pitch yeast. When gravity reaches 1.060 (after about four days of primary fermentation) increase temperature to 70 °F (21 °C) for warm conditioning for at least six additional days. If terminal gravity hasn't yet been reached, letting it go a few more days is fine. Rack the beer into a secondary fermenter on top of the wood and Bourbon, or if you have a Bourbon barrel, then rack beer onto the maple and Bourbon in the barrel. Once flavor profile is achieved with a distinct wood and Bourbon character it's time to package. Carbonate to 2.5 v/v or prime and bottle condition.

AVERY BREWING CO.'S 20TH ANNIVERSARY MEPHISTOPHELES' STOUT CLONE

(5 gallons/19 L, extract with grains)
OG = 1.102 FG = 1.020
IBU = 45 SRM = 70+ ABV = 11%

INGREDIENTS

9.4 lbs. (4.26 kg) golden dried malt extract (DME)
2 lbs. (0.91 kg) dextrose corn sugar
1.63 lbs. (0.74 kg) Special B malt
1.44 lbs. (0.65 kg) roasted barley
1.06 lbs. (0.49 kg) black malt
0.88 lb. (0.39 kg) aromatic malt
2.25 lbs. (1.02 kg) golden dried malt extract (DME)
12.2 AAU Sterling hops (60 min.) (2 oz./56 g at 6.1% alpha acids)
1 oz. (28 g) Apollo hops (0 min.)
1 package oak cubes
~1 oz. (28 g) maple chips, charred
~1 cup Bourbon
Wyeast 3787 (Trappist Style High Gravity), or White Labs WLP530 (Abbey Ale), or LalBrew Abbaye Belgian Ale yeast
¾ cup corn sugar (if priming)

STEP BY STEP

See instructions for maple chips and oak cubes in the all-grain recipe.

Bring 3 gallons (11.4 L) of water to 162 °F (72 °C). Remove pot from the heat source then slowly stir in the DME until fully dissolved. Add your crushed grains (in a grain bag) and steep for 10–15 minutes. Remove grain bag and bring wort to a boil for 60 minutes, adding the hop additions as indicated.

Follow the remainder of the all-grain recipe, making sure to top up the fermenter to 5 gallons (19 L) before pitching yeast.

My Kind Of Town, The Sierra Nevada Story

Ken Grossman has always been a man ahead of his time. With a natural curiosity for taking things apart and putting them back together, if anyone was destined to succeed in the beer world, it was he. Never shying away from a challenge, a teenage Grossman got his first homebrewing kit in 1969 and tried his luck at brewing.

An avid outdoorsman, Grossman visited Chico, California in 1972 and realized it was his kind of town, relocating there just two weeks later. Homebrewing regularly, he focused on several beer styles but gravitated toward hoppier beers.

Trying to find his niche within the beer world, Grossman opened a homebrew supply shop in 1976, two years before homebrewing was officially legalized by the US government. Improved homebrews were one of the results, including honing in a recipe for a beer he really enjoyed, a hop-forward pale ale.

SIERRA NEVADA

In 1980, Grossman took the plunge and opened his own small brewery, named after his beloved Sierra Nevada mountains. Using mostly recycled dairy equipment, this jack-of-all-trades was more than happy to build his brewhouse by hand.

Starting with a stout, it wasn't long until Grossman brewed his soon-to-be-famous pale ale. After about ten iterations, he dialed in the recipe and process. Featuring Cascade hops, this deep-gold beer would eventually change the hearts and minds of beer drinkers everywhere. Hop-forward and 5.6% ABV, this was unlike the watered-down light beers that were pervasive at the time.

Success did not come quickly, however. According to Grossman, the first few years were very lean. All revenue came from bottle sales, most of it going directly back into the brewery. In the early 1980s, a viable draft market for these types of beers didn't exist. In order to increase production, Grossman and his team would fabricate or repurpose used equipment.

In 1983, Grossman purchased a 100-barrel copper brewhouse from a defunct German brewery. Unfortunately, his tiny 3,000-square-foot brewery had neither the space to accommodate the new brewhouse, nor enough money to expand. At the time, banks considered it far too risky to lend money to upstart breweries. The new brewhouse sat in storage for years, while Sierra Nevada maxed out its current capacity.

THE REBIRTH

After years of significant growth, Sierra Nevada was finally able to secure the needed funding for expansion. It was time to shine up that beautiful copper brewhouse and put it to work.

The new brewhouse greatly increased Sierra Nevada's ability to expand its footprint. Palates for new "microbrewed" beers were also on the rise. Establishments began to increase draft offerings, opening up new markets for Sierra Nevada, where Pale Ale became a staple in bars and restaurants across America.

In 1997, with demand outpacing production, Grossman added a 200-barrel brewhouse to go alongside the original. In 2015, a second brewery was built in Mills River, North Carolina to ensure the delivery of fresh beers to both sides of the country.

Forty years later, Grossman can reflect upon everything he and his team has accomplished. With the odds stacked heavily against him at the outset, he gambled on his vision. In the process, he set the standard for craft beer. With beautiful brewing facilities on each side of the country, the man whose original business plan called for 2,500 barrels per year (3,500 barrels if they overachieved) exceeded all expectations, including his own.

"We can always do better and are continuously looking for ways to improve," said Grossman. "We've invested a lot of time and money back into our brewery and hopefully it shows in our products. We've been successful because of our committed following. All I can say is, 'Thanks for supporting us all these years.'"

After all Grossman has accomplished, he's earned the right to celebrate with a special beer — a beer that celebrates the monumental accomplishments of a once tiny, fledgling brewery that eventually became one of America's most treasured icons.

HOPPY ANNIVERSARY ALE

Hoppy beers may be all the rage today, but it was not always the case. When it came time to develop a beer that would properly represent 40 years of brewing, creating a West Coast IPA was a no-brainer. "We've always been focused on hops," said Grossman. "We wanted to feature the hops that were important back in the era of the brewery's beginning."

Billed as "a tribute to the best of the West Coast IPA and craft beer's long, strange journey," Hoppy Anniversary Ale is gold with intense, yet balanced, pine and citrus, and just enough caramel sweetness. Checking in at 6% ABV and 60 IBU, the beer is a classic West Coast IPA that, once again, sets the standard for the style.

Sierra Nevada Brewing Co. (40th Anniversary)

SIERRA NEVADA BREWING CO.'S HOPPY ANNIVERSARY ALE CLONE

(5 gallons/19 L, all-grain)
OG = 1.056 FG = 1.011
IBU = 65 SRM = 6 ABV = 6.0%

A tribute to the best of the West Coast IPAs, and craft beer's long strange journey, Hoppy Anniversary Ale can be considered both a celebration and an autobiography of the craft beer movement. It features Cascade, Centennial, and Cluster hops —three critical hops in the early days of America's craft beer business.

INGREDIENTS

10 lbs. (4.5 kg) North American Pilsner malt
1 lb. (0.45 kg) malted oats (with hull)
0.5 lb. (0.23 kg) caramel/crystal malt (60 °L)
5.75 AAU Cascade hops (85 min.) (1 oz./28 g at 5.75% alpha acids)
7 AAU Cluster hops (85 min.) (1 oz./28 g at 7% alpha acids)
4.3 AAU Cascade hops (10 min.) (0.75 oz./21 g at 5.75% alpha acids)
8.6 AAU Cascade hops (0 min.) (1.5 oz./43 g at 5.75% alpha acids)
15 AAU Centennial hops (0 min.) (1.5 oz./43 g at 10% alpha acids)
1 oz. (28 g) Cascade hops (dry hop)
1 oz. (28 g) Centennial hops (dry hop)
1 Whirlfloc tablet
½ tsp. yeast nutrient
Wyeast 1056 (American Ale), White Labs WLP001 (California Ale), or SafAle US-05 yeast
¾ cup corn sugar (if priming)

STEP BY STEP

Achieve a mash temperature of 154 °F (68 °C) and hold for 60 minutes or until fully converted. After mash is complete, raise temperature to 168–170 °F (76–77 °C) for mashout and about a 10-minute recirculation. Begin collecting your wort and sparge with 170 °F (77 °C) water acidulated to a pH at or near 5.2.

Boil for 90 minutes, adding the first hop additions five minutes into the boil. With 10 minutes to go in the boil, add ½ tsp. of yeast nutrient and a Whirlfloc tablet to help with beer clarity.

At the end of the boil, whirlpool for 10 minutes after adding the flameout hops. Then chill rapidly to 68 °F (20 °C) and oxygenate thoroughly. Fermentation should last 4–5 days, then allow another 9–10 days for conditioning. Add your dry hops on or around day 10. Upon completion of the fermentation cycle (about two weeks after brew day), chill the beer to 38 °F (3 °C) and keg. Chilling the beer first will help pull dry hop matter out of suspension, producing a cleaner beer. Carbonate to 2.5 v/v or prime and bottle condition.

SIERRA NEVADA BREWING CO.'S HOPPY ANNIVERSARY ALE CLONE

(5 gallons/19 L, partial mash)
OG = 1.056 FG = 1.011
IBU = 65 SRM = 6 ABV = 6.0%

INGREDIENTS

5.5 lbs. (2.5 kg) Pilsen dried malt extract
1 lb. (0.45 kg) malted oats (with hull)
0.5 lb. (0.23 kg) caramel/crystal malt (60 °L)
5.75 AAU Cascade hops (85 min.) (1 oz./28 g at 5.75% alpha acids)
7 AAU Cluster hops (85 min.) (1 oz./28 g at 7% alpha acids)
4.3 AAU Cascade hops (10 min.) (0.75 oz./21 g at 5.75% alpha acids)
8.6 AAU Cascade hops (0 min.) (1.5 oz./43 g at 5.75% alpha acids)
15 AAU Centennial hops (0 min.) (1.5 oz./43 g at 10% alpha acids)
1 oz. (28 g) Cascade hops (dry hop)
1 oz. (28 g) Centennial hops (dry hop)
1 Whirlfloc tablet
½ tsp. yeast nutrient
Wyeast 1056 (American Ale), White Labs WLP001 (California Ale), or SafAle US-05 yeast
¾ cup corn sugar (if priming)

STEP BY STEP

Heat 3 qts. (2.8 L) of water to around 160 °F (71 °C). Take the pot off the flame and put the oats and crystal malt into a grain bag and add into the water at this time. Try to hold the grains at 154 °F (68 °C) for roughly 45–60 minutes. Place the grains in a colander and wash with 1 gallon (3.8 L) warm water. Top up to 3 gallons (11 L) then slowly add the extract while stirring continuously until all extract is dissolved. Add heat and bring to a boil. Boil for 60 minutes, adding the hops as indicated.

In the meantime, prepare 2–2.5 gallons (7.6–9.5 L) of water to add to your wort to top up after boil is complete. To be safe, it's best to boil that water, then chill it, to ensure elimination of any contaminants in the water.

Upon conclusion of the boil, chill rapidly to 68 °F (20 °C), add the pre-chilled water to top up, pitch yeast and oxygenate thoroughly. Fermentation at 68 °F (20 °C) should last 4–5 days, then allow another 9–10 days for conditioning. Add your dry hops on or around day 10. Upon completion of the fermentation cycle (about two weeks after brew day), chill the beer to 38 °F (3 °C) and keg. This will help pull dry hop matter out of suspension, producing a cleaner beer. Carbonate to 2.5 v/v or prime and bottle condition. BYO

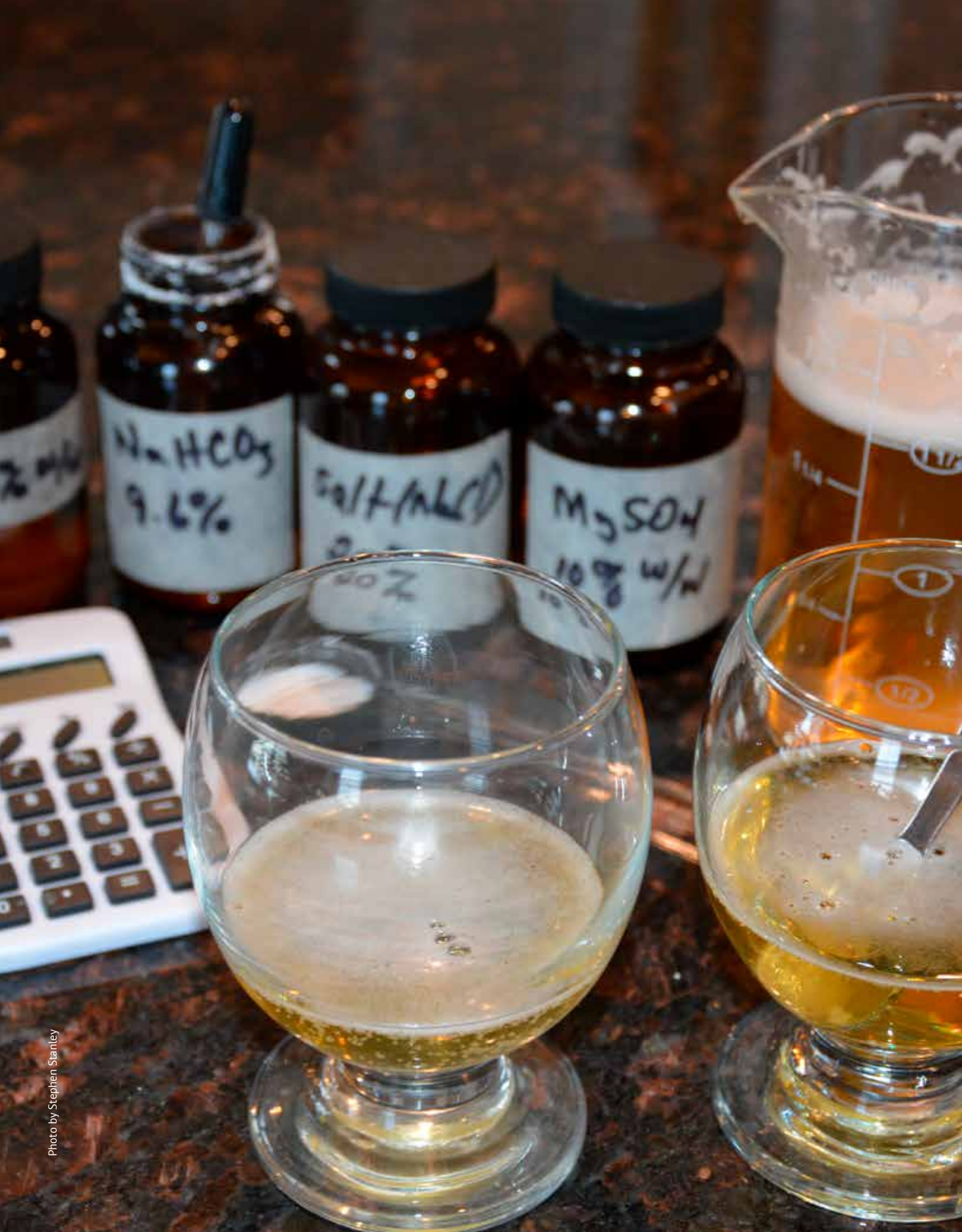


Photo by Stephen Stanley

Adjusting Flavor Using BREWING SALTS

Strategies to set up tests, tastings, and adjustments

by Stephen Stanley

The Beer Judge Certification Program (BJCP) training material outlines a sensory training process for brewers and clubs using ingredients found around the home or the brewery. As Education Chair for the Aurora City Brew Club in Aurora, Colorado, I've expanded this test to include other flavors and particularly, solutions of brewing salts. In the past, as recommended in the training material, I've done the training using very neutrally flavored beers, generally a rather popular Colorado American light lager.

Using easily sourced ingredients and a neutral beer allows trainees to taste off flavors in a more interactive way than standard off-flavor test kits. For example, if the taster can't taste the nutty flavor added by one drop of almond extract, he or she can add more until they taste the "nuttiness," then back off until they discover their taste threshold for the flavor. On a recent Learn to Brew day I was asked to give the demonstration at our local homebrew shop, the Brew Hut, using the homemade sensory training kit I'd developed. Given the Brew Hut's licensing restrictions, I could not bring outside beer into the tasting room and instead was provided a very flavorful, American blonde ale for use in testing. This happy accident led to an epiphany in the use of brewing salts to affect beer flavor.

Table 1: Percent of Ions in Brewing Salts

Salt Formula	Ca++	Mg++	Na++	SO_4--	Cl-	HCO_3-	H_20
Gypsum **($CaSO_4 \cdot 2H_2O$)**	23.2%			55.8%			21.0%
Calcium Chloride **($CaCl_2 \cdot 2H_2O$)**	27.2%				49.2%		22.6%
Epsom Salt **($MgSO_4 \cdot 7H_2O$)**		9.9%		39.0%			51.4%
Baking Soda **($NaHCO_3$)**			27.4%			72.6%	
Table Salt **(NaCl)**			39.3%		60.8%		
Magnesium Chloride **($MgCl_2 \cdot 6H_2O$)**		12.0%			34.9%		53.4%

Table 2: Dilutions

Salt Solution				Anions		Cations	
Salt Formula	Solution Percent	Grams Required	Salt (mg/mL)	Ion	mg Ion/mL Solution	Ion	mg Ion/mL Solution
$CaSO_4 \cdot 2H_2O$	0.02%	0.24	2.3	Sulfate	1.34	Calcium	0.55
$CaCl_2 \cdot 2H_2O$	10%	10	100	Chloride	49.2	Calcium	27.2
$MgSO_4 \cdot 7H_2O$	10%	10	100	Sulfate	39	Magnesium	9.9
$NaHCO_3$	8.80%	10	88	Bicarbonate	63.9	Sodium	24.1
NaCl	10%	8.8	100	Chloride	60.8	Sodium	39.3
$MgCl_2 \cdot 6H_2O$	10%	10	100	Chloride	34.9	Magnesium	12

While fairly neutral in flavor, the golden ale had good malt flavors, restrained but perceptible esters, low but obvious bitterness and hop presence, and good balance. In other words, I used a good professionally-brewed beer with some homebrew-like qualities for the test. To our surprise, the effects of dosing the finished, carbonated beer with the solutions of brewing salts and acids had a profound effect on the beer's flavor. My artificial butter extract and ester solutions forgotten, we spent the rest of the afternoon testing the flavor effects of brewing salts in beer.

SETTING UP THE TESTS

I don't advise anyone to try dosing a carbonated beer with powdered salts to avoid the "Mentos" effect. Putting those tiny crystals in a supersaturated carbon dioxide solution (beer) may result in gushers, leaving you with a mess instead of modified beer. Instead, I prepared known strength solutions of the salts in distilled water. Since the solubility of sodium bicarbonate (baking soda) in water at room temperature is 9.6 grams per 100 mL, I use a "standard" dilution of 10% by weight. For example, if I want a 10% solution of calcium chloride, I measure out 10 grams of the salt and 90 grams of water. Exceptions are baking soda, as mentioned, at 8.8% solubility (8.8 grams of salt and 91.2 grams of water) and gypsum at 2.3% solubility (2.3 grams of salt and 97.7 grams of water).

I use the "standard" brewing salts for the test: Gypsum (calcium sulfate) and calcium chloride, as well as table salt (sodium chloride), baking soda (sodium bicarbonate), and Epsom salt (magnesium sulfate). I also test lactic acid, the standard 88% solution available at homebrew stores. I do not use chalk (calcium carbonate) because it is not soluble in water with a neutral pH. I dissolve the salts in distilled water. Stored in brown glass bottles, the solutions are essentially shelf-stable forever. Everything is food-safe and nothing in the concentrations used in testing is harmful.

Table 1 gives the percentage of each ion in the salt in the far left column. A gram of gypsum, for example, has 232 mg of calcium, 558 mg of sulfate, and 210 mg of water (note the totals may not add to exactly 1,000 mg due to rounding).

I use 10% salt solutions where possible, exceptions are baking soda and gypsum, which are less soluble in water than 10%, as mentioned earlier. Weigh the appropriate amount of salt into the container, then add water to make a combined weight of 100 g.

Table 2 gives mg of the common brewing ions per mL of solution. A few definitions and we are ready to season some beer. One part per million (ppm) is roughly equivalent to one mL per liter. If you want to add 100 ppm of an ion to a solution, you will add 100 mg per liter of solution. Another equivalency we will be using is a liter is 1,000 mL. Finally, a drop is approximately 1/20 of a mL.

SETTING UP THE TASTING

The math and chemistry is not necessary for informal testing: To test the effects of the salts, I have the tasters take a sip of the 1 oz. (~30 mL) sample of control beer to provide a reference point, then add the solutions either mL or drop-wise to the beer, depending on the concentration of salt. For example, gypsum is not very soluble in water so it generally takes more of it to perceive an effect from sulfate (and it may be better to use Epsom salt to add low amounts of sulfate). I use a

“Bicarbonate smoothed the rough edges of roasty, dark beers and made the light beer “flabby,” a loss of liveliness often mentioned in wines low in acidity.”

flavorful light beer such as helles or blonde ale for all of the salts and acid, and a roasty dark beer, something like a dry Irish stout, for the bicarbonate (baking soda), although other salts may be tested using dark beer as well. After tasting the doctored beer, I ask the tasters to tell me how the solutions changed the flavor of the beer. For a more formal test, I do a standard blind triangle test.

When I performed the triangle test using members of the Aurora City Brew Club, the test resulted in a statistically significant difference in the beers dosed with 100 ppm of sulfate from gypsum but not with bicarbonate from sodium bicarbonate. Things got interesting afterward, during homebrew tasting and bull session. A group assembled around my test solution and we began dosing peoples’ beers. Here’s a summary of the results:

• Sulfate generally was not perceived positively. Testers mentioned decreased mouthfeel and overall loss of flavor as well as increased dryness.

• Chloride performed as generally described. Testers mentioned rounder, sweeter, maltier flavors and a fuller mouthfeel compared to the base beer.

• Bicarbonate smoothed the rough edges of roasty, dark beers and made the light beer “flabby,” a loss of liveliness often mentioned in wines low in acidity.

• Adding standard 88% lactic acid improved light beers as long as the “tartness” threshold was not crossed, however it increased the harshness in other styles.

• We did not perceive any of the commonly mentioned effects from the metallic ions (calcium, sodium, magnesium). This is likely because the dosing rate kept their concentrations below taste thresholds.

TASTING PROCESS

The tasting process is as follows:

1. Pour about an ounce (30 mL) of beer into a small glass and taste.

2. Pour a second 1-oz (30-mL) sample and, with an eyedropper, add salt solution, either by drop or mL, and stir the salt solution into the beer.

3. Taste the first sample and then the second sample and describe the change.

4. If you consider the results to be an improvement and are attempting to improve a beer, calculate the amount of salt you need using the procedure described earlier.

If you’re doing this test on finished, carbonated beer, you can modify your recipe and add the required salts to the next batch at any point in the brewing process after the mash. If you’re testing at packaging, remember the carbonation will contribute acidity and tartness to the flavor of the beer. To calculate the amount of salt you will need for a complete batch based on the number of drops of solution used in a one-ounce (30-ml) sample (assuming drops for all but gypsum at 20 drops/mL) by 1.67 times your batch size in liters. Multiply by the concentration from table 2 (remembering 10% is 0.1) and add that much of the salt to your next batch after the mash.

Example:
1 drop of table salt solution in your 1-ounce (30-mL) sample was just right. To determine how much salt to add to your next 6-gallon (23-L) batch, multiply 1 drop by 1.67 (1/20 mL/drop x 33.3 samples per L) then multiply by 23 liters to arrive at 38.3 mL of your solution needed, then multiply by 0.1 to get 3.8 grams of salt added to the next brew of the beer.

KEY TAKEAWAYS

Key takeaways are that adding salts to finished beer can serve the same purpose as a chef’s saltshaker, adding that final touch that transforms the beer from good to great. Likewise, too much or the wrong salts can transform a beer from great to bad — think of over-salted food. The third takeaway was that finished beer acidity matters greatly. Reducing pH by adding acid can bring a brightness to a lackluster pale beer. Likewise, increasing the pH can reduce the harshness of an IPA or smooth out the roastiness of a dark beer. Specifically:

• If your malt flavor seems lost or the beer is too dry or thin-bodied, try dosing with some chloride.

• If your beer could stand a bit of dryness, add some sulfate.

• If your beer seems lifeless and flat, try adding a bit of acid.

• If your dark beer or IPA is too acrid or harsh, try adding some bicarbonate.

• A bit of plain table salt can improve many beers: Think of what bread would be like without it.

• Avoid excessive additions of any salt: Any of the ions can cause problems in too high of concentrations.

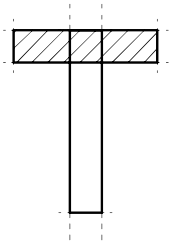
In conclusion, adjusting the salt content will not save a poorly made beer. There’s no acid or salt that will help if your recipe is off or your sanitation fails. But adjusting salt concentrations or pH can improve a well-made beer from good to great. BYO

PRESSURE RELIEF VALVE

FUNDAMENTALS OF STAINLESS STEEL CONICAL FERMENTERS

Pro equipment on a homebrew scale

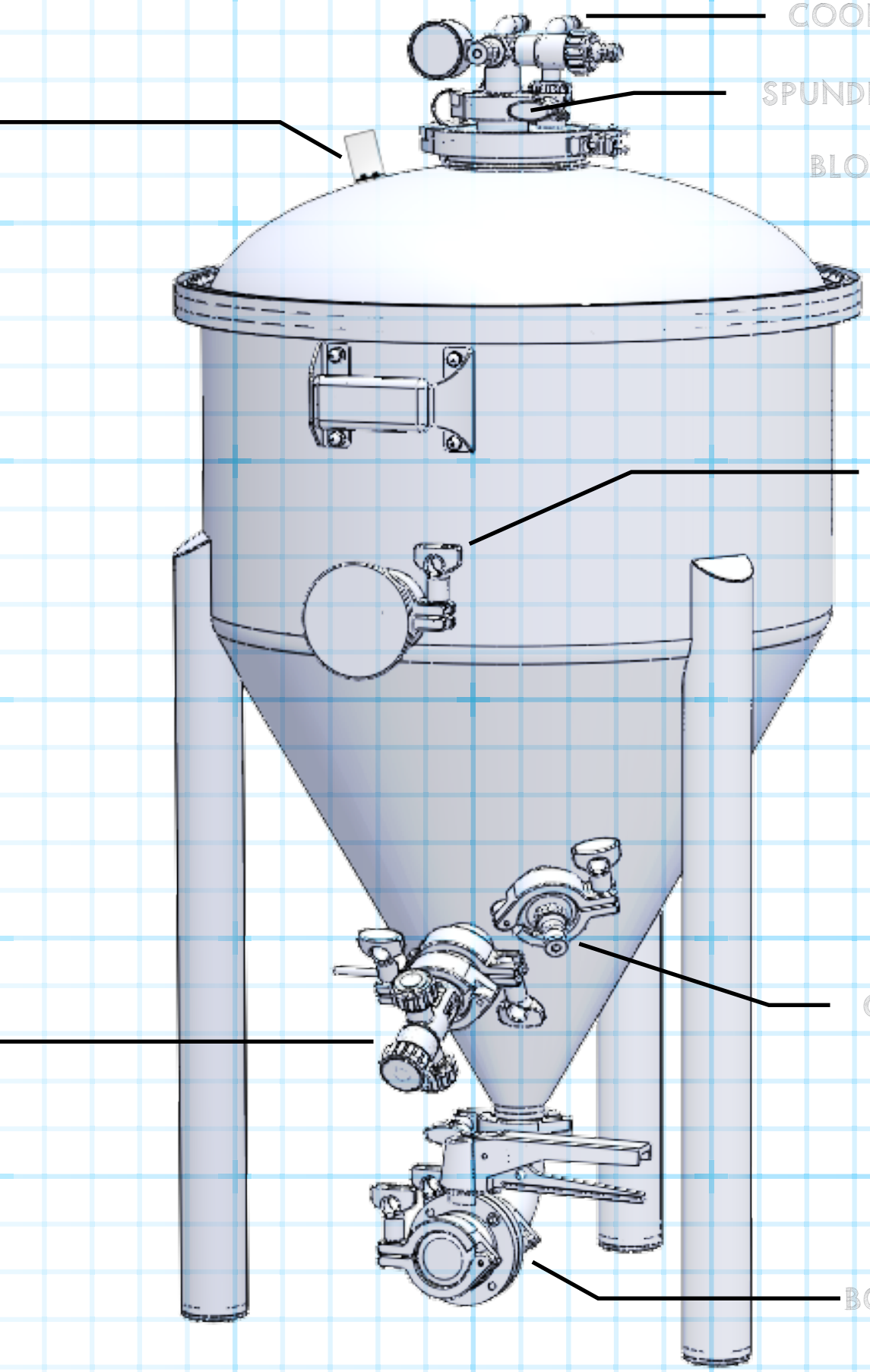
by John Blichmann



Throughout history brewers have probably utilized every type of vessel they could get their hands on to ferment their brew. From sheepskins, clay pots, glass, enamel, and everything between. The English had their open wood vats and Burton union fermenters. The Belgians utilized open flat coolships for natural cooling and also spontaneous fermentation. Lager breweries in Europe used pitch-lined open fermenters. And like brewers today, they adopted new technology to brewing whenever they could.

In the "dark ages" of homebrewing in the '70s, about all that was available were glass carboys and plastic buckets. That was still the case when I started homebrewing in the early '90s. At that time, all-grain brewing was less common than it is today, but as soon as I got a handful of extract batches under my belt I made the move to all-grain. I quickly discovered that it was super fun, but it took a lot more time. So I began to think about bigger batches to make my toil worth the effort. I was tired of using multiple carboys, and racking them into yet more (secondary fermentation was a big thing back then). I finally managed to find a 12-gallon (46-L) Nalgene jug with a bottom valve. I used it for a few 10-gallon (38-L) batches, but I had one batch get contaminated and the thing was really hard to clean. So the search for a larger vessel went on. I did take a house remodel sabbatical in the mid-'90s, and three little girls added into the mix so it wasn't until the late-'90s that I began again looking in earnest to get that larger fermenter.

ROTATING RACKING ARM


COOLING COIL
SPUNDING VALVE OR BLOW-OFF
THERMOMETER PORT
CARB STONE PORT
BOTTOM DUMP

INTRODUCING CONICALS TO THE HOMEBREW MARKET

In my search, I stumbled across a supplier I had never used before called MoreBeer!, which had a small stainless conical on their webpage. But there was no way I'd get that expense by my wife. So as my engineer mind drew into deep thought, I had this hair-brained idea to make five of them and sell three on this new thing called eBay to pay for the other two for myself. Certainly this would pass muster with the wife. After much negotiation I made the plunge.

Anita Johnson, the owner of my local homebrew shop in Indianapolis at the time, soon convinced me I should sell these through retailers. That was the launch of Blichmann Engineering. I can't thank Anita enough for giving me that nudge. I also can't tell you how many retailers that I called who told me I was an idiot to think that anyone would pay that much for a fermenter. But I did manage to convince a handful of retailers and set up shop in my garage selling a whopping 3–4 a month. In a couple years I found I had two full-time jobs and left my engineering job at Caterpillar and went full time Supreme Commander of Blichmann Engineering. Well, I was also Mr. Mom to three daughters, too. It was pretty cool, looking back, to be a pioneer along with MoreBeer! in the high-end homebrew-specific stainless steel products. To see things evolve from a niche little hobby market to a mainstream hobby where buying stainless conicals is now commonplace is pretty awesome. How the times have changed!

DEFINING CONICAL

What is a conical and what does uni-vessel mean? The term "conical" or "cylindro-conical" are merely reflective of the shape of the device. The conical portion aids in collection and discharge of sedimentation to the bottom of the cone where a discharge or "bottom dump" valve is affixed. The cone angle is commonly 60 degrees, but you'll see shallower cone angles as well. Generally, the steeper the cone the better the removal of sediments. But also the taller the unit needs to be for a given volume. That is not really an issue for homebrewers, so the 60-degree cone angle is pretty standard. The cylindrical section holds the bulk of the volume.

The term uni-vessel or uni-tank means it is capable of holding pressure adequate for carbonation. Nearly all commercial, and most homebrewing conicals these days, are able to hold pressure up to 15 PSI and have cooling capability, so this allows them to be utilized for both fermentation and carbonation. Although, in practice, carbonation in a conical is rarely done in commercial brewing. Usually the brewers allow time in the conical for the beer to clear reasonably, and then it is transferred to a bright beer tank for final clarification and carbonation. From the bright tank, the beer is either transferred into bottles, cans, or kegs. For homebrew-size batches, it makes financial sense to transfer the finished beer straight into kegs (or bottles) since kegs can be had for a fraction of the cost of a stainless conical. And you can get another batch in the fermenter much sooner since it isn't tied up dispensing. That said, this is a hobby and some brewers love the gadgets and showpieces in their brewery. I fully appreciate that!

The two defining features for conicals are the bottom dump and the rotating racking arm. Let's start at the bottom (of the conical).

BOTTOM DUMP

Having a drain on the bottom of the vessel eliminates the need to rack (transfer) to another vessel for secondary fermentation. Secondary fermentation (racking to a second fermenter to separate the wort from the trub after fermentation is complete) used to be recommended for all beers, but these days using a secondary fermenter for ales is pretty uncommon. That said, it is so fast and easy to dump sediment in a conical that there really isn't a reason not to "secondary." Lagers definitely benefit from racking off excessive sediments for long-term maturation. What's great about the conical, is you simply open the valve and dump the sediment, leaving the clear beer behind. This is also where you can collect yeast for repitching (more on that later). Not only is this a significant time- and cost-saver, it reduces the potential for contamination and oxidation. I always recommend dumping sediment from the bottom dump valve after high kräusen, and then again in a week or so for lagers. For ales, normally only one sediment dump is needed.

If you've waited too long to dump the sediment you might open the valve and discover that it doesn't drain. Wait patiently for it to begin flowing, and be ready to close the valve quickly. When compacted, yeast is a non-Newtonian fluid. Meaning it is more like toothpaste than molasses. So it can support the weight of the beer above it even with the large butterfly valves commonly used on conicals. If you have a stuck dump, applying a little CO_2 pressure to your tank will usually get things moving again. But, of course, never exceed the pressure rating of your fermenter.

Beyond dumping the sediment, the primary use for the bottom dump is for harvesting yeast. The key benefits are generating large healthy yeast pitches for future batches, and saving money on yeast. This is a particularly great option if you brew frequently and use the same yeast strains regularly. If you're a brewer that likes to tinker with all sorts of strains this may be a less attractive feature. Similarly, if you're an infrequent brewer you may not be able to keep the yeast healthy between batches. If you're unable to pitch the yeast for another couple of weeks you'll want to reactivate the yeast with wort before using. And after four weeks you're safer going with a new package of yeast.

The process of harvesting yeast is fairly simple, but it does require strict adherence to sanitation. After the main fermentation activity has slowed (high kräusen has passed), you'll want to drain trub, hop particles, and early flocculating yeast from the bottom of the cone using the dump valve. It is handy to have a sanitized large diameter hose connected

to the valve. Be sure to spray sanitizer in the valve as well. If you have a conical that can hold pressure, add a couple PSI of CO_2. Much more than this and you'll spray the yeast aggressively out of the valve. Slowly open the valve and let the brown trub and green hop material pass. Close the valve and spray sanitizer on the inside of the valve. If you have a cap to cover the open end of the valve that is advisable to keep the inside surfaces sanitary. If you haven't put pressure on the tank, simply use a sanitized CO_2 hose through the airlock hole to purge any oxygen out of the headspace. Run CO_2 for a few minutes. It isn't necessary, or advised, to immerse the hose in the beer. A few days later, repeat the process, again being sure all surfaces and the hose are well sanitized, as you'll be collecting this yeast for reuse. Alternatively, you can collect the yeast in one step by letting the brown trub pass into a waste container and collecting only the cream colored yeast.

Two excellent storage containers for yeast storage are Mason jars or Erlenmeyer flasks. However, it is important to keep yeast harvested in clear glass out of direct sunlight as much as possible. If using a Mason jar, you'll leave the lid on slightly loose to let CO_2 escape. For the flask, you'll use an airlock and stopper, cotton plugs, or a piece of aluminum foil secured with a rubber band. Purging the container with CO_2 before and after filling is recommended. Yeast can be stored in a refrigerator for a couple of weeks and 4–6 generations is common in a home setting.

RACKING ARM

The second defining feature of a conical is the rotating racking arm. While some manufacturers offer this as an optional item, it shouldn't be. This is the easiest way to transfer the clear beer to your kegs or bottles while leaving the sediment behind. This curved rotating drain tube and valve allows you to begin draining into your keg (or bottling bucket) and then you slowly rotate the arm downward until you see a bit of yeast being drawn through the hose letting you know you've reached the yeast cake. Then rotate it back slightly and continue to drain. The racking arm is also a great place to take gravity samples to monitor fermentation progress. Spray some sanitizer inside the valve, and then simply open the valve and fill the sample cylinder. Then spray the surfaces again to sanitize and remove beer drips from the valve after taking the sample to keep bacteria and mold off of the surfaces for subsequent samples and draining.

A racking arm is rotated to adjust the level at which beer is transferred from the conical to a keg or bottling bucket, allowing it to be set just above the yeast cake to minimize beer left behind.

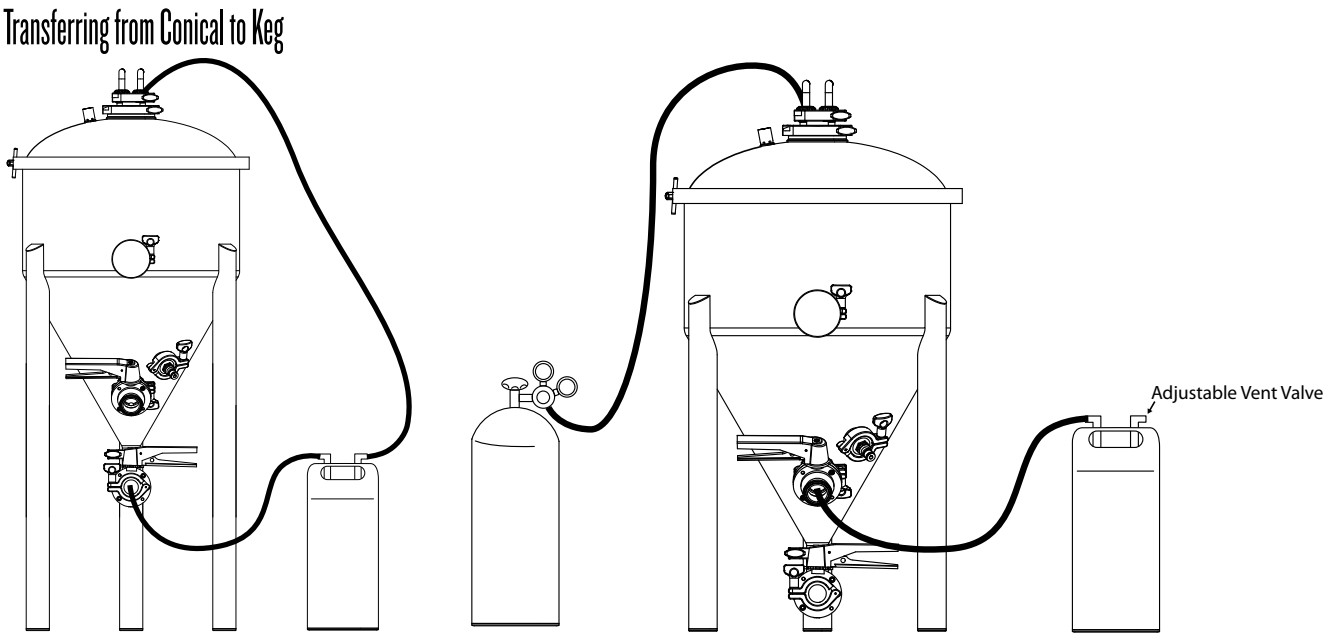
One thing to keep in mind is that when you're removing beer from a fermenter, is that you're also drawing air into the headspace to replace the beer you've just removed. The easiest way to ensure you don't leave oxygen in the headspace for a long time is to apply a bit of CO_2 pressure to the tank prior to drawing a sample or dumping sediment. The CO_2 will simply expand to keep any oxygen out. A couple PSI is plenty. If you don't have a pressure-capable tank, the best option is to purge the headspace after a dump/sample by placing a CO_2 hose in the airlock hole as described earlier.

TRANSFERRING FROM A CONICAL

The simplest way to drain your beer from the conical into a keg or bottling bucket is gravity. It is super easy to connect a hose to the racking arm and place the other end into the bottom of a CO_2-purged keg. But this requires the fermenter to be elevated above the receiving vessel.

Fortunately, most conicals on the market have enough pressure capability to allow you to pump your beer using CO_2 pressure — something you'd never do with glass. This feature makes lifting the fermenter above your keg, or using leg extensions, unnecessary. Connect the racking arm of your conical to the liquid-out post of the keg. This fills the keg from the bottom up. Open the pressure release valve (PRV) of the keg to vent any CO_2 pressure and leave it open. Add a couple PSI of CO_2 pressure to the conical and then open the racking valve. You should see beer begin to flow. If it doesn't, increase the pressure slowly until you do. The idea is to slowly make the transfer to avoid foaming. Watch the transfer closely so you can quickly shut off the racking valve when gas enters the hose, signaling that the fermenter is empty. Gas pumped through the beer might result in a bit of a mess. If beer comes out of the keg relief valve stop the transfer. If your keg is not full to the brim, pressurize the keg and pull the PRV a few times to expel any air that may have entered the keg.

If the beer has been carbonated



Two ways to transfer beer from the conical to a keg without introducing any oxygen are (left) using a gravity transfer where a return hose from the keg is connected to the conical so the CO_2 being pushed out of the keg returns to the head space of the conical. Another way (right) uses CO_2 to push beer through a hose from the racking arm of the conical into the liquid-out post of the keg (open the vent of the keg to release any CO_2).

in the fermenter, you will need to "counter-pressure fill" your keg. To do that you'll need an adjustable relief valve affixed to the CO_2 post, connected to your gas post. This allows the keg to be pressurized, to the same pressure as the fermenter, and then slowly releases the CO_2 gas in the keg until the beer flows. This keeps the CO_2 in solution and prevents excessive foaming. Adjust the pressure of the keg to a slightly lower pressure than the fermenter. Set the adjustable relief valve a little higher than the conical pressure. This is done to prevent CO_2 gas from blowing back into your fermenter from the keg and kicking the yeast back into suspension. Open the racking valve and the beer should begin to flow. When you hear the CO_2 regulator stop flowing, gradually open the relief valve until you hear CO_2 hissing out of the valve. Leave the adjustable valve at that setting until the keg is full. When the hose fills with CO_2, or beer sprays out of the PRV, stop the transfer by closing the racking valve.

TEMPERATURE CONTROL

Temperature control of any fermentation is paramount. The old school and simplest method for homebrewers to cool their conicals is by utilizing a refrigerator or upright freezer and overriding the thermostat (there are a number of controllers on the market for this). Simply tape the temperature probe onto the side of the conical with a piece of thermally conductive aluminum duct tape and you're good to go. This reduces cycling of the refrigerator, reads very accurately, is very quiet, extremely reliable, and there is nothing extra to clean.

Another common option is to use an immersion type cooling coil and insulation jackets that most conical manufacturers offer for their products. This requires a supply of cool liquid to be circulated through the inside of the cooling coil. On the simple side this can be a cooler of ice water and an immersion pump. The real drawback with this method is that the frequent addition of ice to the cooler can be a chore. A more elegant, but more expensive, way is to use a glycol chiller. These systems utilize a refrigeration system to cool propylene glycol (a food-grade antifreeze) that is pumped through the cooling coil inside of the conical. All these meth-

Ice water or glycol can be recirculated through an immersion cooling coil as a way to control temperature inside of a conical. Insulation jackets will help maintain the temperature.

ods do an excellent job of maintaining your fermentation temperature and can take your fermentations to the next level of control.

FERMENTING UNDER PRESSURE

If you've got a fermenter that can handle up to 15 PSI you've got the opportunity to do pressure fermentations to suppress ester formation and ferment at room temperature, and avoid the need for dropping your fermentations to lagering temperatures. Plus you can finish the batch at the speed of an ale! Chris White from White Labs and I did an experiment a few years ago on the flavor of lager fermented in the traditional way, and also at room temperature at 0, 1, and 2 BAR (0, 15, and 30 PSI). Chris quantitatively analyzed the finished beer (Munich helles) utilizing a gas chromatograph (see the results in Table 1). The pressure resulted in a very significant reduction in esters (ethyl acetate and isoamyl acetate). From the independent qualitative tasting done by high-ranking Beer Judge Certification Program judges, the winner was still the traditional lager method, but the 1 BAR (15 PSI) room temperature batch was a close second. The 0 BAR (0 PSI) was notably more fruity. The 2 BAR (30 PSI) batch had hop bitterness that was a little harsh and had a little thinner mouthfeel. Another focal point to notice is diacetyl. The room temperature fermentations were all very low in diacetyl. While the beer fermented in the traditional method had a more typical level of diacetyl for the style. This is likely what tipped the win to the traditional lager as it had a fuller mouthfeel and rounder balance.

If you're interested in experimenting with pressure fermentation then a spunding valve is needed. Note that a PRV is only intended to be activated in an accidental overpressure situation. Using a PRV as a spunding valve is akin to installing a fire alarm in your house because you have faulty wiring. It is always better to fix the wiring. Or in this case, use a spunding valve according to the manufacturer's instructions.

Table 1: Pressure Fermentation Quantitative Analysis

Test	Units	Lager	0 BAR	1 BAR	2 BAR
Alcohol by Volume	%	5.06	5.09	5.11	5.12
Alcohol by Weight	%	3.97	3.99	4.01	4.01
Apparent Attenuation	%	80.14	81.02	80.93	80.66
Apparent Extract	Plato	2.36	2.25	2.27	2.31
Calories	per 12 oz.	156.58	155.75	156.47	157.18
Color	SRM	5.52	5	5.58	5.8
Original Extract	Plato	11.89	11.84	11.89	11.94
pH		4.46	4.35	4.34	4.55
Real Degree of Attenuation	%	66.14	66.84	66.77	66.57
Real Extract	Plato	4.2	4.09	4.12	4.16
Specific Gravity	68 °F (20 °C)	1.009	1.009	1.009	1.009
Diacetyl	ppb	32.07	<10	12.61	12.2
IBU	BU	22.5	16.5	20	21
1-Propanpl	ppm	15.79	20.96	18.19	17.57
Acetaldehyde	ppm	10.77	5.08	4.26	6.91
Acetone	ppm	none	none	none	none
Amyl Alcohol	ppm	52.03	63.23	56.79	52.75
Ethyl Acetate	ppm	33.01	40.5	23.52	19.7
Ethyl Butryate	ppm	none	none	none	none
Isoamyl Acetate	ppm	2.18	2.78	1.66	1.26
Isobutanol	ppm	10.17	16.23	15.79	11.97
Isobutyl Acetate	ppm	none	none	none	none
Methanol	ppm	none	none	none	none

CONICAL CARE

When you get a new conical there is a step that should be taken before initial use — passivating. Initial cleaning and passivating of a new stainless fermenter is pretty simple. The purpose is to thoroughly remove any manufacturing residue including oil and polishing compounds. PBW, AmBrew, or plain detergent all work well for removing oils and polishing compound residue. Follow that up with an acid cleaner like Bar Keepers Friend (oxalic acid), which is available at any grocery store. Simply sprinkle some on a sponge and scrub away. Bar Keepers Friend is slightly abrasive, so highly polished surfaces may exhibit some swirl marks, but this is not harmful to the stainless, and won't affect performance. Another acid commonly available at homebrew stores is citric acid, which also works well for passivating. Stainless steel is considered "passive" when the surface has developed a thin (several molecules thick) layer of chromium dioxide. So the idea behind "passivating chemicals" is to clear the surface of things like wax, oil, water salts, and soils so that the oxygen in the air can react with (oxidize) the chromium on the surface of the steel. That's why it is also important for you to let the surfaces dry completely after cleaning. It is the oxygen reacting with the chromium that does the passivating, not the chemicals. The chemicals are like eHarmony — they just aid in arranging the meeting! It is this thin layer of CrO_2 that is extremely stable and resistant to corrosion. After the initial cleaning, you'll be able to use any alkaline cleaner to keep the surfaces squeaky clean, but an occasional scrubbing with Bar Keepers Friend

is recommended to keep the passive layer in good shape.

After that initial cleaning, future cleaning, sanitizing, and care for your conical is fairly simple. The latest craze is CIP (clean in place). This is accomplished with pumping cleaning and sanitizing agents through a spray ball mounted inside of the tank to mechanically and chemically clean the tank. This is the process used in commercial breweries by necessity — it is virtually impossible and certainly impractical to clean the larger vessels any other way. Even after cleaning your tank in this manner it is important to inspect all ports and hatches to ensure that the spray ball was able to reach these areas.

For homebrew-sized vessels, it is certainly possible to manually clean them, and it is generally faster and more thorough to just scrub and sanitize by hand. Particularly when you add in the setup time for CIP pumps and hoses. Ultimately, it is a matter of choice. If using CIP, be sure to choose cleaning and sanitizing agents that are non-foaming. For manual cleaning, a product like PBW or AmBrew is great for soil removal and StarSan or SanStep for a spray surface sanitizer. In the old days it was common to fill a fermenter completely full of sanitizing solution. But with the modern acid sanitizers simply spraying the surfaces is more than adequate and saves a lot of time and money.

One of the things that make conical fermenters useful is the plethora of accessories that can be added. Rotating racking arms, carbonation stones, thermometers, blow off tubes, cooling coils, insulation jackets, and much more. It also makes them look pretty cool. But all of that comes with a hidden cost (in addition to the actual cost) — lots of extra cleaning. So when selecting accessories, realize that you've got to disassemble and clean and sanitize all those items! I've always been a fan of simple is better, so factor that into your decisions too. Remember that commercial tanks have many of those accessories because there is simply no other way to accomplish some tasks in any other way.

SAFETY CONSIDERATIONS

Conical fermenters do resolve a lot of the safety issues of fermenting in glass. But they also introduce a couple other issues that warrant discussion. They tend to be top heavy due to the nature of their shape. Not really a big issue unless you add casters to them and want to move them or lift them. They are also available in sizes larger than 5 gallons (19 L), so they can get quite heavy. Be sure to follow the manufacturer's warnings for handle capacity if you intend to lift when it is full. When moving with casters, take extra care to avoid tipping.

For pressurizeable fermenters let's have a discussion about pressure (P), area (A), and force (F). Pressure is the force exerted over a given area. While 15 PSI doesn't sound like much, that is all relative to area. Specifically F = P x A. Where area (for a circular lid) = Diameter^2 x 3.14 / 4. For a conical with a lid that is only 6 inches (15 cm) in diameter, the force on that lid at 15 PSI is 15 x 62 x 3.14 / 4 = 424 lbs. (192 kg) of force. For a 16 inch (41 cm) diameter lid, that force jumps to 3,000 lbs. (1,360 kg).

I go through this exercise so that you recognize how important it is to have a PRV on your fermenter at all times. And how important it is not to tamper with it. ALWAYS release all pressure before attempting to open any hatch on the fermenter. Even a plastic lid with that kind of force on it can cause serious injury. Not to mention a colossal loss of beer! While it is tempting to assume that you'll be fine without a PRV if you're using a blow-off tube or airlock, if any of those devices clog your yeast will easily tolerate over 30 PSI and can cause a severe over-pressurization. Don't be penny-wise and pound-foolish.

TIME TO GET A CONICAL?

A frequent question when buying a conical fermenter is selecting the right unit for doing multiple size batches. While you can make a 5-gallon (19-L) batch in a 10-gallon (38-L) conical, it is even more important to pay attention to keeping oxygen out of the tank after fermentation activity has stopped. The other drawback is

A pressure relief valve is a critical piece of safety equipment to ensure the conical is not over-pressured.

that you will have less static pressure to discharge yeast from the reduced level of beer in the fermenter. That is easily remedied by adding a little CO_2 pressure if needed. In general, I've always recommended going with the batch size you do most often, and sacrifice on the other batch size. If 90% of your batches are 5 gallons (19 L), and 10% are 10 gallons (28 L), go with a matching size for the 5-gallon (19-L) batch, and fill a carboy with the extra 5 gallons (19 L) you've made on those less frequent occasions. If you're torn, go with the bigger size. In general, a 10-gallon (38-L) batch size conical isn't a lot more cost than a 5-gallon (19-L) batch size unit.

Material of construction is also a core decision to make. One of the key things I love about stainless steel conicals is the rugged durability. Glass carboys are awesome for corrosion resistance and overall ease to clean, but are quite fragile and present some serious safety issues. We've all seen the cuts and carnage from glass. PET conicals eliminate the safety issues of glass, but care must be taken to use the right chemicals for cleaning, and at cooler temperatures to prevent damaging the material over time. Being a softer material, you'll want to avoid cleaning with anything abrasive that may damage the interior surfaces. Stainless is also UV impermeable so no light-struck beer issues! Like glass, stainless steel is also impermeable to oxygen. PET plastic has a fairly high resistance to oxygen ingress, but is not impermeable. Of course, plastic conicals will be more cost effective.

It has been truly amazing watching the development of home-scale conical fermenters over the past 20 years to where they are now fairly commonplace. I hope this article has taken some of the mystery out of all the valves and fittings on these devices. As you're selecting a conical fermenter, recognize that it is really a balancing game of features and benefits you'll actually use, against the price. And let's be honest, another driver is that cool look to dress up your brewery. After all, this *is* a hobby! BYO

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WEDNESDAY, MARCH 24, 2021

INSIDER TOUR OF DENVER-AREA CRAFT BREWERIES - You'll tour – and taste – at four different craft breweries in the Denver area during this pre-event optional offering. You'll have the opportunity to meet brewers and ask questions in addition to sampling their beers. Includes a beer-pairing meal. A great way to kick off your BYO Boot Camp experience and check out some of Denver's thriving craft beer scene.

THURSDAY, MARCH 25, 2021 DENVER BOOT CAMPS

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

TROUBLESHOOTING HOMEBREW FAULTS & FIXES – ***with Ashton Lewis*** – Join *Brew Your Own*'s Mr. Wizard and Technical Editor Ashton Lewis as he walks you through the potential minefield of beer flaws and faults homebrewers can face. You'll learn how to troubleshoot – and fix! – your own homebrews with Ashton who has helped thousands of homebrewers over the last 20+ years troubleshoot common and not-so-common beer problems as *BYO*'s Mr. Wizard. You'll have a chance to experience many faults first-hand to better recognize them later. Plus as a special bonus, bring in your own troubled homebrews and Ashton will use your beer as a live example walking the class through the thought process as he figures out what might have gone wrong with your homebrew and what you can do to fix the problem moving forward.

ALL-GRAIN BREWING ESSENTIALS – ***with John Palmer and John Blichmann*** – Designed for intermediate to beginner homebrewers getting into all-grain brewing, this full-day workshop will cover all you need to know to successfully make great homebrews using all-grain brewing both with traditional and newer techniques. *How To Brew* author John Palmer and equipment guru John Blichmann will take you hands-on through the full all-grain process from milling, mashing, and sparging before going into the boil. You'll get to know the equipment, techniques, and ingredients first-hand and learn all-grain brewing by doing in a small-class environment. They'll also cover newer homebrew all-grain techniques such as Brew-in-a-Bag and No Sparge in addition to traditional mash methods and some advanced tips as well.

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

SIMPLIFY YOUR BREWING – ***with Drew Beechum and Denny Conn*** – As a homebrewer progresses through the hobby there comes a temptation to feel you need to keep adding more equipment, more techniques, more ingredients, and more of everything. At a certain point you can find yourself wondering how it all got so complicated and even less fun than it was at the beginning. BYO Techniques Columnists, book authors, and podcasters Drew Beechum and Denny Conn will spend the day making sure you still produce great beer, but with less headaches, worries, and time. From streamlining your brewing process to simplifying your recipes without sacrificing beer quality, Denny and Drew will free up your time to brew more often and have more fun and success as they remind you why you fell in love with homebrewing in the first place.

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

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

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

FRIDAY, MARCH 26, 2021
BONUS BOOT CAMP SEMINARS
9:15 A.M. TO 5 P.M.

We are adding a third bonus day to our normal event schedule based on feedback we've received from past attendees who wished they had a chance to learn from all our assembled speakers beyond their Boot Camp workshops. So for 2021, we've scheduled a full day of seven different seminars led by our cast of brewing all stars who will share their knowledge with you on their area of expertise. It will be a full day packed with great tips and techniques from the best in the industry so get ready to learn. Plus you'll have even more time to check out the latest homebrew gear and ingredients with our Boot Camp sponsors located right in the meeting area.

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

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

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

NOON TO 1 P.M.
Lunch

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

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

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

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

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

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

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

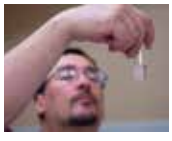
SATURDAY, MARCH 27, 2021 DENVER BOOT CAMPS

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

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

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

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



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

HOMEBREW EXPERIMENTS – ***with Drew Beechum and Denny Conn*** – Developing your own recipes, refining your own brewing techniques, and tweaking your equipment set-up all require the know-how to conduct your own homebrew experiments. Without reliable results you rely on guesswork instead of facts to improve your brewing. Join two of the true leaders in experimenting with homebrews – podcasters and book authors Drew Beechum and Denny Conn from Experimental Brewing as they first walk you through how to properly conduct your own experiments at home including structured blind evaluation techniques, and then walk you through some real life homebrew case studies to show how these experiments can play out. Get ready to roll up your sleeves and get your science on!

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

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

SUNDAY, MARCH 28, 2021

INSIDER TOUR OF DENVER-AREA CRAFT BREWERIES

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

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

BY DREW BEECHUM & DENNY CONN

MALTED "OTHERS"

Adjuncts that are no longer raw

In the course of brewing history, human beings have strayed so far from the mystical magic of the vaunted four ingredients of beer — malted barley, hops, yeast, water — that it seems like a holy peak to attain as opposed to the practical.

Look around these days and you'll see breweries and brewers throwing everything into the mash and the package. Want whole cheeseburgers in your beer? Yeah, there are a few of those. Donuts? Jeez, get into line, man — two blocks over! Fresh fruit puree straight into the growler. Well yes, people are doing that, but for the love of all things beery: No! Let's get back to the nuanced and fundamentals of beer and brewing. Today it's time to talk about the malted "adjuncts" we can use in beer.

Different varieties of malt, from plain base malt to roasts and toasts and caramel malts, all have differing drying processes to add color and character.

From top left going clockwise: Malted corn, oat malt, rye malt, wheat malt, malted sorghum, and rice malt. They all have a tradition in brewing, some more than others.

A QUICK REVIEW OF MALT

We've said the word "malt" enough that it's become almost devoid of meaning, so let's shove some meaning back into our brainpans. Remember that kernels of our cereal grains are seeds that we've hijacked for culinary purposes. Each kernel is full of the stuff needed to create more cereal. Malting is our process of activating the grain's inner growth engine to unlock even more potential.

Malting starts with dried grain (like barley) steeped in water off and on for a few days to activate the seed and begin the process of growing a new plant.

It's whisked away to germinate. Inside the kernel a new sprout forms and a number of chemical changes happen including beginning the degradation of the starchy interior, releasing enzymes (like amylases), and freeing the nutrients necessary to create a plant.

The maltster closely monitors the process and waits for the acrospire (sprout) to become visible and almost as long as the kernel. If they did nothing, we'd be well on our way to making a new stalk of grass, but being interested in the results for other purposes, the maltser arrests the growth and dries the malt with carefully controlled blasts of hot air. Different varieties of malt, from plain base malt to roasts and toasts and caramel malts, all have differing drying processes to add color and character.

There's a ton of details that we've left out — we don't have the whole magazine after all! But suffice it to say the process of malting prepares the grain to become beer as the universe clearly intended it to be!

OTHER MALTS

You'd be forgiven if you walked into this thinking that malt and barley are synonymous. But even though barley comprises most of what is malted, you now know that malting is just a process for supercharging a grain for brewing and baking purposes. (So many baked goods have malted barley in them; you'd be surprised!)

As a side note — barley is our chief malting cereal largely because it starts with a high level of enzymes, which makes it ideal for a conversion scenario like mashing. Also, let's face it — barley bread is not nearly as tasty as the stuff made from wheat, which is why historically so much barley has gone to animal feed. Unmalted adjuncts depend on the enzyme content found in malted grains, like barley, to fully convert in the mash. Fortunately, modern barley malt is so enzymatically "hot" that barring crazy loads of non-enzyme containing adjuncts, you'll be fine.

So what else is out there and what do they bring to the table? We'll start with the "most obvious" and move down the list — and for our friends trying to

avoid gluten — this becomes very important!

Photo by Charles A. Parker/Images Plus

MALTED WHEAT

Chances are if you think of anything as malted, other than barley, it's good old wheat. Wheat has a long history of being used in brewing. Speculative recipes of beers from the Egyptian and Sumerian periods often use a blend of barley and early varieties of wheat like Emmer and Einkorn. Wheat has had such a long history of domestication and importance to human civilization that it would be odder to not find it in beer repeatedly and continuously.

After all, the theory goes that the usage of wheat for beer instead of bread was one of the reasons behind the formation of the vaunted Reinheitsgebot. (Theory being that the popularity of weizen beers threatened the bread supply in Bavaria, so out it went for the general populace, except for the royals . . . well that's another legend.) The classic Bavarian hefeweizen is a simple blend of pale malt and wheat malt – with grain bill ratios like 60-70% wheat malt and the rest being pale malt. Note that at that usage level, you'd find it impossible to convert unmalted wheat without additional enzymes.

Note that there are two base types to raw wheat — white and red. The difference lies in the outer bran coating (red has coloring) and protein levels (white has less). There are people who swear they can tell the difference between red and white wheat in their beers and a hefeweizen would be the best case for it with its heavy wheat character, but we've never detected it. In the US, many homebrewers were taught to use wheat malt in their recipes for better head retention thanks to wheat's higher protein content compared to barley. That lesson seems to have largely subsided as practices and products have become better, but a little wheat can still lend a soft sweetness to your beer.

Photo courtesy of Great Fermentations

MALTED RYE

Denny discovered the joys of rye malt when he was developing his semi-world famous (neighborhood famous?) rye IPA recipe around the turn of the century. He had been brewing an IPA recipe from *BYO* when he heard discussion of rye malt on the late, lost Homebrew Digest mailing list. (Yeah, that's how long ago it was!) He decided he'd start experimenting with replacing a portion of the base malt with rye malt. It added a beautiful, full mouthfeel along with an earthy spiciness. And a monster was born. The same process can be applied to any beer where you want to experiment with rye malt. Simply replace a portion of the base malt with rye malt. Remember, we're talking about rye malt here, not flaked rye, which has a distinctly different flavor.

A couple caveats about using rye malt. You'll often hear people say you need to use rice or barley hulls with malted rye to improve lautering and help avoid a stuck runoff. That's pretty much dependent on the lauter design of the brewing system you use, so know your equipment. With Denny's hose braid/batch sparge system he's never had a stuck runoff, even using as much as 60% rye malt. If your system is prone to stuck runoffs, you should probably toss a handful of hulls mixed into the mash.

The other thing to think carefully about is how much rye you'll be using. Denny's feeling is that you need to have at least 18% of your total grist as rye malt in order for it to really be noticeable. Some people use as little as 10%. Try it for yourself to find your own flavor sweet spot. On the other end, don't overdo it. I know some people have made 100% rye malt beers. Since rye malt has enough diastatic power to convert itself, that's certainly possible. But it may not be prudent! Besides the heavy dose of earthy spiciness, the body really thickens up. Denny found his 60% rye malt beer to be just the line in the sand. Your tastes may (and probably will) vary.

MALTED OATS

Photo courtesy of MoreBeer!

Oats have a very long history in brewing. It makes sense as they're starch rich, but make terrible bread. No, seriously, oat cakes will keep you moving, but not as happy as we've become accustomed to our warm, fluffy wheat bread. So even when wheat was being preserved for bread (see the Reinheitsgebot), oats were freely available. And these days, with the hazy IPA craze, oats have never been more in-demand. While most brewers use readily available flaked oats, there is a tradition of making oat malt. The traditional use of oat malt was heavily centered around a stout tradition. (Maclay being the primary driver of the style that would later be morphed into the modern oatmeal stout.)

Oat malt is a very thin kerneled malt that some brewers will run through a tighter mill gap. (Drew just mixes his thoroughly with the base malt to insure crushing). It provides an interesting combination of the richness of regular flaked oats with a less fatty and more toasty character. The malt doesn't glue up the mash as much as other forms of oats and is particularly aided in lautering by the more abundant husk (compare this to things like wheat, corn, and rice).

In addition to the previous benefits, malted oats are surprisingly potent critters, enzymatically speaking, that can actually convert themselves. This means that partial mash brewers can steep the oats without needing malted barley or wheat additions. In theory, you could make a 100% malted oat beer. Drew can't recommend this idea however — every beer he's tried above 70% malted oats ends up tasting like a ham sandwich. The most Drew has ever done is around 60% in a Dutch-style tripel that's oat heavy, and it's awesome.

OTHER MALTED GRAINS

Now we're going to go a lot less conventional — at least from a North American-European point of view. Now for the record, these grains that are coming up are crucial to our fellow lovers of beer who are gluten intolerant. For more information on that subject and why "gluten-reduced" doesn't suffice for everyone, listen to our *Experimental Brewing* episode, "Brew Files 84" with Brian Newcomb, about brewing with 100% gluten-free grains.

SORGHUM

This is quite possibly the most popular malt you've never used. Sorghum has been used in both traditional and com-

Photo courtesy of Deer Creek Malt

mercial African brewing traditions from around the continent. In the US, we mostly encounter sorghum in the form of sorghum molasses or animal feed, but it's considered one of the most critical cereal crops in the world.

Sorghum malt itself is hard to come by in the US and Drew's only encountered the extract form produced by Briess. It's marketed towards beer drinkers wanting a gluten-free product. Sorghum has an interesting flavor profile with a lingering tanginess. For that reason, Drew thinks it'd be a lovely addition to a stout to recreate some of that traditional "tang" element Guinness has been known for.

Photo courtesy of Epiphany Craft Malt

CORN

While we tend to think of corn (maize) for brewing as something we buy either in easy-to-use flaked form or cause ourselves stress by using grits that require pre-cooking, there is a tradition of malted dent corn used in distilling. Where it used to be hard to find at the homebrew level, craft maltsters like Epiphany Craft Malt are producing corn malt at levels suitable for homebrew use.

The big advantages of corn malt according to its proponents is a fresher, less washed out corn flavor and that it can be mashed straight into your mash tun without precooking. Another advantage is that craft maltsters are choosing interesting varieties of corn with different flavor profiles. You know Drew's going to drop some of that into a cream ale!

RICE

Photo courtesy of Eckert Malting & Brewing Co.

Like corn, we tend to picture rice in terms of American lagers and either using flaked rice or ground rice that we then cook separately. Rice malt, well, that gets a bit confusing.

On the one hand, there is whole rice malt with a husk, fit to be ground. Gluten-free brewers use it as a replacement for pale malt, but in that use it requires additional enzymes to ensure conversion. The bonus – it comes with free rice hulls! On the other hand, you'll see "rice malt syrup" sold in health food stores (or "brown rice syrup"), which is, like malt extract, the result of a mash that's concentrated. Interesting to note is the amount of maltose found in the rice syrups that can lend a different flavor than straight malt.

OUTRO

So there you go – a few fine examples of a non-barley malt variety positively impacting your brewhouse and brews. In general, malted versions of grain are going to be easier to use and offer better characteristics to our mash tuns and the final beer than unmalted versions. This of course comes with certain caveats, exceptions, and understandings that ingredients need to be carefully chosen to fit your goal for each beer. BYO

BY BRITTNEY BERG

YEAST NUTRITION

Feed your yeast to ensure success

Every year, or month even, there seems to be a new trend in the brewing industry. Ranging from high-gravity fermentations to low-nutrient-available beverages; i.e. hard seltzers, hard kombucha, etc. The ideas keep on coming without a stop in sight. Whether you like or dislike these beverages is a separate discussion. What we need to focus on is that with whatever you're brewing, a strong understanding of yeast and nutrients is a necessity. Yesterday it was *this*, tomorrow it's *that*. But today is always a good day to learn about nutrients.

Before we jump right in, let's take a step back and start with the main ingredient here: Yeast. I may be a little biased as I work at a major yeast company, but I have to say it — yeast is the soul of beer. They're awesome and complex. They give our beers flavor, depth, mouthfeel, and the most important, alcohol. So let's get a better understanding of these cool little critters. Brewer's yeast is a fungus that falls under the genus of *Saccharomyces*, which literally means "sugar fungus."[1] In the most simple of terms, yeast utilize carbon sources to produce ethanol and CO_2. There are hundreds of other reactions that occur in a yeast cell, and each reaction can be influenced by different factors: pH, pressure, temperature, wort composition, etc. If you change one factor, you will likely cause a chain reaction. Yeast nutrients, also known as yeast foods, can be one component of influence. Yeast nutrition "refers to how the cells utilize food sources for subsequent anabolic and catabolic reactions that insure the growth and survival of that cell."[2] If yeast are nutritionally deprived, unfinished fermentations may follow, and lead to beer off-flavors. Adding nutrients, can "improve alcohol yield, reduce fermentation time, enhance yeast viability and vitality, and increase diacetyl removal, as well as control undesirable flavor compounds."[3]

Ideally, all-malt wort should provide the necessary components for a successful fermentation: Sugars, amino acids, vitamins, and minerals. However, we don't always have the most ideal situations or ingredients; e.g. low-quality malt or a zinc deficiency. Fermentation in general is already pretty taxing on the yeast cells. With high-gravity brewing, high-adjunct brewing, sour wort, serial repitching, etc., yeast are now put into more stressful environments and need all the help they can get. Yeast nutrients are available to supplement where the ingredients fall short and can be used as a yeast "insurance" to continually have consistent fermentations.

So what do yeast need and how are these available?

- **Carbon:** Although not an added yeast nutrient per se, I mention carbon because it's the core component of carbohydrates — an essential component in yeast metabolism. Carbohydrates can be provided through sugar additions, but typically come from malt as maltose, maltotriose, and small amounts of sucrose, glucose, and fructose.[1] Sugar uptake can be strain-dependent. For example, there are strains that do not assimilate the trisaccharide, maltotriose. Most brewer's yeast are not able to hydrolyze dextrins (long-chain sugars) into fermentable sugars, but some strains, such as *Saccharomyces cerevisiae var. diastaticus*, produce enzymes that can. When brewer's yeast break down and assimilate sugars, they go into glycol-

Yeast nutrients are available to supplement where the ingredients fall short and can be used as a yeast "insurance" . . .

Certain yeast nutrients need to be added to the boil in order to allow their nutrients to be freed up and subsequently assimilated by yeast.

ysis, on their way to produce alcohol.

- **Oxygen:** Oxygen is another essential component in yeast metabolism that is typically injected separately, but still important to mention. Oxygen/air is necessary for efficient cell division immediately after yeast pitch to ensure adequate cell population for fermentation.* The oxygen is used for the production of sterols and unsaturated fatty acids, which are important in maintaining membrane structure and integrity and synthesizing healthy membranes as cells divide. These sterols and unsaturated fatty acids act like stress protectants to the yeast cell — they reinforce the membrane to uphold yeast function and viability. On the other hand, oxygen deficiency can result in poor fermentation and a high amount of acetyl coenzyme A, which can lead to increased levels of esters. This further influences the overall flavor of beer.[1]
  *Oxygen/air is not normally required for standard fermentations using active dry yeast on first pitch, because when dry yeast is produced, it's in presence of copious amounts of oxygen and is therefore filled with sterols.

- **Nitrogen:** Nitrogen is present in proteins, peptides, amino acids, and ammonium. When discussing yeast nutrients, you'll commonly hear the term free amino nitrogen (FAN). But what does FAN mean? Free amino nitrogen is an overall measurement of the available amino acids and small peptides in wort. FAN plus ammonia ions, gives us YAN (yeast assimilable nitrogen). YAN is commonly used in the wine industry, so we will stick with discussing only FAN for simplification. Nitrogen is necessary for successful fermentations as it's transported into the cell and integrated into key proteins responsible for yeast cell function. These proteins can affect yeast performance and beer flavor. The majority of these compounds are provided through malted barley. The malting process has been perfected over years to deliver the necessary amounts of carbohydrates, nitrogen, and enzymes for the brewing mashing process. Roughly 70% of wort FAN is produced during malting.[4] When brewing with all-malt, the addition of a nitrogen nutrient is not necessarily required. However, if adjuncts are added to the mash, this can dilute the amount of nitrogen in the wort and an external source of nitrogen would be beneficial for the fermentation. Nitrogen can be introduced in the form of a yeast extract/autolyzed yeast (an inactivated yeast) or by inorganic compounds such as diammonium phosphate (DAP). Hard seltzer production is an extreme example of a nitrogen-deficient fermentation that is in major need of nitrogen supplementation. The minimum necessary FAN levels for successful fermentations is roughly 140 mg/L.

- **Vitamins:** Vitamins are necessary for overall yeast health. Biotin, pantothenic acid, and thiamine are critical for enzyme function and yeast growth. These act as co-factors for the enzymatic reactions . . . in other words they help hold the 3-D structure of the enzyme in its proper shape to allow them to be most effective. Biotin is known to be one of the more crucial vitamins because it's a catalyst for multiple important reactions, such as "amino acid metabolism, fatty acid biosynthesis, and energy metabolism."[5] In general, yeast cells are not capable of synthesizing biotin, so it's derived primarily from the malt and hops used in the brewing process.[6] These can also be added externally by common nutrient blends on the market.

- **Minerals:** Phosphate, potassium, calcium, magnesium, and especially zinc, are crucial minerals for successful fermentations. Overall, these are needed in trace amounts, but are cofactors for enzymatic reactions such as glycolysis or alcohol synthesis. Zinc is the important mineral to note because it can be deficient even in all-malt wort due to the loss of zinc during lautering. It's needed in the last step of fermentation. Zinc deficiencies can cause fermentation and flocculation problems. Adequate zinc in wort (0.15–0.3 mg zinc/L) positively influences the uptake of maltose and maltotriose, contributes to protein synthesis and yeast growth, protects enzymes, and stabilizes the protein and membrane systems, which in turn can provide faster fermentations and better flocculation.[7] The common ways to add zinc to wort is by adding zinc sulfate, nutrient blends that contain zinc, or by adding zinc-enriched yeast.

Now that we have an understanding of these important nutrients, let's go over some data that shows the benefits. A study focusing on yeast nutrients was completed by Sylvie Van Zandycke and Tobias Fischborn from Lallemand. They published a paper called *The Impact of Yeast Nutrients on Fermentation Performance and Beer Quality*.[3] In it they took a look at 4–5 different nutrients and examined the effects of these nutrients over eight generations from 100% malt wort and high-gravity wort (60% malt/40% adjunct).

On the following page are Figure 1 and Figure 2 showing the fermentation kinetics in 100% malt wort among four yeast nutrients ($ZnSO_4$ [mineral zinc], zinc-enriched yeast, nutrient blend 1, and nutrient blend 2) on the first and eighth generation. Nutrient blend 1 and nutrient blend 2 are different brands that contain nitrogen and zinc blends with added vitamins as well. As stated before, ideally, all-malt wort does not necessarily need added nutrients. From Figure 1, you'll notice that the control performed similarly to the nutrient-added fermentations. The differences are more noticeable as the generations go on (Fig. 2) — the two nutrient blends and the zinc-enriched yeast create faster and more consistent fermentation than the control alone.

Next they looked at fermentation kinetics in high-gravity wort containing 60% malt and 40% adjunct. The following figures show the first generation (Fig. 3) versus eighth generation (Fig. 4) yeast, using five different yeast food formulations (mineral zinc, zinc-enriched yeast, nutrient blend 1, nutrient blend 2, and nitrogen blend). This time there is a difference in the control vs. nutrients in the first generation of high-gravity brewing (Fig. 3). By the eighth generation, it is quite clear the benefits of the addition of nutrients (Fig. 4). This may be more important at the commercial level (in order to free up fermentation space) then at the homebrew level, but yeast perfor-

Figure 1

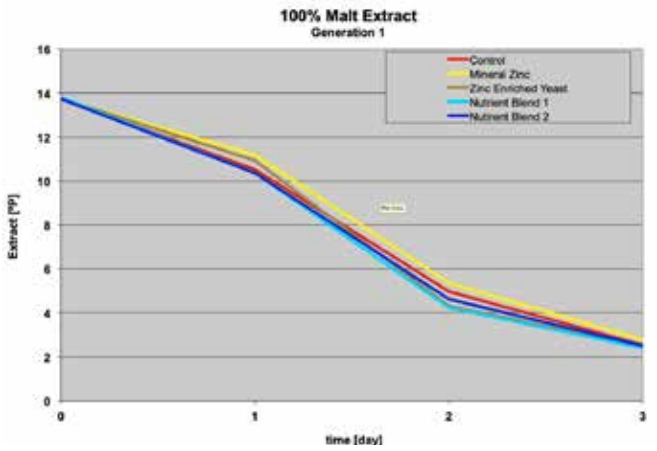


Figure 2

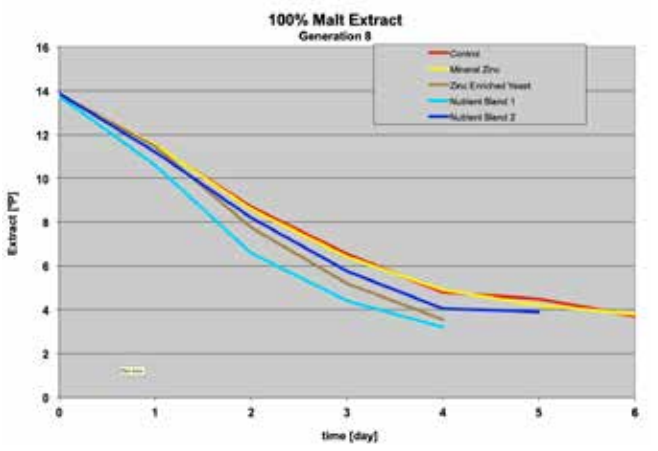


Figure 3

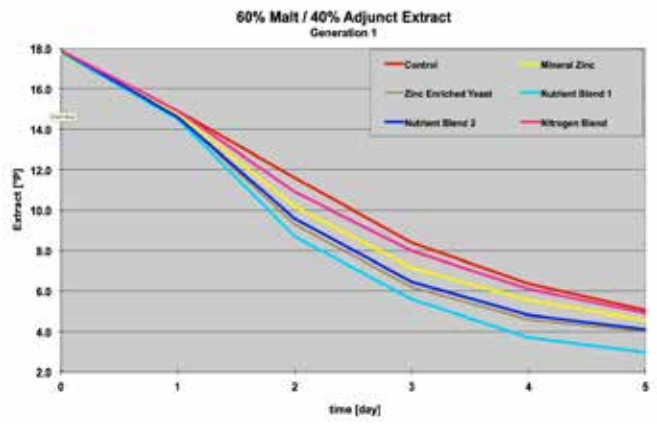
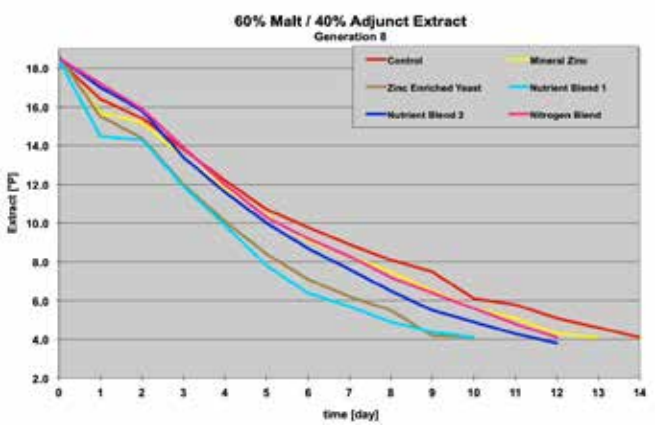


Figure 4



Note the time scale differences between the graphs (x-axis). The stress on the yeast cells are clearly visible in later generations without nutrient supplements.

mance is an indication of yeast health.

Please note that these tests were run in a lab setting and may not represent true brewing conditions, as stress was induced to demonstrate effect of the nutrients to show the efficiency. Also of note, the time scales of the graphs have been adjusted to make it easier to see the differences between the nutrient additions and the control.

It can be overwhelming and confusing when trying to figure out what nutrients are needed for a particular fermentation. Nutrient requirements can vary depending on one's needs. If you don't know where to start, ask yourself: What yeast strain are you using? Are you planning to ferment a high-gravity wort? Are you looking for more consistent fermentations batch-to-batch when re-pitching? It's best to have an understanding of your overall goals before you start looking at all the nutrient options. If there are any questions or concerns, it's recommended to reach out to your yeast or nutrient supplier.

In summary, it is possible to have successful fermentations with or without added nutrients. However, for best results in high-gravity brewing or the need of consistent fermentations, nutrients are an obvious choice. Yeast are living cells and we control the environment we provide them. Give them their ideal environment, and they'll do their job well for you. BYO

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BY AUDRA GAIZIUNAS

CASH IS KING

Mastering your cash flow statements

When nanobrewers create business plans and subsequently open, their tendency is to focus almost exclusively on their income statement. What are our revenue streams? What are our recipe costs? What will it take to keep the lights on in our little establishment? While these are certainly important questions, many business owners seem to miss asking the questions pertaining to the other two financial statements: The balance sheet and the cash flow. What is our monthly debt payment? Should we order a specific quantity of grain based on a price break? If our local accounts can order on credit, what are our payment terms? When should we order our next set of fermenters? These questions are just as critical (if not more) for our brewery's survival.

One of the most common misconceptions I witness when working with breweries is the confusion that exists between the income statement and cash flow statement. Often these two statements are viewed as one and the same, when they are not. Profitable breweries can fail to adequately manage their cash flow and close. Likewise, breweries showing losses but mindful of cash flow management can pivot and succeed. I can walk through the list of brewery closures from 2019 and 2020 (prior to COVID-19) and state with a high degree of certainty poor cash flow management as the top culprit responsible for the demise of those entities.

One of the most common misconceptions I witness when working with breweries is the confusion that exists between the income statement and cash flow statement.

Illustration courtesy of Shutterstock.com

I was working with a California client who wanted to buy out a nano that had been open for about three years. He asked that I run a valuation on their financial position to ensure the asking price was reasonable. The seller insisted his operation was worth more, as he had shown a profit every year and had adequate cash in the bank. He truly believed his operation was successful. Yet upon closer inspection, I discovered he kept taking out additional debt to pay his bills, so the cash in his bank account was there not from his own internally generated earnings, but rather by loans. He was showing a profit because he neglected to include such key figures as interest expense and credit card processing fees from his point-of-sale. When I analyzed the number of barrels he was brewing and subsequently selling over the past three years, then projected forward for the next five years, the worth of this business was dramatically different than what he had calculated it to be. It was worth significantly less. "But I'm showing a profit; it's worth at least three times that!" he insisted. His entire focus was on the income statement. I showed him the cash flow statement and explained how the high debt payments eroded his cash position to the point he couldn't pay his day-to-day operational costs; therefore, had to take on more debt. His nano was catapulting down a loan-fueled spiral it wouldn't be able to climb out. I walked him through his balance sheet. At this point he had a higher degree of debt than his assets were worth; his equity position was negative. There wasn't enough growth in his sales for the asking price he wanted. The buyer and seller ended up working out an agreement, and once the buyer took ownership of the equipment we created a budget for his operation. I taught him the fundamentals of each of the three major financial statements, and the budget was built tying all three together. We could discuss the point in time he'd be able to afford additional fermenters based on his own internally generated earnings and at what

point it made financial sense to add his first and second employees. Two years later, he's still clicking down that path with the cash flow statement driving his major business decisions.

The cash flow statement serves as a bridge between the balance sheet and the income statement — it ties them together. The first section of the cash flow statement is cash flow from operations, which includes transactions from all operational business activities. The cash flows from operations section begins with net income, then reconciles all noncash items (such as depreciation, amortization, and interest expense) to cash items involving operational activities. So, in other words, it is the brewery's net income, but in a cash version. This section reports cash flows and outflows that stem directly from a brewery's main business activities, which include buying and selling inventory and experiences, as well as paying employees (if there are any other than the owner) their salaries.

This investing section for a brewery typically includes cash spent on property and equipment required. It also includes the sale of any property or equipment.

The financing section measures cash flow between the brewery and its owners and its creditors and includes such items as debt payments on long-term notes, dividend payments, owner draws, and SBA loan proceeds.

The cash flow statement is believed to be the most intuitive of all the financial statements because it follows the cash made by the nano in three main ways — through operations, investment, and financing. The sum of these three segments is called net cash flow.

Most breweries use accrual accounting, which means the company's income statement is not the same as the company's cash position. Let's say a brewery delivers beer to a local restaurant on payment terms of net 15 (payment is due in 15 days time). In other words, the brewery is extending credit to the restaurant for 15 days. Even though the brewery recognizes that sale as revenue at the time the beer is delivered, the brewery may not receive cash until up to 15 days later. The brewery earns a profit on the income statement and incurs excise taxes the month the beer was removed for sale, but the brewery may bring in more or less cash than the sales or income figures, and it may not line up with the same month the sale was recognized. Revenue and expenses may be incurred in one month, but the payment for or receipt of cash may be another month, so the key to wading through and mastering the cash inflows and outflows to offer clarity to your brewery's operations is understanding and controlling the timing of those inflows and outflows.

Here are some other best practices for cash flow management over the short term?

• ***Understand your fixed overhead***. What are your expected monthly cash outflows despite any level of production, whether 0 BBLs or 200 BBLs? Which bills will you have to pay? Items such as a lease, insurance, music licensing fees (if you have music in the taproom), Quickbooks Online subscription, and debt payments are a few examples. Know your fixed overhead because it tells you how much cash (and more specifically, profit) you have to generate to pay for those costs to stay open.

• ***Focus on generating working capital***. Working capital is the cash you need to meet the obligations of your day-to-day operations. On your balance sheet, it is calculated as current assets minus current liabilities. The excess you have left is working capital. The cash you generate from your own operations comes with no stipulations nor interest expense; thus working capital is the cheapest way to grow your nano. Building your cash reserves will also help keep you nimble.

• ***Manage your inventory, accounts receivable, and accounts payable***. One of the most effective ways to master the timing of inflows and outflows are through these operational channels. Analyze these amounts on your balance sheet at least quarterly. Collect funds owed you as quickly as possible. Delay paying invoices until they are due. Review inventory balances, looking for slow-moving products, outdated hops or grain, or amounts that creep up over time. Oftentimes we find Easter eggs of cash bumps here.

Let's take a look at faux brewing company that I've name ABC Brewing that is bleeding money (Chart 1).

ABC Brewing
Cash Flow Statement
For the 6 months ended November 30, 2020

	Month 1	Month 2	Month 3	Month 4	Month 5	Month 6
Cash Flow From Operations						
Net Income	(17,440)	(16,812)	(16,302)	(16,772)	(16,752)	(14,771)
Depreciation & Amortization	3,477	3,477	3,477	3,477	3,477	3,477
Interest Expense	1,170	1,150	1,130	1,109	1,089	1,069
(Increases)/Decreases in Accounts Receivable	0	0	0	0	0	0
(Additions)/Depletions of Inventory	0	0	0	0	0	0
Increases/(Decreases) in Accounts Payable	0	0	0	0	0	0
Net Cash From Operating Activities	(12,793)	(12,185)	(11,695)	(12,185)	(12,185)	(10,225)
Cash Flow from Investing Activities						
Purchase of Property & Equipment	0	0	0	0	0	0
Sale of Property & Equipment	0	0	0	0	0	0
Deposits on Kegs	0	0	0	0	0	0
Net Cash From Investing Activities	0	0	0	0	0	0
Cash Flow from Financing Activities						
Line of Credit Borrowing	0	0	0	0	0	0
Dividends	0	0	0	0	0	0
New Current Borrowing - Additional Loan or Equity	0	0	0	0	0	0
Long Term Liability Repay (Principal Only)	(4,830)	(4,850)	(4,870)	(4,891)	(4,911)	(4,931)
Net Cash From Financing Activities	(4,830)	(4,850)	(4,870)	(4,891)	(4,911)	(4,931)
NET CASH FLOW	(17,623)	(17,035)	(16,565)	(17,076)	(17,096)	(15,157)
Beginning Cash	37,645	20,022	2,987	(13,578)	(30,654)	(47,750)
Ending Cash	20,022	2,987	(13,578)	(30,654)	(47,750)	(62,907)
Months of Cash	0	0	0	-1	-1	-1

Chart 1: A doomed brewery.

Before investigating their accounts receivable, accounts payable, and inventory balances, ABC Brewing appears it will run out of cash three months from now.

By taking the effort to call their customers to collect amounts due to the nano and changing payment terms from 15 days to cash-on-delivery, ABC Brewing brings some additional cash in the door. They also delay paying some of their invoices and set notifications to pay others the day they are due. This buys ABC Brewing some additional time to work through their loss slump (see Chart 2). Now they aren't forecasted to run out of cash until month 6.

And finally, ABC Brewing sells some of their older malt to local homebrewers and brews a few collabs using ingredients that are slow moving or no longer part of their

normal recipes. They also offer a bundled sale for some of their bottled barleywines to get them out the door. Now look at their cash flow. They've bought themselves an additional 3 months to get profitable and figure out a plan of action. By understanding their cash flow statement and the levers they have to push, ABC Brewing is on its way to a sustainable position (see Chart 3).

The operations section of the cash flow should be our primary area of focus for short term planning and decision making. The investing and financing sections are where we look over the longer term.

In part 2 of this series we will explore best practices to take over the long term and witness where it leads ABC Brewing. We will also explore cash flow financial ratios, creating a financial contingency plan, and delve into diversification of resources to ensure survival. Until then, cheers! BYO

ABC Brewing
Cash Flow Statement
For the 6 months ended November 30, 2020

	Month 1	Month 2	Month 3	Month 4	Month 5	Month 6
Cash Flow From Operations						
Net Income	(17,443)	(14,812)	(16,302)	(16,772)	(16,752)	(14,771)
Depreciation & Amortization	3,477	3,477	3,477	3,477	3,477	3,477
Interest Expense	1,170	1,150	1,130	1,109	1,089	1,069
(Increases)/Decreases in Accounts Receivable	0	24,100	500	2,200	0	0
(Additions)/Depletions of Inventory	5,200	4,400	1,600	0	0	600
Increases/(Decreases) in Accounts Payable	11,650	22,300	0	0	0	0
Net Cash From Operating Activities	**4,057**	**38,615**	(9,595)	(9,985)	(12,185)	(9,625)
Cash Flow from Investing Activities						
Purchase of Property & Equipment	0	0	0	0	0	0
Sale of Property & Equipment	0	0	0	0	0	0
Deposits on Kegs	0	0	0	0	0	0
Net Cash From Investing Activities	**0**	**0**	**0**	**0**	**0**	**0**
Cash Flow from Financing Activities						
Line of Credit Borrowing	0	0	0	0	0	0
Dividends	0	0	0	0	0	0
New Current Borrowing - Additional Loan or Equity	0	0	0	0	0	0
Long Term Liability Repay (Principal Only)	(4,850)	(4,850)	(4,870)	(4,891)	(4,911)	(4,931)
Net Cash From Financing Activities	(4,850)	(4,850)	(4,870)	(4,891)	(4,911)	(4,931)
NET CASH FLOW	(793)	33,765	(14,465)	(14,876)	(17,096)	(14,557)
Beginning Cash	37,645	36,872	70,637	56,172	41,296	24,200
Ending Cash	36,872	70,637	56,172	41,296	24,200	9,643
Months of Cash	**1**	**2**	**1**	**1**	**1**	**0**

Chart 2: Still cash poor, but an improved financial situation for ABC Brewing.

ABC Brewing
Cash Flow Statement
For the 6 months ended November 30, 2020

	Month 1	Month 2	Month 3	Month 4	Month 5	Month 6
Cash Flow From Operations						
Net Income	(17,443)	(14,812)	(16,302)	(16,772)	(16,752)	(14,771)
Depreciation & Amortization	3,477	3,477	3,477	3,477	3,477	3,477
Interest Expense	1,170	1,150	1,130	1,109	1,089	1,069
(Increases)/Decreases in Accounts Receivable	0	24,100	500	2,200	0	0
(Additions)/Depletions of Inventory	5,200	4,400	1,600	0	0	600
Increases/(Decreases) in Accounts Payable	11,650	22,300	0	0	0	0
Net Cash From Operating Activities	**4,057**	**38,615**	(9,595)	(9,985)	(12,185)	(9,625)
Cash Flow from Investing Activities						
Purchase of Property & Equipment	0	0	0	0	0	0
Sale of Property & Equipment	0	0	0	0	0	0
Deposits on Kegs	0	0	0	0	0	0
Net Cash From Investing Activities	**0**	**0**	**0**	**0**	**0**	**0**
Cash Flow from Financing Activities						
Line of Credit Borrowing	0	0	0	0	0	0
Dividends	0	0	0	0	0	0
New Current Borrowing - Additional Loan or Equity	0	0	0	0	0	0
Long Term Liability Repay (Principal Only)	(4,850)	(4,850)	(4,870)	(4,891)	(4,911)	(4,931)
Net Cash From Financing Activities	(4,850)	(4,850)	(4,870)	(4,891)	(4,911)	(4,931)
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Beginning Cash	37,645	36,872	70,637	56,172	41,296	24,200
Ending Cash	36,872	70,637	56,172	41,296	24,200	9,643
Months of Cash	**1**	**2**	**1**	**1**	**1**	**0**

Chart 3: Now ABC Brewing has balanced their cash flow statement.

BY ANDREW MARTIN

HEAT SHIELD

Retain that wasted energy

As an engineer by trade, I find that I have a natural tendency to improve upon things to make them more efficient, cheaper, and faster. If you've seen Dilbert's "the Knack" clip, you get the idea. Brewing, with its numerous processes and large number of variables, will likely provide me with years and years of tinkering.

I'm currently in a phase of my brewing hobby where I want to upgrade to a single, standalone unit for my all-grain brewing. In my online research of single-tier brewing systems, I started reading about burner height in reference to the bottom of the kettle. Recent studies have suggested that controlling the burner exhaust to vent out the back of the setup results in preventing your valves and sight glass from overheating and promotes better combustion. Brewershardware.com even sells single-tier stands and heat shields based around this principle determined from their own experimentations.

Before spending too much money on building an entire single-tier setup, I decided to make my own single-burner stand that allowed directed venting of the exhaust gases from the burner. Needless to say, it worked! My sight glass and valve stayed cooler and all the exhaust gases vented out the back. However, after feeling the large amount of heat I was venting, it bothered me. I paid for that heat, and it's just blowing away, not providing me any value. As any good engineer, I thought to myself, "I can fix this!", which resulted in the heat shield described here.

Tools and Materials

- 18-gauge sheet metal (Thinner is fine)
- Homemade sheet metal brake
- Tin snips or angle grinder with cutting wheel
- ¾-in. sheet metal screws
- Drill

Typical homebrewing setups involve putting all the heat in the bottom of the kettle only. The rest of the kettle dissipates heat. As an example, I brew in keggles that are 15.5 in. diameter x ~23.5 in. tall (40 cm x 60 cm). For easy figuring, let's just assume those dimensions are in contact with the wort. Normal homebrewing, with heat only applied to the bottom, results in ~189 in.^{2} (0.12 m^2) of the keggle absorbing heat. The total surface area of the keggle (not including the top) is ~1,333 in.^{2} (0.86 m^2) meaning, as homebrewers, we're heating 189/1333 or ~14% of the kettle. The rest of the kettle is dissipating heat, which is working against us when trying to put heat into the kettle for boiling. Pro brewers typically use jacketed kettles so they're heating on all sides, or at least more than just the bottom. This improves overall efficiency. Adding a heat shield to a homebrew setup that captures the hot exhaust gases and channels them up along the side of the kettle results in those exhaust gases continuing to heat the kettle. Or at a minimum, reduce my heat loss from the sides of the kettle.

I typically brew batches of 10+ gallons (76+ L) utilizing 90-minute or more boils. Between heating my sparge water and boiling, I usually use close to an entire 20-lb. propane tank. The addition of the heat shield appears to have reduced that to approximately around ⅓ of a tank!

I designed the heat shield shown to maintain a gap of about ¾ in. (1.9 cm) all around the kettle sides, go 3 in. (7.6 cm) below the kettle bottom to ensure collection of exhaust gases, and only cover an arc around the kettle that doesn't include my valve and sight glass (to keep those components cool). So let's get into it.

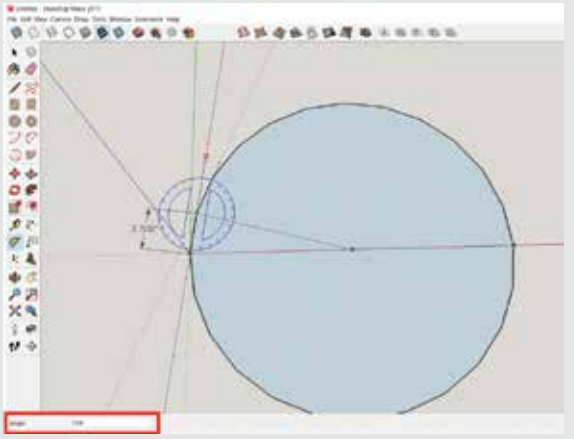
Typical homebrewing setups involve putting all the heat in the bottom of the kettle only. The rest of the kettle dissipates heat.

Photos by Andrew Martin

STEP BY STEP

1. GEOMETRY TIME

Probably nobody's favorite step but definitely the most important. There are lots of different kettles out there so you'll need to calculate how much sheet metal you need, how often to bend, and how far to bend depending on your kettle. I arbitrarily picked a 24-sided polygon for mine. To maintain ¾ in. (1.9 cm) all around that makes my diameter of the heat shield 17 in. (43.2 cm). I used the free version of Sketchup but you can also Google "Polygon calculator" and find a quick calculator to give you the dimensions you need. Due to the placement of my sight glass and valve. I decided on a ~285° arc. Assuming a 24-sided polygon, each leg is about 2 3/16 in. (5.55 cm) bent at a 15° angle. Now, I know how often to bend and where to bend.



2. DETERMINE MATERIAL SIZING

I decided to have my heat shield go to the top of my keggle and I added 3 in. (7.6 cm), which will go below the kettle for capturing the hot exhaust. For my keggle, that's a total of 26.5 in. (67.3 cm) in height. To determine the length of my sheet metal, the perimeter of the 17 in. (43.2 cm) heat shield is π x D multiplied by the fraction of the total arc. In my case, π x 17 in. x 285° / 360° = ~42.25 in. (π x 43.2 cm x 285°/360° = 107.4 cm). But you also need to add material that will get bent into your kettle at the ends. I decided on ¾ in. (1.9 cm) clearance all around in step 1, but if I added 1.5 in. (3.8 cm) to account for my two endcaps, I wouldn't get there because you can't bend sheet metal perfectly with a homemade metal brake (refer to step 3) and I wanted to be sure the edges came in close contact with the kettle to keep the heat in and away from my sight glass, which would be directly on the other side. I added 2.5 in. (6.4 cm) to account for this. This results in my sheet metal size of 44.75 in. x 26.5 in. (113.7 cm x 67.3 cm).

I used 18-gauge 304 stainless purchased at a metal yard. You can go thinner as well. Most big box stores don't carry large enough sized sheets for most homebrew kettles. If a big box store is your only option, you can pop-rivet or screw together multiple sheets. You don't have to use stainless but please do not use galvanized as the heat could burn off the galvanized coating, which results in toxic fumes.

3. BENDING YOUR METAL

Cut your sheet metal to size using tin snips or an angle grinder with cut-off wheel. From your measurements determined in step 1, lay them out on your sheet metal and start bending. Many likely do not have a metal brake at home or have access to one. If not, Google "2x4 sheet metal brake" and you'll find a whole bunch of videos and pictures showing how to make one from some lumber and a pair of door hinges. I bent the 90° ends first. Then I eyeballed the 15° and after I completed all the bends, went back and increased any bend in the brake or gently pushed on it to decrease the bend so the final heat shield appeared round.

4. ADD SHEET METAL SCREWS FOR SPACERS

Place your kettle onto your brew stand or burner and place the heat shield on it. You want to maintain the gap all around so for large discrepancies, bend it accordingly either by hand or with the brake. Once it's close, add the sheet metal screws as you see fit. I placed mine about every 60 degrees-ish, 6 in. (15.2 cm) from the top and 6 in. (15.2 cm) from the bottom. The screws do not go into the kettle! They're simply spacers to push against the kettle to maintain the gap.

5. NOTCH THE HEAT SHIELD

Option 1: For my setup, to get the heat shield below the bottom of the kettle, I had to notch the heat shield in areas where it contacted my stand. Setting the heat shield in place, I marked the contact points with a sharpie and notched, in those locations, up 3 in. (7.6 cm). As you can see, after notching, my heat shield is now about flush with the top of my kettle and goes below the bottom of my kettle to capture the hot exhaust gases.

Option 2: If your setup doesn't allow for this, instead, you could suspend the heat shield from the top of the kettle using longer screws than used in step 4. For instance, If my stand wasn't big enough to support the heat shield, I likely would have ran 2-in. (5.1 cm) screws around the perimeter of the heat shield 1 in. (2.5 cm) from the top. Then the heat shield would be suspended from those screws sitting on top of my kettle.

6. USAGE

The first time to put this heat shield into service, you need to carefully watch your boil to avoid boil overs. I reached boil in a fraction of the time. Once I reached boil, I had to turn the burner way down to prevent more boil overs. Once the heat shield heated up and started not only channeling heat but also radiating heat back to the kettle, I had to turn the burner down farther. I found a good way to minimize boil overs with this setup is through the use of a 6-in. (15 cm) duct fan sitting on my hop spider blowing into the kettle. Once you've adapted to your new setup, sit back and enjoy the fact you're saving money . . . which you should spend on more brewing! Cheers!

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WHO INSPIRED THE WIZARD TO BREW?

Mr. Wizard's journey into brewing

My answer to this question, like the terrible thank you speeches following a Hollywood award, includes multiple influencers. I started homebrewing in high school and caught the brewing bug early. When it came time to choosing a college major I asked my father, a USDA (United States Department of Agriculture) scientist at the time, for his advice on an appropriate educational path for a would-be brewer. Dad suggested majoring in food science and that turned out to be great advice.

During my time at Virginia Tech I continued homebrewing, worked in a wine, beer, and fish market where I became pretty good at filleting fish, and really liked food microbiology. But as I started my junior year at Virginia Tech I realized that a BS in food science was not enough to take me where I wanted to go, and I decided I wanted to go to graduate school somewhere.

Enter my mother. Mom put a *New Brewer* magazine in my 1989 Christmas stocking that featured brewing education. I think Michael Lewis' warm smile and professorial cover photo triggered some innate response that was waiting to be triggered, because that's when I decided that I needed to go to this place called Davis. I had never been to California and did not know where Davis was located, but I knew I needed to be there. Putting all of my eggs in one basket, I applied to the UC-Davis graduate program in food science, and specifically declared my interest to study in Dr. Michael Lewis' lab. Good thing that all worked out because I had no Plan B.

Shortly before leaving Virginia for California I went to a beer tasting at the Brickskeller in Washington, D.C. featuring well-known beer journalist Michael Jackson from England. I had Jackson's most recent hard-back book and asked for his autograph at the close of the tasting. His inscription reads "To Ashton, brew great beer. Cheers, Michael Jackson 1991." (See photo at the bottom left.) Over the years, I have read that simple phrase and have tried my best to live up to Michael Jackson's command.

While at UC-Davis I really fell in love with everything about beer, brewing, and brewing education. Although terribly uncomfortable with public speaking, I paid my way through school by accepting teaching opportunities offered to me by my mentor. Brewing students seemed to connect with me . . . hell, I was younger than most of them and they probably figured they could get me to pick up bar tabs . . . and I developed a lifelong commitment to sharing brewing knowledge, something that previously seemed so unattainable, with others with the same thirst.

I also landed a job at a local brewery, Sudwerk Privatbrauerei Hübsch, where I learned that brewing was 90% plumbing and cleaning, and that Karl Eden, Sudwerk's affable and quirky German brewmaster, had a wonderful sense of the absurd and had no inhibitions on clothing. While cleaning and brewing at Sudwerk, I also learned about how an unlocked fermentation cellar could be irresistible to one drunk college kid who thought it would be cute to jump in an open fermenter, but that's another story.

So, there you have it; the folks who helped pave my way towards a delightful and rewarding future in brewing were my wonderful parents, a terrific mentor and professor, a famous journalist and beer advocate, and a whole cast of characters who were part of that magical place called UC-Davis. We all have dreams about our futures, and the moral of this little story is to chase those dreams! BYO

Putting all of my eggs in one basket, I applied to the UC-Davis graduate program in food science, and specifically declared my interest to study in Dr. Michael Lewis' lab.

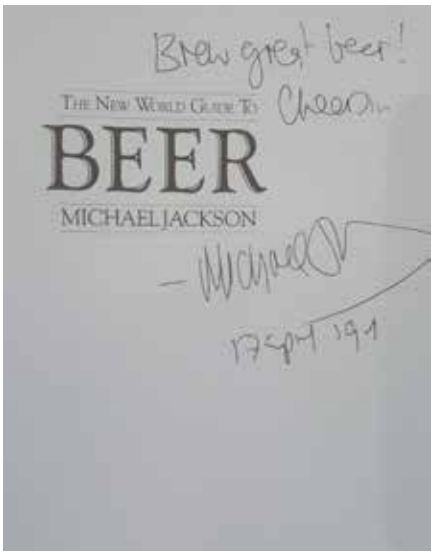

Photo by Ashton Lewis

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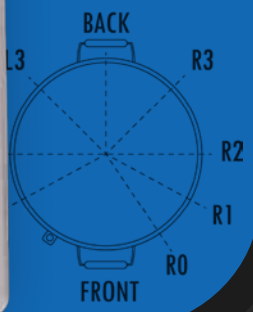

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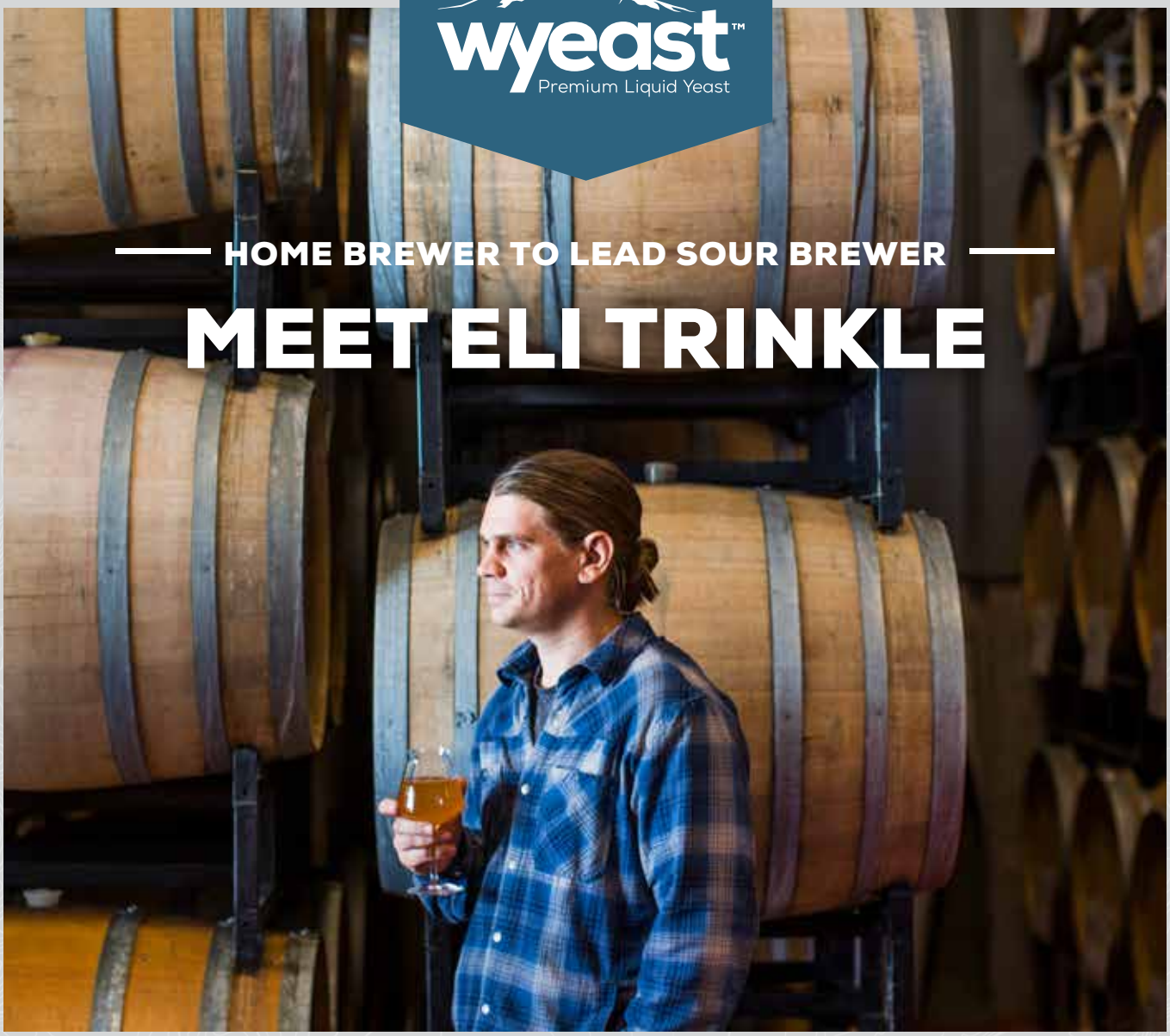

HOME BREWER TO LEAD SOUR BREWER

MEET ELI TRINKLE

Eli Trinkle of Upland Brewing Co. was immediately drawn to home brewing after being introduced to it by his neighbor. After just one month of owning his own home brew setup, Eli was brewing all-grain with Wyeast smack-packs and kegging his own beer. He admits he was so intrigued by the process, it consumed his life. He spent countless hours researching and experimenting–he even worked as an assistant brewer while finishing his degree in engineering technology. Post-graduation, Eli decided that instead of pursuing more education, he'd turn his passion for brewing into a career.

Today, Eli has crafted a diverse portfolio of award-winning sours for Upland. He attributes his present-day brewing devotion to his colleagues at Upland, to the people of Bloomington, IN and the pride associated with pioneering a quality fermentation product. At Wyeast we share these same values, which is why we're pleased to toast the work of Eli and the rest of the Upland Brewing team.

See **wyeastlab.com** for homebrewing recipes from Eli and other commercial craft brewers.

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