TAKING NOTES FOR BETTER BEER

DOPPELBOCK LIKE LIQUID BREAD

BREWING WATER SIMPLIFIED

Brew Your Own

THE HOW-TO HOMEBREW BEER MAGAZINE

NOVEMBER-DECEMBER 2026, VOL. 32, NO. 6

WWW.BYO.COM

THE HOMEBREWER BEHIND TRILLIUM

TIPS, TECHNIQUES & 5 CLONE RECIPES

FROM ONE OF NEW ENGLAND'S CRAFTBREW DARLINGS



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- Visit 12 Danish breweries (and 2 Swedish breweries!) - including the big to the small and the old to the new
- Attend the Copenhagen Beer Festival filled with Denmark's best craft beers
- Meet with local pro brewers to get your brewing questions answered as you sample their beers
- Go on a day trip to Sweden to check out their craft beer scene
- Climb aboard a recreated traditional Viking boat and sail a beautiful fjord
- Enjoy beer-paired Danish meals at local breweries
- Pedal your bicycle through scenic Danish towns, cities, and countryside to the next brewery stop
- Travel with other homebrewers who share your passion for beer and brewing!

FOR MORE DETAILS VISIT: BYO.COM/TRIP

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by John Palmer

CELLAR SCIENCE

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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 U.S. 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 U.S. gallons whenever gallons are mentioned.


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THE HOW-TO HOMEBREW BEER MAGAZINE

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Cover Photo:
Trillium Brewing Co.

Q What beer (or beer style) do you always have on hand for the holidays?

I always keep a crisp, hop-forward Pilsner on hand for light, easy drinking that pairs with any meal and isn't an intimidating drink to carry through the whole day. To appease guests who want something a little different, I will also have a bolder option like a Bourbon barrel-aged stout.

When it comes to my beer purchasing habits, there are few things that are consistent. I am one of those beer lovers who buys whatever suits my fancy when I'm at the store. The holiday season is an exception, and the beer most likely to be found in my fridge is Sierra Nevada Celebration Ale. It is a true American classic and a beer that holds a special place for me as a brewing professional.

Winter, and around the holidays in particular, is the perfect season for imperial stout. Ordinary imperial stouts, oak-aged imperial stouts, adjunct-laden imperial stouts … they are all welcome at my house for the holidays!

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suggested pairings at BYO.COM

Designing Homebrew Labels



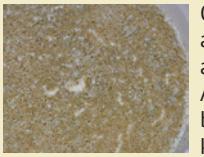
Label design plays a huge role in the appeal of commercial beers, and it can make your homebrews just as enticing. A graphic designer shares tips for designing your own labels at home — and having fun while doing it. www.byo.com/articles/designing-homebrew-labels

Spunding 101



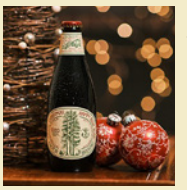
You can carbonate your kegged beer naturally using spunding. Watch this video to learn how using the calculations, equipment, and best practices for this technique with *Brew Your Own* Technical Editor Ashton Lewis. www.byo.com/videos/spunding-101

Kräusening Techniques



Question: What's a good thing to add to lager beer? Answer: More beer! Read this kolumn to krack the kode on kräusening. www.byo.com/articles/krausening-techniques

Christmas Traditions: Unwrapping the secrets to Anchor's Our Special Ale



It has been three years since the closure of Anchor Brewing Company, and three years since one tradition many beer aficionados looked forward to each holiday season came to an end — drinking Anchor's beloved Our Special Ale. The beer had been released with a new recipe in time for the holidays for nearly 50 years in a row. Get advice from a former Anchor brewmaster to brew a beer similar in style that may just become your new tradition to share with family and friends. www.byo.com/articles/christmas-traditions-unwrapping-the-secrets-to-anchors-our-special-ale

MAIL



DIGGING DEEPER INTO THE FLAVOR NETWORK

(Email and answer edited for brevity)

I am writing about "The Flavor Network Behind Your Best Brews" by Antal Németh in the September-October 2026 issue. The article got me building a small recipe development tool on the same idea, so I tried to reproduce its worked examples from the Ahn et al. 2011 dataset. As a check on my own arithmetic, I recomputed all 1,834 edge weights published in Figure 2 of the underlying paper. All 1,834 match exactly.

On that basis, wheat + strawberry = 44 reproduces exactly — but only if "wheat" means the dataset's "wheat bread" entry, which is worth knowing, since baked wheat carries compounds raw wheat does not. Five other examples come out consistently higher for me: coffee + orange; coconut + beer; chocolate + roasted malt; coffee + vanilla; and vanilla + orange. Two questions, if there is a quick answer:

1. Citra® + mango = 18 and Hallertau + mango = 3. Neither database contains hop cultivars, only a generic "hop" entry. Where does cultivar-level data like that come from? This is the one I care about most; a brewing tool needs exactly that granularity.

2. Which dataset produced the five examples above?

József Dudás • *emailed from Hungary*

Author Antal Németh responds: "Thank you for the detailed analysis. Reproducing all 1,834 edge weights exactly is correct and confirms your methodology. Answers to your two questions follow.

"1. Two things worth knowing: First, the network/bridge claim in the article (beer's structural position, the edge-weight numbers you reproduced) comes from the Ahn et al. dataset, the same one you've been validating. Cultivar-level hop data doesn't exist in that dataset, or in FlavorDB2, as you found. It comes from a separate layer we maintain: Published hop aroma/oil descriptor data cross-referenced against a compound-level flavor database, folded into an aroma-family model. Different source, different metric — not a shared compound count, but an aroma-family overlap strength on a 0-1 scale.

"Second, here's what that layer actually returns right now for hop cultivars against mango:

Continued on page 8

contributors



Dawson Raspuzzi is the Editor of *Brew Your Own* magazine and its sister publication *WineMaker* magazine. Prior to joining both publications in 2013, Dawson was a newspaper reporter covering local and statewide news in Vermont. He has been homebrewing for nearly two decades and greatly prefers writing about the topics of beer and wine over spending his evenings at school board and town meetings. When he's not brewing or staring at a computer screen he's usually at a field coaching his kids' youth sports.

In the name of research, Dawson recently visited Canton, Massachusetts, to get a behind-the-scenes look at the brewing operations at Trillium and get advice on brewing their world-class beers, which he shares in this issue's cover story beginning on page 34.



John Palmer is the author of the bestseller *How to Brew: Everything You Need to Know to Brew Great Beer Every Time*, co-author of both *Brewing Classic Styles*, and *Water: A Comprehensive Guide for Brewers*. He's also written numerous articles for *Brew Your Own* and other homebrewing publications over the years. He earned a degree from Michigan Tech University in metallurgical engineering and worked in the space program at a failure analysis lab in Irvine, California. He has helped design, build, and inspect hardware that is currently flying on the International Space Station.

On page 46, John simplifies how to approach brewing water depending on the style of beer you are brewing.



Julie Rhodes is a business journalist and 20-plus-year veteran of the food and beverage industry. She owns Not Your Hobby Marketing Solutions, a fractional consulting and education company for craft beverage brands, and co-founded Kick Fizz, a low-dose hemp-infused beverage brand. She writes and speaks widely on beverage sales, digital marketing, distributor management, and business strategy, and teaches in several university programs. Named the 2023 Brewers Association Mentor of the Year, she serves on the BA Business Development Committee and is an active member of numerous trade associations and state guilds.

In this issue's "Nanobrewing" column starting on page 55, Julie offers advice for nanos to get the most out of social media.

- *Citra®'s tropical family overlap = 0.667*
- *Mosaic®'s tropical family overlap = 0.889*
- *Hallertau Blanc's tropical family overlap = 0.250*
- *Hallertauer Taurus's tropical family overlap = 0.400*
- *Hallertauer Mittelfrüh has no measurable overlap*
- *Hallertauer Mittelfrüher has no measurable overlap*
- *Hallertauer Tradition has no measurable overlap*
- *Hallertauer Magnum has no measurable overlap*

"So, the direction the article described holds, and looking at the real numbers, it actually understates it — the classic noble Hallertau varieties show no measurable tropical family overlap with mango at all, while Citra® and Mosaic® clearly do. This doesn't map onto the article's 18/3 figures directly (different metric), but it's the real, current answer to the question you said you cared about most: Cultivar resolution comes from cross-referencing aroma-descriptor and compound data, not from either public network dataset.

"2. The other five pairings (coffee/orange, coconut/beer, chocolate/roasted malt, coffee/vanilla, vanilla/orange):

"I checked those against our system too, and the answer is different from the hop case. 'Beer' itself isn't an ingredient node in our system at all — we treat it as the output, not a component of something else, so coconut + beer isn't something we can evaluate in our terms regardless of database. For the others, our engine is scoped specifically to brewing ingredients — hops, malts, yeasts, brewing adjuncts — not general culinary ingredients like plain "coffee" or "orange." We have brewing-relevant relatives (coffee beans, cold brew coffee, orange peel, blood orange, dark chocolate, chocolate malt, etc.) but not the generic nodes you're referencing, so a like-for-like comparison isn't really possible on our end either. That's a scope difference, not a data gap. The cultivar-level enrichment work we do is concentrated exactly where it's useful for brewing.

"What this does and does not affect:

"The article's central claim — beer's structural bridge position in the flavor network — is based directly on Ahn et al.'s published results. That claim is unaffected and requires no correction. Only the specific illustrative examples are affected.

"More broadly: The recipes and the underlying pairing logic in the piece are sound, which is the core focus for practical brewing — every cultivar in our data has real compound and sensory backing, and every pairing question gets an evidence-based answer, whether that's a genuine overlap or a genuine absence of one. We track confidence explicitly. For this article, the goal was to make the science accessible to brewers, rather than publishing a raw data export — hence the rounding.

"The cultivar-level gap you identified is a real, unsolved data problem — exactly what a practical brewing tool needs to address beyond what the public datasets provide. Good luck with your build"

WRITE TO *BYO*

Have a question about something you've seen in *BYO*? Write to us at: edit@byo.com, find us on Facebook: www.facebook.com/BrewYourOwn, Instagram: @brewyourownmag, or reach out to us on X (formerly Twitter): @BrewYourOwn. You can also send requests for a clone recipe: replicator@byo.com or ask your homebrewing questions of Mr. Wizard: wiz@byo.com BYO



NEWS

2025 HOP HARVEST REPORT



Photo courtesy of Shutterstock.com

A recent report on the 2025 hop harvest shows another disappointing year for hop growers, with few signs of better things to come in the immediate future. The global hop market remains under significant pressure despite acreage reductions the past few years. Globally, hop acreage fell by 5.5% to 130,000 acres (52,660 hectares) in crop year 2025. It is the fourth consecutive year hop acreage has declined from a high of about 155,000 acres (62,900 ha) in 2021. There was also a decline in crop volume: A total of 109,188 metric tons of hops was harvested worldwide, 3.8% less than in 2024. These figures are taken from the BarthHaas Report 2025/2026.

Germany remained the largest hop-growing country, with about 47,000 acres (~19,000 ha) harvested in 2025. This represents a year-to-year reduction in acreage of 6.5%. The United States is second with 42,000 acres (~17,000 ha), down nearly 8%.

Despite the smaller planted area, hop production still exceeded demand in 2025. Global beer production fell by 0.7% last year, yet hop demand fell by nearly 3%. In addition to less beer being produced, according to the report, the key factors responsible were reduced hop dosage in the brewing process and changes in beer style structure. As a result, there was a surplus of approximately 1,200 metric tons of alpha acid. This corresponds to a structural overproduction capacity of approximately 12,600 acres (5,100 ha).

Find the full BarthHaas Report here.

UPCOMING EVENTS

NOVEMBER 7, 2026

LEARN TO HOMEBREW DAY



Celebrated on the first Saturday of November each year, Learn to Homebrew Day was established in 1999 by the American Homebrewers Association to promote the most rewarding and delicious activity of all time — homebrewing. Beer lovers worldwide are invited to brew, share their knowledge, and celebrate the hobby of homebrewing annually. Not sure what to brew to celebrate the holiday? Check out byo.com/beer-styles-and-recipes for inspiration.

WHAT'S NEW

NEW DRY IPA YEAST



Suava Ale (WLP079) is the newest addition to the White Labs dry yeast portfolio. Selected by Escarpment Labs and produced by Lallemand Brewing, this strain gives brewers a practical tool for modern IPA, hazy IPA, double IPA, pale ale, and other aroma-driven beer styles. Suava Ale helps develop balanced thiol expression and supports hop character through biotransformation, with aromas of white grape, blackcurrant, and tropical fruit. It is a non-GMO and STA1-negative strain with an adaptable sensory profile depending on fermentation temperature and hop selection. Suava Ale is the first White Labs yeast sold only in dry format. It is available in 500-g bricks and 11-g sachets. Learn more here.

pH2Go



pH2Go by Anton Paar delivers lab-grade pH precision in a compact, portable handheld device. It features a glass-free, ISFET sensor — meaning no fragile glass, no special storage, and no tedious cleaning. The pH2Go requires just a 0.5 mL sample to provide ±0.02 pH accuracy across the full 0.00 pH to 14.00 pH range. The results are available in as little as two seconds. Pair it with the free app for fast, guided calibration. It retails for $479. Learn more here.

LUNA® HOPS



The latest hop released by Hop Products Australia (HPA), Luna® is distinguished by its lush mango, dark berry, and spicy citrus characteristics, alongside a high polyphenol content that elevates the flavor profile and mouthfeel to round out the palate. From Pilsners to IPAs, Luna® offers brewers creative flexibility backed by agronomic reliability. Luna® was created by HPA's hop breeding program in 2003 through a cross-pollination of high-alpha Australian and Liberty hops. Luna® was initially identified for its early harvest window but has always performed exceptionally well in brewing trials. Luna® is currently available in limited commercial quantities. Learn more here.

BEER MUSINGS FROM JAPAN

BY ASHTON LEWIS

On a recent business trip to Japan, I had the opportunity to dig into two topics that have become increasingly popular among U.S. craft brewers: Adjuncts and sake.

BREWING WITH RICE

As someone who has worked in multiple areas of the U.S. brewing industry for the last 35 years, including brewing, education, consulting, equipment design and fabrication, raw material supply, and journalism, I have long been puzzled by the animosity many craft brewers have toward adjuncts. I clearly remember sitting in a Brewers Association (BA) member meeting at the 2006 Craft Brewers Conference in Seattle, Washington, when the newly minted definition of a craft brewery was discussed.

Instead of simply declaring that all U.S. brewers except for the big boys, breweries with more than 25% ownership by one of the big boys, and foreign-owned breweries qualified as craft brewers, the BA created an elaborate set of rules that essentially accomplished the same thing. Perhaps the most divisive part of the definition concerned adjuncts. While the BA embraced traditional brewing, the definition asserted that using adjuncts to lighten flavor was not traditional. This meant that one of the nation's oldest traditional breweries, August Schell, was not considered a craft brewer because its traditionally brewed lagers used adjuncts. This goofiness was eventually corrected through a softer craft brewer definition, but not before craft brewers did a bang-up job convincing consumers that "adjuncts are bad; adjuncts are very bad."

The irony is that Japanese-style and Mexican-style lagers are now popular among many U.S. craft brewers, and that dated "adjuncts = bad" messaging has largely been replaced by the opposite. If you are thinking about pursuing brewing professionally, or are already making your living in this world, I offer three words of advice: Never say never.

There are many intriguing facets of craft brewing in Japan, but one of the most interesting to me is the way brewers view adjuncts such as rice and corn starch. Because rice is a staple of the Japanese diet and is held in high regard as an important crop, Japanese craft brewers do not seem to carry the same ingrained bias against its use in brewing. And because homebrewing is not permitted under Japanese tax law, there has been significant knowledge transfer from the large Japanese brewers, specifically Asahi, Kirin, Sapporo, and Suntory, to the craft brewing community. As a result, Japanese craft brewers tend to view adjuncts simply as another set of ingredients available for use. It also means that adjunct cookers and decoction mashing are relatively common because the large Japanese breweries have historically relied on both methods.



Photo by Ashton Lewis

TIME TO CLIMB OUT OF THIS RABBIT HOLE!

On my most recent trip to Japan, I once again enjoyed Hitachino Nest Red Rice Ale, brewed with Asamurasaki red rice as a key part of the grist. What makes

this beer especially interesting is that the rice contributes both color (as seen in the earlier image) and flavor. I also visited a craft brewery that not only has a dedicated cereal cooker, but uses corn starch instead of rice because rice is expensive and corn starch is an excellent adjunct when the goal is to produce a delicate flavor profile without the added step of rice milling.

SAKE BEER

In the United States, we are beginning to hear more about "sake beers." I use quotation marks because these are not yet a well-defined beer style. These beers are often brewed with ingredients associated with sake production, such as sake yeast and koji, steamed rice inoculated with *Aspergillus oryzae*, the mold used to convert rice starch into fermentable sugars.

I was fortunate to be gifted a few cans of Flor Fermentation's Mizuha during a visit to the brewery. This very tasty, higher-alcohol beer is named after Mizuhanome-no-Kami, the goddess of water, and is brewed with koji from Yasui Sake Brewery, a historic sake brewery in Koka City, Shiga Prefecture.

Another sake beer I was fortunate to sample at the brewery in Kobe was Paint Palette's Timeless Symphony, brewed with lemongrass and sake kasu, the mixture of rice solids, yeast, and residual sake removed from moromi after fermentation is complete. Paint Palette collaborated with Kobe Shushinkan, a highly regarded local sake brewery best known for its Fukuju sake.

I don't normally taste beer before lunch, but this one was too good to resist, and I happily finished the entire can. Fortunately, I enjoyed a hearty breakfast that morning.

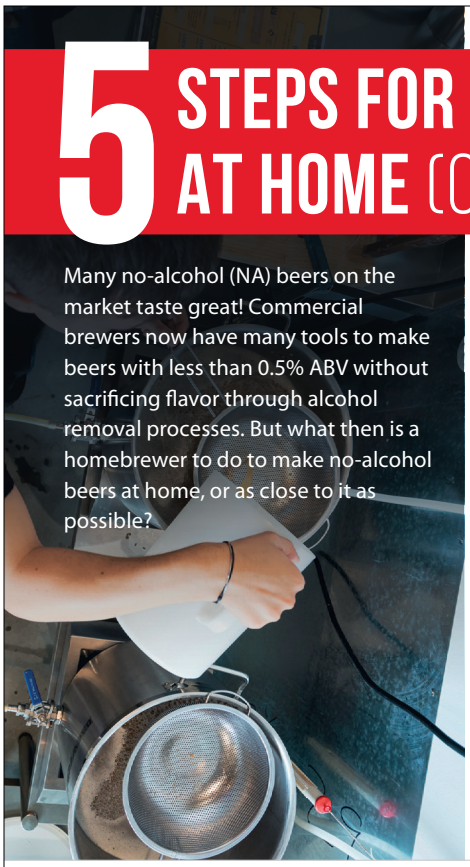
My message to homebrewers is simple: Keep coloring outside the lines. Explore rice cultivars that contribute more than starch to wort and consider incorporating elements of sake production such as sake yeast, koji, and sake kasu into your brewing if you have access to them.



Photo by Ashton Lewis

Paint Palette Owner and Brewer Shogo Tokami encouraging me to go for it!

And to the U.S. craft brewers reading this, continue embracing all brewing ingredients for the opportunities they provide to express creativity and keep today's fickle consumers interested in craft beer. *Kampai!* BYO



5 STEPS FOR BREWING NO-ALCOHOL BEERS AT HOME (OR CLOSE TO IT!)

Many no-alcohol (NA) beers on the market taste great! Commercial brewers now have many tools to make beers with less than 0.5% ABV without sacrificing flavor through alcohol removal processes. But what then is a homebrewer to do to make no-alcohol beers at home, or as close to it as possible?

STEP 1: LESS MALT = LESS TOTAL SUGAR

Less fermentable sugar starts with less malt. For a 19L (5 gal) batch, target around 2-3kg (4.5-6.5 lbs) of malt to achieve an original gravity around 1.020 (5°P). By cutting your grain bill in half, you are already halfway there to achieving 0.5% ABV.

STEP 2: HIGH TEMPERATURE MASH = LOW FERMENTABILITY

A high-temperature mash (above 75°C / 167°F) strongly favors the activity of alpha-amylase over beta-amylase. As the mash temperature rises, the amount of maltose decreases and the amount of dextrin increases, resulting in a lower overall fermentability. Our research shows that the lowest overall fermentability is achieved at around 85°C (185°F). If you want to get as close as possible to 0.5% ABV, target a higher temperature of around 80°C (176°F), but if you are happy landing somewhere between 0.5-1.5% ABV then aim for 75°C (167°F).

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REPLICATOR

BY DEREK DELLINGER

DEAR REPLICATOR, I recently tried an excellent saison called Pyramid of Skulls from Goshen Brewing Co. in Goshen, Indiana. It has an excellent flavor profile, with white grape being the very forward flavor. Their website doesn't list the hop used for that delicious flavor or give many hints to begin with clone recipe development. I would like to make something with that great taste if you're able to help!

Larry Peters,
Osceola, Indiana



Jesse and Amanda Sensenig are both natives of Goshen, Indiana, and Goshen College graduates, though their passion for craft beer developed further from home while living in Charleston, South Carolina, and Fort Collins, Colorado. Inspired by the dense, high-quality brewing culture of Fort Collins, Jesse began developing his own recipes. Upon returning home to Indiana, the Sensenigs started envisioning a space that prioritized conversation and connection. The culmination of their dream was Goshen Brewing Company, which the Sensenigs built out from a repurposed Northern Indiana Public Service Company building.

The brewery has grown steadily over the past 11 years, adding a second bar, increasing brewing capacity, and even introducing hard cider made from local apples. While the business has largely focused on in-house pub sales, an upcoming production expansion is planned to increase the brewery's distribution, barrel-aging program, as well as their lager program.

Head Brewer Derek Lambacher began homebrewing in college and learned what he could through the hobby before landing a part-time gig at a local brewery just before graduation. As Goshen Brewing expanded, Lambacher took the opportunity to join the team and eventually worked his way up to head brewer by tackling recipe development, production planning, and tighter quality control.

As a brewer, Lambacher has evolved by leaning into technical precision. Like many brewers, he's developed a deep appreciation for the delicacies of a well-made lager. "The subtlety and precision involved in lager brewing, not to mention the refreshing sessionability, keeps drawing me to those styles," he says. His approach to hops has also radically shifted, moving away from simple kettle additions in favor of whirlpooling, active fermentation dry hopping, and advanced hop products.

Developing these techniques has not only shaped how Lambacher approaches the IPAs he brews, but many other styles as well. For the past three years, Goshen's summer seasonal has been Pyramid of Skulls, a saison that marries the rustic, spicy tradition of a classic Belgian-style ale with the bright, fruity punch of a modern IPA.

"While the base of the beer looks like a typical saison recipe, the addition of Nelson Sauvin™ in the dry hop adds a more modern hop profile," Lambacher explains. "Overall, it's firmly rooted in saison, but the dry hopping gives it a more contemporary, hop-forward expression."

The malt bill is straightforward but purposeful: Pilsner malt provides a simple, crisp base, with white wheat bolstering the body and mouthfeel and rye adding a touch of rustic spice to complement the phenols from the yeast. For the hot-side, Lambacher keeps the bittering smooth and traditional with Spalter Select hops. The Nelson Sauvin™ dry hop — 1.5 lbs. per bbl. at Goshen's production scale — is more than enough to set the beer apart from other saisons on the market.

For his yeast, Lambacher opts for White Labs WLP550 (Belgian Ale). While some brewers prefer to underpitch or under-aerate their saisons to stress the yeast into producing massive ester profiles, Lambacher has found this to be unnecessary. "I treat this yeast like any other ale in terms of pitch rate. Rather than chasing additional ester production through under-pitching or limiting oxygen, I'd rather produce those flavors through healthy fermentation and temperature management," he says. He prefers to add yeast nutrient near the end of the boil and a zinc supplement during knockout, which help ensure yeast health. Since yeast nutrients homebrewers use generally include zinc, homebrewers will be fine without an additional zinc addition.

Lambacher recommends cooling the wort to about room temperature before pitching and then allowing the temperature to free rise only slightly (to around 71 °F/22 °C) the next day. Homebrewers should be mindful of one quirk of Lambacher's recommended yeast strain, however: Sulfur. Still, as long as the yeast is healthy and the pitch rate is correct, he believes that patience is enough to get around this — the yeast will naturally scrub the sulfur out of the beer over time. Homebrewers should therefore give the yeast plenty of time to finish fermentation before moving on to the dry hop.

"Nelson Sauvin™'s white grape and tropical fruit character complements the peppery phenols and fruity esters produced by the Belgian yeast rather than competing with them," he says.

Lambacher encourages homebrewers to take detailed sensory notes and not be afraid of crossing traditional boundaries. "Historically, many saisons were dry hopped, and while it may seem a bit odd to add New Zealand hops to a saison, I think it fits perfectly within the spirit of the style."

GOSHEN BREWING CO.'S PYRAMID OF SKULLS CLONE

(5 gallons/19 L, all-grain)
OG = 1.058 FG = 1.008
IBU = 30 SRM = 4 ABV = 6.5%

INGREDIENTS

9 lbs. (4.1 kg) Pilsner malt
2 lbs. (0.9 kg) white wheat malt
1 lb. (0.45 kg) rye malt
6 AAU Spalter Select hops (60 min.) (1.5 oz./43 g at 4% alpha acids)
4 AAU Spalter Select hops (15 min.) (1 oz./28 g at 4% alpha acids)
4 oz. (113 g) Nelson Sauvin™ hops (dry hop)
½ tsp. yeast nutrient (15 min.)
White Labs WLP550 (Belgian Ale) yeast, Wyeast 3522 (Belgian Ardennes), or Mangrove Jack's M31 (Belgian Tripel) yeast
¾ cup corn sugar (if priming)

STEP BY STEP

Mash in with 3.5 gallons (13.2 L) of water to achieve a single infusion rest temperature of 152 °F (67 °C). Hold at this temperature for 60 minutes.

With sparge water at 170 °F (77 °C), collect about 6 gallons (23 L) of wort. Bring wort to a boil. At the start of the boil, set a timer for 60 minutes and add the first Spalter Select hop addition. With 15 minutes remaining in the boil, add the second Spalter Select hop addition and the yeast nutrient.

Chill the wort to 68 °F (20 °C). Oxygenate normally and pitch the yeast. Allow the fermentation temperature to free rise to 71 °F (22 °C) the following day and then keep there the remainder of fermentation. After two to three weeks, ensure fermentation is complete and crash the beer to 54 °F (12 °C). The following day, add the Nelson Sauvin™ dry hops. Hold at 54 °F (12 °C) for 2–3 days.

Add priming sugar and bottle condition or keg and force carbonate to 2.8–3.0 volumes.

GOSHEN BREWING CO.'S PYRAMID OF SKULLS CLONE

(5 gallons/19 L, extract only)
OG = 1.058 FG = 1.008
IBU = 30 SRM = 4 ABV = 6.5%

INGREDIENTS

4.5 lbs. (2 kg) Pilsner dried malt extract
1 lb. (0.45 kg) wheat dried malt extract
1 lb. (0.45 kg) rye liquid malt extract
6 AAU Spalter Select hops (60 min.) (1.5 oz./43 g at 4% alpha acids)
4 AAU Spalter Select hops (15 min.) (1 oz./28 g at 4% alpha acids)
4 oz. (113 g) Nelson Sauvin™ hops (dry hop)
½ tsp. yeast nutrient (15 min.)
White Labs WLP550 (Belgian Ale) yeast, Wyeast 3522 (Belgian Ardennes), or Mangrove Jack's M31 (Belgian Tripel) yeast
¾ cup corn sugar (if priming)

STEP BY STEP

Add 6 gallons (23 L) of water to a kettle. Bring to a boil, then turn off the heat and carefully stir in the malt extracts until fully dissolved. Return to a boil and set a timer for 60 minutes, then add the first Spalter Select hop addition. With 15 minutes remaining in the boil, add the second Spalter Select hop addition and the yeast nutrient.

Chill the wort to 68 °F (20 °C). Oxygenate normally and pitch the yeast. Allow the fermentation temperature to free rise to 71 °F (22 °C) the following day and then keep there the remainder of fermentation. After two to three weeks, ensure fermentation is complete and crash the beer to 54 °F (12 °C). The following day, add the Nelson Sauvin™ dry hops. Hold at 54 °F (12 °C) for 2–3 days.

Add priming sugar and bottle condition or keg and force carbonate to 2.8–3.0 volumes. BYO



Photo courtesy of Goshen Brewing Co.

BY ASHTON LEWIS

CARBONATION METHODS

Plus: Adjusting beer pH & improving foam

Q WHAT'S YOUR PREFERRED WAY TO CARBONATE LAGER BEERS FOR HOMEBREWERS — SPUNDING, KRÄUSENING, FORCE CARBONATION, OR SOMETHING ELSE? WHAT ARE THE BENEFITS/DRAWBACKS OF EACH?

JASON BERKLEY
ANAHEIM, CALIFORNIA

A It's not often that I'm asked for an opinion, and I'm going to take full advantage of the opportunity! Before I do that, however, I want to cover a few fundamentals.

From a brewing science perspective, all of these methods can be used to carbonate ales and lagers, and there are few hard facts that position any of them as clear winners. But there is one practical consideration that affects craft brewers: Tank pressure ratings. I know there are commercial brewers who read my column, so I'm going to begin with that fact-based discussion.

Spunding and kräusening both rely on fermentation to carbonate beer. In the case of lagers, brewers are lucky, whether we realize it or not, because lager yeast can ferment at much lower temperatures than ale yeast. In round numbers, lager yeast will slowly chug along at temperatures as low as 39 °F (4 °C), while most ale yeast begins hibernating when temperatures drop to about 59 °F (15 °C).

This is relevant to commercial brewing because most beer tanks are rated to 14.7 PSIG (1 barg). In the U.S., pressure ratings above this threshold generally require ASME (American Society of Mechanical Engineers) certification. Because higher pressure ratings add cost to both vessels and their associated pressure relief devices, most brewery tanks in the United States are designed below this limit. Regulations vary in other countries, but many use similar thresholds for special pressure vessel requirements.

What does this have to do with carbonation? Quite a bit. Carbonation level is a function of both temperature and pressure, and tank pressure ratings establish the practical carbonation limit for beers carbonated by fermentation. Using 59 °F (15 °C) and 14.7 PSIG, the maximum carbonation level achievable in an ale is about 2 volumes of CO_2, or roughly 4 g/L.

I live in Missouri, and around here many people would describe a beer carbonated to 2 volumes as flat. Fans of cask ale know otherwise when that beer is served through a beer engine, but most would agree that a beer at this carbonation level is far from lively.

This means that if you have consumed a lively craft ale served from a keg, it was almost certainly carbonated using a method that did not rely entirely on fermentation in the package. And unless the brewery has a CO_2 recovery system and is carbonating with gas recovered from fermentation, chances are high that your favorite draft craft ale was carbonated using some form of forced carbonation.

I'm definitely not throwing shade on this method because I've made a lot of beer using it. It's simply one of those basic brew-economic decisions commercial breweries make when specifying fermenter design pressures.

The good news is that beer and soda kegs enjoy a special exemption because these vessels include sufficient design margins and pressure relief devices to exempt them from ASME pressure vessel requirements.

Spunding and kräusening both rely on fermentation to carbonate beer.



Photo by Christian Lavender

Spunding is made easier with a spunding valve that ensures the beer in your spunding vessel does not over-carbonate.

My favorite homebrewing pressure vessel is the Cornelius keg, with an impressive and very useful pressure rating of 65 PSIG.

Now for the fun part: Opinions.

This is where I take off my mortarboard and my Mr. Wizard hat and transport myself back to 1992, when I was a first-year graduate student at UC-Davis and had just begun working at the local lager brewery, Sudwerk Privatbrauerei Hübsch. At that time, Sudwerk's lagers were fermented in open fermenters and naturally carbonated.

This process was important because Sudwerk had no easy way to correct lagers or weizenbiers that ended up low in carbonation. If we screwed something up in the cellar, the only real option was kräusening, and we weren't particularly well equipped for it. So it was important not to screw it up. I suspect that's why I've always had a fondness for the method we used in those days.

Fermentation progress was tracked three times per day by dipping a sanitized stainless-steel hydrometer cylinder, equipped with a long handle, into the open fermenter. Because the cylinder was usually warmer than the fermenting beer, carbon dioxide would rapidly come out of solution until both the cylinder and the sample equilibrated with the bulk beer. I fondly recall bobbing the cylinder up and down to exchange beer until the boiling release of carbon dioxide stopped. Only then would we carefully insert the hydrometer and measure fermentation progress.

We called the process spindling and recorded apparent extract in degrees Plato along with temperature in degrees Réaumur, where 0 represents the freezing point of water, and 80 represents the boiling point. Karl Eden, Sudwerk's Brewmaster, was a peculiar man, and his use of Réaumur in the cellar was just one of many eccentricities.

The trick with proper spunding is to move fermenting lager from fermentation to lagering with sufficient extract for carbonation. The truth is that spunding valves make this process a little easier than it sounds because moving the beer early is not a problem, as spunding valves vent excess pressure, making carbonation easy peasy. But the foam hits the fan when a fermentation is moved too late. This is why we spindled every eight hours.

I know this sounds like a lot of work based on how I've described the monitoring process. But remember, this was 1992, long before many of today's homebrewers had even considered brewing beer. Modern brewers have access to all sorts of gadgets, including Bluetooth-enabled density monitors that beer nerds of my generation never imagined.

Although this is one of the most traditional methods of lager cellaring, it does have a major weakness: Everything depends on the yeast. If the yeast is not in top condition when pitched, fermentation may proceed slowly and become even less vigorous after the beer is transferred to the lagering tank. This is where kräusening shines.

Unlike with spunding, kräusening typically blends beer that has nearly completed fermentation with a portion of very young beer in the high-kräusen phase, generally 36–48 hours after pitching. The beauty of kräusening is that the base beer does not need to be transferred at a precise moment, provided kräusen beer is available at the proper stage.

A typical blend consists of about 85% fermented green beer and 15% kräusen beer. The fresh, actively fermenting yeast in the kräusen portion can finish any remaining fermentation, provide more than enough fermentables for carbonation, and help clean up fermentation byproducts before cooling drives the yeast into dormancy.

Kräusening is a kick-ass process, but it's also a pain in the ass for commercial breweries because kräusen beer must always be available to keep cellar operations running smoothly. For the life of me, I never understood why homebrewers and craft brewers talked smack about large breweries without appreciating the operational challenges of these traditional practices.

I'll finish with one more thought about spunding. What many brewers discuss today as pressure fermentation with a spunding valve is not traditional lagering. Traditional lager brewers often find that the increased static pressure associated with taller fermenters suppresses ester formation. News flash: Lagers absolutely have ester profiles. And suppressing these compounds is not necessarily desirable.

My work now takes me to Japan on a fairly regular basis, and I'm a huge fan of Japanese "big beer" because it is just so damn good. One characteristic many Japanese lager brewers intentionally seek is a delicate ester profile.

Spunding valves, pressurized fermentation, and elevated fermentation temperatures may be all the rage these days, but this old dude isn't convinced of their universal merits. All I can say is that today's interpretation of spunding is very different from the process I cut my teeth on as a young and eager brewer in Davis, California, back in 1992.

Q SHOULD I EVER CHANGE THE pH OF FINISHED BEER? IF SO, WHAT SHOULD IT BE, AND WHAT SHOULD I USE TO ADJUST IT?

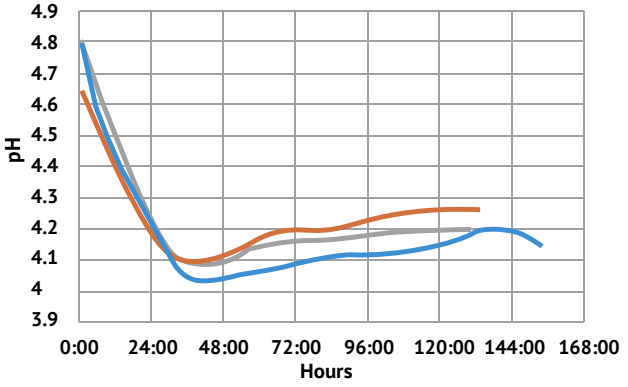
FROM MR. WIZARD LIVE

A The word *should* brings with it nuanced implications. Most people will agree that we all *should* routinely bathe. However, when my wife says, "Hey Ashton, you should take a shower," there is usually a reason behind the statement. Your question about beer pH leaves me scratching my head a bit because it sounds like something went wrong that prompted it. I'll leave that stone unturned! Beer pH depends on mash properties, including water chemistry and the many malt components that influence wort pH, hopping rate and timing, wort boil duration, yeast strain, ingredients added during fermentation, such as hops and fruit, and sometimes bacteria that are intentionally or accidentally

present in the fermenter. Beyond setting the stage, most brewers don't actively control beer pH once yeast is pitched.

It's normal for pH to drop from about 5.0–5.2 to 4.0–4.5 within the first 48 hours of fermentation. When beer pH is continuously monitored, a common trend is a slight increase after the initial drop to a value that typically remains stable during and after fermentation. The pH curves shown in Figure 1 (borrowed from this article by Amy Todd) illustrate these changes during three different fermentations.

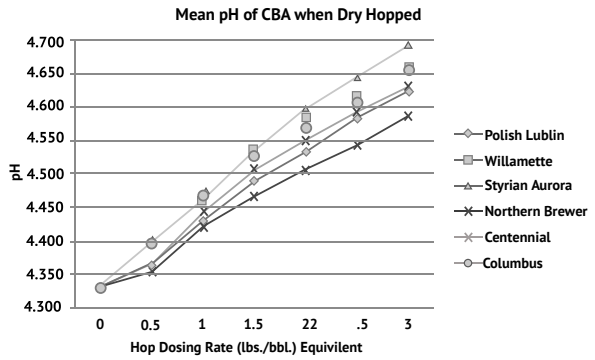
Figure I: Typical pH curves in three beer fermentations



There are some cases where pH increases more significantly than the typical blips shown in Figure 1. Dry hop additions are arguably the most common reason beer pH increases above about 4.5 after fermentation begins. Figure 2 shows the effect of six different dry-hop additions ranging from 0–3 pounds of hops per barrel of beer (0–1.5 oz./gallon or 0–11.6 g/L) on the pH of a commercial beer sample. Matthew Schmick's 2014 master's thesis contains similar data for four commercial beer samples. Five of the six hop varieties used in the trials shown in Figure 2 resulted in beer pH values greater than 4.6 at the upper end of the dosing range. I'll come back to this later.

In extreme cases where beer is aged on heavy yeast loads, autolysis can increase beer pH because amino acids released from yeast cells tend to buffer beer upward. However, autolysis is also associated with the proliferation of lactic acid bacteria because these fastidious bacteria grow best when amino acids are readily available, and competition from yeast for these nutrients is low. A reduction in beer pH following fermentation is typically caused by bacterial contamination, often from the pitching yeast itself and only apparent weeks or months after pitching when the conditions are best.

Figure 2: Mean pH values for commercial beer A (CBA) after dry hopping



Source: Matthew J Schmick, 2014 Masters Thesis, Dry Hopping and its Effect on Beer pH

Contrary to the advice commonly found on homebrewing forums, I believe yeast should be removed once fermentation is complete. Racking into a clean vessel, sometimes called a secondary fermenter or lagering vessel, is one reliable method of yeast removal. Purging from the bottom of cone-bottom fermenters is another very reliable option for brewers fortunate enough to have these fancy fermenters.

Aside from the effects of hops and yeast, fruit additions are another factor that commonly influences beer pH. Because fruits contain organic acids such as malic and citric acids, fruit additions typically reduce beer pH.

Now it is time to bring these concepts together into a coherent discussion. In food microbiology, pH 4.6 is a critical threshold because foods with a pH below this value are classified as high-acid foods, while those with a pH above 4.6 are classified as low-acid foods. This distinction is based on the behavior of *Clostridium botulinum*, a spore-forming pathogenic bacterium capable of producing a potent and potentially fatal neurotoxin. Under favorable conditions, dormant spores can germinate and develop into vegetative cells that produce the toxin. However, *C. botulinum* spores cannot germinate and grow in foods with a pH below 4.6. As a result, producers of high-acid foods can make safe products without the severe heat treatments required for low-acid canned foods, where preventing botulism is a primary food safety concern. This is one of the many reasons brewers can jump up and down and sing with joy!

Circling back to your original question: Should you ever adjust the pH of your finished beer? The answer is yes, under certain circumstances. When a finished beer has a pH greater than 4.6, acidification can be used to reduce the pH below this important food safety threshold. In practice, however, few commercially produced heavily dry-hopped beers are acidified after fermentation, and many beers currently on the market exceed pH 4.6. Although there have been no documented cases of pathogenic bacteria causing illness in commercially produced beer, brewers should remain aware of the potential risk associated with elevated pH. It is also worth noting that many foodborne pathogens can grow in foods with a pH below 4.6. *Clostridium botulinum* receives special attention because of the severity of botulism and the widespread occurrence of its spores in nature.

Let me ask myself a question on your behalf: Hey Ashton, when would you adjust pH after fermentation? Beer pH, like cider and wine pH, influences flavor balance. Post-fermentation pH adjustment is a lever that brewers do not typically pull because, in the long run, it is usually easier to make pH adjustments before fermentation by adding acid before or after wort boiling. However, for one-off batches, acid additions after fermentation are another tool in the brewer's toolbox.

Organic acids also bring flavors of their own and can act like amplifiers for other flavor compounds. For example, a beer with citrus-like hop character can be perceived as containing lime juice when citric acid is added. Similarly, malic

acid can accentuate apple-like aromas and flavors. Even additions of balsamic vinegar can add another layer of complexity to an otherwise garden-variety kettle sour.

As for what pH to target, there is no universal answer because the ideal value depends on the beer style and the flavor profile you are trying to achieve. If the goal is simply to move a beer below pH 4.6, small additions of food-grade lactic or phosphoric acid are commonly used. If the goal is flavor adjustment, I recommend proceeding cautiously and making additions in measured increments because relatively small changes in pH can noticeably affect beer flavor and balance.

Q I RECENTLY WATCHED YOUR INFORMATIVE VIDEO ON IMPROVING BEER FOAM USING THE PGA (PROPYLENE GLYCOL ALGINATE) METHOD. I WAS IMPRESSED WITH THE RESULTS YOU GOT AND WOULD LIKE TO DOSE INDIVIDUAL BOTTLES USING A BEER GUN FROM A KEG. I HAVE ALREADY TRIED A FEW EXPERIMENTAL BOTTLES BUT HAVEN'T HAD FAVORABLE OUTCOMES. FROM YOUR VIDEO, IT SEEMS LIKE YOU JUST ADDED A FEW DROPS OF YOUR PGA MIXTURE INTO THE JAR OF BEER AND HAD A SUCCESSFUL EFFECT. COULD YOU PLEASE SPECIFY THE EXACT TITRATION FOR THE INITIAL MIXTURE AND THE DOSAGE RECOMMENDED FOR BOTTLING? I WOULD LIKE TO ONLY ADD ABOUT 3–5 mL OF THE PGA MIX INTO EACH BOTTLE, BUT WOULD EXPERIMENT ON A RANGE TO FIND AN OPTIMAL RESULT.

MIKE DAVIES
VIA EMAIL

A Thank you for asking about one of my favorite beer topics. To prepare this answer, I had to rewatch that video to clear the cobwebs from my memory. I have to admit, I enjoyed revisiting that segment. Next time, I'll do a better job of hiding the "mystery" beers before pouring off camera!

In that video, I used Kerry Biofoam® K, a PGA powder specifically marketed for beer applications. The powder was dissolved in RO water to prepare a 1% stock solution. Adding 5 mL of this solution to 1 liter of beer results in a dosage rate of 0.05 g/L, which falls squarely in the middle of the recommended range of 0.03 to 0.08 g/L.

To my knowledge, Kerry Biofoam® K is not available to homebrewers. However, products marketed to home cooks are available that contain 100% propylene glycol alginate (PGA) powder. Although I have not personally used the PGA powder sold by Cape Crystal® Brands, I would expect it to perform similarly to the product demonstrated in the video. BYO

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BY GORDON STRONG

DOPPELBOCK

Light and dark liquid bread

The development of the stronger doppelbock is credited to the monks of Saint Francis of Paula, who settled in Munich after immigrating from southern Italy.

DOPPELBOCK BY THE NUMBERS

OG:	1.072–1.112
FG:	1.016–1.024
SRM:	6–25
IBU:	16–26
ABV:	7–10%



Photo courtesy of Shutterstock.com

Doppelbock is one of the strongest, maltiest traditional lager styles that is regularly brewed. Originating in southern Germany, it shares some characteristics with other German lagers, but most beers do not reach its strength. While many correctly think of this as a darker beer, there are also excellent paler versions that are quite enjoyable, albeit without the full depth of malt richness. Think of it as the difference between a dunkles bock and a helles bock, but with two percent more alcohol. "Doppel" means "double" in German, but it shouldn't be taken literally (same idea as with double IPA).

One of the stories told about doppelbock is that monks consider the beer to be "liquid bread" that can be consumed during the fasting of Lent. With the carbohydrates of malt and residual sweetness and the added calories of alcohol, doppelbock can conceivably sustain a healthy person for a short period of time, although those who tried this diet this century typically reported significant weight loss (you can search for and read those stories online from various local news sources). So, is this an actual story or a myth? Personally, I'm always suspicious of stories that sound just a little too good, but it is at least possible. Or at least it is enough to support the beer's nickname.

"Bock" is also the German word for ram or billy goat, so there is often goat-like imagery associated with the style. This also leads some people to incorrectly assume that the male gender should be used since bock is masculine. However, people aren't drinking goats; they are drinking bockbier, and bier (beer) has a neuter gender, so it is "das (bock)beer" not "der bock(beer)," if that makes sense.

The Beer Judge Certification Program (BJCP) Style Guidelines categorize Doppelbock as Style 9A in the Strong European Beer category, along with Baltic Porter and Eisbock. For competition purposes, the variation (pale or dark) should be identified to assist with judging. When purchasing doppelbocks, consumers should take note of the color in the bottle lest they be surprised.

HISTORY

As doppelbock is a stronger variation of bockbier, we logically need to start with the origin of that style. Bock (also known as dunkles bock or traditional bock) comes from the city of Einbeck in Lower Saxony in the northern part of Germany. Einbeck is about halfway between Dortmund and Berlin. Michael Jackson notes in *New World Guide to Beer* that bock has been produced in Einbeck since at least 1351.

Doppelbock is associated with the city of Munich in the state of Bavaria in the southern part of Germany. But bockbier from Einbeck did not arrive in Munich until the second half of the 1500s, at the earliest. The development of the stronger doppelbock is credited to the monks of Saint Francis of Paula, who settled in Munich after immigrating from southern Italy. Versions of the beer were documented as being made in 1634 in the Neudeck ob der Au Monastery, which is considered the founding date of Paulaner Brewery (named after their patron saint).

Paulaner's first doppelbock, which they called Salvator (Savior in German), was made for consumption by the monks until it was first sold commercially in 1780. After a legal ruling in the 19th century held that only Paulaner could use the name Salvator, other breweries began adopting names ending in "-ator" for their doppelbocks, a tradition that is widely followed in Germany, the U.S., and elsewhere. Ayinger Celebrator, Spaten Optimator,

and Tröegs Troegenator are some well-known examples. Knowledgeable beer enthusiasts will often assume the style of the beer simply when they see this type of name on a product.

Pale doppelbocks are a post-World War II creation, with many appearing since the 1990s. Eggenberg Urbock 23° was first made in 1970 in Austria, and is a strong example. Kulmbacher EKU 28 is a very strong pale lager that could be considered a pale doppelbock, if not a unique beer, and was first made in 1953. Darryl Richman, in his 1994 classic style series book on bock, simply mentions that pale doppelbocks are now appearing on the market. Certainly, the pale versions do not have the long history associated with Salvator.

SENSORY PROFILE

A doppelbock is a strong, richly malty German lager, with the dark version having a greater depth and richness of malt flavors than the lighter versions. The dark examples are a deep copper to dark brown color, often showing reddish highlights, while the pale versions are deep gold to light amber in color. Darker versions usually have an off-white head, while pale versions have a white head.

The darker color doesn't come from roasted malts, so don't expect any burnt or roast flavors, except perhaps a faint chocolate note. Flavors associated with Munich-type malts (including dark Munich malts) dominate, with their strong Maillard product flavors imparting richness and depth (a character often amplified by decoction mashing). Flavors are deeply toasty and bready, less so in the pale version. Some caramel flavors are often noted, but as a deeper enhancement to the toasty, bready notes, not a primary flavor. Dark versions often have some dark fruit character like plums, dark grapes, or fruit leather, while pale versions may have a light floral, spicy, or herbal hop flavor.

The alcohol strength should be at least 7%, and can range up to 10% perhaps (which is one reason I tend to think of the pale 11% EKU 28 as a bit of a unique product, like the

DOPPELBOCK

(5 gallons/19 L, all-grain)
OG = 1.089 FG = 1.019
IBU = 20 SRM = 21 ABV = 9.4%

INGREDIENTS

6.5 lbs. (2.9 kg) Pilsner malt
5 lbs. (2.3 kg) dark Munich malt
4 lbs. (1.8 kg) Munich malt
1 lb. (0.45 kg) Carapils® malt
1 lb. (0.45 kg) CaraMunich® III malt
1 lb. (0.45 kg) CaraVienne or Belgian Cara 20 malt
8 oz. (227 g) CaraBohemian® or Belgian Cara 200 MD malt
2 oz. (57 g) Carafa® II Special malt
3.5 AAU Crystal hops (60 min) (1 oz./28g at 3.5% alpha acids)
4.5 AAU Tettnang hops (60 min) (1 oz./28g at 4.5% alpha acids)
White Labs WLP833 (German Bock Lager), Wyeast 2487-PC (Hella Bock), or SafLager W-34/70 yeast
¾ cup corn sugar (if priming)

STEP BY STEP

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

Mash in Pilsner and Munich malts at 144 °F (62 °C) and rest for 20 minutes. Pull one-third of the thick portion of the mash, and boil in a separate pot for 15 minutes, stirring often. Return the decoction to the main mash to hit 154 °F (68 °C) (if you undershoot this temperature, increase the temperature manually), then rest for 45 minutes. Pull a thin decoction and boil for 10 minutes in a separate pot. Add remaining malts to the main mash, remix the decoction with the main mash, and stir to hit 170 °F (77 °C). Begin recirculating, and rest at this mashout temperature for 20 minutes while recirculating. Sparge slowly with 170 °F (77 °C) water, collecting 6.5 gallons (24.5 L) of wort.

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

Chill the wort to 48 °F (9 °C), pitch the yeast, allowing temperature to rise to 50–52 °F (10–11 °C), and ferment until complete. Rack and lager for eight weeks at 32 °F (0 °C). Rack the beer, prime and bottle condition, or keg and force carbonate.

DOPPELBOCK

(5 gallons/19 L, extract with grains)
OG = 1.089 FG = 1.019
IBU = 20 SRM = 21 ABV = 9.4%

INGREDIENTS

4 lbs. (1.8 kg) Pilsner liquid malt extract
6 lbs. (2.7 kg) Munich liquid malt extract
1 lb. (0.45 kg) Carapils® malt
1 lb. (0.45 kg) CaraMunich® III malt
1 lb. (0.45 kg) CaraVienne or Belgian Cara 20 malt
8 oz. (227 g) CaraBohemian® or Belgian Cara 200 MD malt
2 oz. (57 g) Carafa® II Special malt
3.5 AAU Crystal hops (60 min) (1 oz./28g at 3.5% alpha acids)
4.5 AAU Tettnang hops (60 min) (1 oz./28g at 4.5% alpha acids)
White Labs WLP833 (German Bock Lager), Wyeast 2487-PC (Hella Bock), or SafLager W-34/70 yeast
¾ cup corn sugar (if priming)

STEP BY STEP

Heat 6.5 gallons (24.5 L) of water in the brew kettle to 158 °F (70 °C). Steep the grains in a mesh bag for 30 minutes, then remove, rinsing lightly.

Turn off the heat. Add the malt extracts and stir thoroughly to dissolve completely. You do not want to feel liquid extract at the bottom of the kettle when stirring with your spoon. Turn the heat back on and bring to a boil.

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

Follow the remainder of the all-grain recipe.

dark 14% Samichlaus). The alcohol strength is often felt as a light warmth, but shouldn't burn or be tasted. The rich, medium-full to full body and malty finish helps temper the impression of alcohol.

The balance of doppelbock is always malty, and may seem fairly malty-sweet on the palate, but the finish should seem attenuated if not outright dry. Paler versions can have a drier finish. The impression of sweetness often comes from the medium-low to medium bitterness that allows the rich malt flavors to dominate. The carbonation is medium to medium-low, which can also allow body to be appreciated. The smooth lager character further enhances this impression.

The pale versions will not have the same malt richness nor darker malt and fruit flavors as the dark variants, as these flavors are derived from the same malts used to give the beer color. The paler versions will seem a bit drier and more bitter, as can be found in helles bock, and may have a bit more hop flavor. The slight change in balance and addition of hops compensates for the absence of the deeper malt and fruit flavors.

BREWING INGREDIENTS AND METHODS

As a Bavarian beer, doppelbock is made according to Reinheitsgebot traditions using only barley malt, hops, yeast, and water. German brewing tradition is to make this style with a decoction mash, although modern German practices have largely replaced this method with step infusion schedules. Historically, Germans would have used no more than a double decoction mash.

The grist is usually heavy in the Munich and dark Munich malt, but other malts are common. Pilsner and Vienna malts can be used to cut the richness of the Munich malt. Medium crystal malts can be used to add more depth to the sweetness and bring in some additional dark fruit flavors. Aromatic malt can be used to boost the malt presence. Decoction mashes are traditional, but I've also made this style with an infusion mash, usually with a corresponding bump up in dark Munich and aromatic malts. Avoid heavily toasted or roasted malts.

Hops are usually just in the bittering, with German noble hops the common choice. A clean bittering hop like Magnum is also a good choice. Low mineral water or water with a light amount of chlorides is fine; anything that isn't heavy in carbonates and sulfates should work. The yeast should be a clean and neutral lager strain with low sulfur production. White Labs WLP833 (German Bock) — and the comparable limited release Wyeast 2487-PC (Hella Bock) — yeast is a natural choice as it emphasizes the rich and malty flavors, but other clean German lager yeasts — Wyeast 2124 (Bohemian Lager), White Labs WLP830 (German Lager), SafLager W-34/70, or Wyeast 2206 (Bavarian Lager) also work well.

A normal German lager fermentation schedule should be followed, fermenting around 50 °F (10 °C), then lagering for a couple of months at near-freezing temperatures. German tradition was to lager one week for every degree Plato of original gravity, so four or five months is not out of line. Modern practice is to accelerate this schedule, possibly by kräusening. However, I also think when you have an 8 or 9% beer that more time will help smooth out the alcohol.

HOMEBREW EXAMPLE

I've been making variations of this recipe for nearly 30 years, and it consistently delivers. I learned decoction mashing when making the first iteration of this recipe, so it has a special place in my heart. When I make traditional German lagers, I tend to go old school on my methods since it feels like the extra effort shows respect. I also don't like doppelbocks that taste like I'm drinking a can of malt extract, so I shoot for a rich, malty flavor on the palate with a smooth texture, while finishing a little dry to encourage another drink.

To respect the classics, I'm using a grist heavy on Munich and dark Munich malts and a double decoction mash. Layering crystal malts helps give the darker fruit flavors and a bit of residual sweetness, but using Pilsner malt for part of the base counters this effect. I'm using just a touch of a huskless roasted malt to adjust the color and give it a hint of chocolate. The decoction mash can give deeper color on its own, but not really that extra flavor. I'm recommending the Ayinger yeast strain, which is a low-sulfur producer and really brings out the maltiness in beers.

Hops are simple, just a bittering addition that could be any German noble hop, really. The water should be a low mineral profile with just a bit of calcium chloride to enhance the malty finish. Note that I also use older methods of lagering, preferring an extended near-freezing conditioning to help smooth out the palate, clean up any yeast byproducts, and allow the alcohol time to integrate. You can prime and bottle condition, although I usually carbonate it in the keg using a lower PSI setting for an extended time to give a creamier texture and a finer carbonation.

When tasting the beer, pay attention to the finish to see if the alcohol is too noticeable. The malt flavors should always be dominant, but if the alcohol is too strong, just age it longer. Also, you probably want to drink this at a slightly warmer temperature than your typical lagers (perhaps 50 °F/10 °C), as colder temperatures tend to reduce the malt impression on the palate. BYO

Related Links:

- *Lesser known than Oktoberfest, Munich's spring beer festival Starkbierfest (Strong Beer Festival) is every bit as fun. We take you inside the festival and share advice from some of Munich's great brewers on creating a doppelbock fit for Starkbierfest.* **www.byo.com/articles/starkbierfest**
- *There are a number of challenges to brewing high-gravity lagers, and a number of approaches as well. We asked four American craft brewers who have nailed the doppelbock style for their advice to the toughest questions.* **www.byo.com/articles/doppel-your-pleasure-doppel-your-fun**

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Seminar Descriptions

Friday, October 23, 2026

11:00 a.m. – 12:00 p.m. (Eastern)

LOW-ABV & NA BREWING STRATEGIES FOR NANOS

▶ *BREWERY OPERATIONS*

Don't miss out on the rising popularity of lower-alcohol or no-alcohol options at your taproom. *BYO*'s Technical Editor Ashton Lewis will walk you through the keys to successfully brewing and serving these low-to-no ABV beers on small-scale craft brewing systems. And just as importantly, what common pitfalls to avoid when tackling making these beverages in-house for your taproom.

ASHTON LEWIS, *INTERNATIONAL TECHNICAL ACCOUNT MANAGER, RAHR BSG*
TECHNICAL EDITOR, BREW YOUR OWN MAGAZINE

YOUR BREWERY START-UP LEGAL CHECKLIST

▶ *START-UPS*

Your to-do list when starting up a new nano brewery and taproom will always be a long one. However one mistake that many new brewery start-ups make is putting all their focus on the brewing and serving side and not enough on the legal aspects when getting ready to open a brewery. But don't worry – we have Matthew McLaughlin, an attorney specializing in alcohol beverage law who has helped dozens of new breweries through the start-up legal hoops (including his own craft brewery!) He will give you a checklist covering the legal needs to take care of and consider before you ever pour your first pint.

MATTHEW MCLAUGHLIN, *FOUNDER, MCLAUGHLIN, PC*

FORECASTING BREWERY CASH FLOW IN A CHALLENGING MARKET

▶ *BUSINESS OPERATIONS & SALES*

Over the last few years the craft brewing market has changed dramatically. All that change and churn has resulted in additional challenges for small breweries trying to get an accurate handle of their all-important cash flow projections. Understand the best strategies you can use to map out your brewery's cash flow in these ever-changing times with brewery financial expert Kary Shumway.

KARY SHUMWAY, *PUBLISHER, CRAFT BREWERY FINANCE*

12:15 – 12:45 p.m. (Eastern)

Q&A WITH NANO VENDORS

You can check in live with your choice of top craft brewing vendors to get your questions answered about nano-sized equipment, gear, ingredients, and supplies.

1 – 2 p.m. (Eastern)

NANO PANEL: PRIVATE TAPROOM EVENTS FOR PROFITS

▶ *BUSINESS OPERATIONS & SALES*

Your taproom spaces can pull double duty to boost your profitability especially during slower times. Many nano breweries are regularly renting out taproom areas to private groups for parties and functions creating a new revenue source. But there are plenty of common mistakes to avoid when getting into private rentals. Our panel of small craft brewery owners will discuss the pros and cons of adding or boosting private rentals to your overall business strategy.

ANDREW COPLON, *FOUNDER, SECRET HOPPER*
FOUNDER, CRAFT BEER PROFESSIONALS

NEW POURING TECHNIQUES FOR NEW CUSTOMER BEER EXPERIENCES

▶ *BREWERY OPERATIONS*

Think that your beer's final flavor is set once it is kegged? Think again, as Master Cicerone® and commercial draft beer expert Neil Witte explains how the pour can influence flavor in many directions. From adding a variety of faucet styles to your taproom to different pouring techniques, customers will get excited learning more about how flavors can change with each pour. And an excited customer is a good customer!

NEIL WITTE, *MASTER CICERONE® & OWNER/FOUNDER, CRAFT QUALITY SOLUTIONS*

PRACTICAL AI TOOLS FOR NANO FINANCIAL REPORTS

▶ *BUSINESS OPERATIONS & SALES*

Setting up the right financial reports for your nano brewery is important, but it can be time consuming taking away from the thousands of other tasks on your list. Brewery Finance expert Audra Gaiziunas is here to help you save time and still get the reports you need to make better business decisions for your brewery. She has done all the research for you on how to put AI to work creating reports and financial tools to make sense of your numbers without you having to spend hours creating your own spreadsheets. With Audra's help, let AI help you work smarter and not harder on the financial side of your business.

AUDRA GAIZIUNAS, *OWNER, BREWED FOR HER LEDGER, LLC*

2:15 – 2:45 p.m. (Eastern)

Q&A WITH NANO VENDORS

You can check in live with your choice of top craft brewing vendors to get your questions answered about nano-sized equipment, gear, ingredients, and supplies.

3 – 4 p.m. (Eastern)

FEATURED PANEL: NANO LESSONS LEARNED I WISH I KNEW WHEN I STARTED MY BREWERY

▶ *BUSINESS OPERATIONS & SALES/BREWERY OPERATIONS/START-UPS*

Hear stories from fellow nano brewers on important lessons they learned (and wish they knew earlier) after starting their breweries. Chances are their hard-won advice covering both the business and brewing sides can be put to use to help your own brewery.

JOHN HOLL, *HOST, BYO NANO PODCAST*
EDITOR, ALL ABOUT BEER

4:15 – 4:45 p.m. (Eastern)

Q&A WITH NANO VENDORS

You can check in live with your choice of top craft brewing vendors to get your questions answered about nano-sized equipment, gear, ingredients, and supplies.

5 – 6 p.m. (Eastern)

TRACKING MARKETING ROI AS A SMALL BREWERY

▶ *BUSINESS OPERATIONS & SALES*

As a nano brewery you are always running lots of different marketing campaigns – from beer release events to social media post promos to dozens of other ways to boost beer sales and foot traffic into your taproom. But how do you know if any of these efforts really worked or not? That's where brewery marketing wiz Julie Rhodes comes in to help you understand how to measure your return on investment (even if that investment is just your time). Learn how to track your marketing efforts so you can repeat those marketing campaigns that worked and leave behind those that failed according to the numbers.

JULIE RHODES, *OWNER, NOT YOUR HOBBY MARKETING SOLUTIONS*

SMARTER BREWERY INGREDIENT & SUPPLY PURCHASING TO GAIN MARGINS

▶ *BUSINESS OPERATIONS & SALES*

In today's current craft brewery landscape every penny counts. One area many breweries can improve their margins is improving how they plan their beer ingredient and supply purchases. Given your small scale (and usually smaller storage spaces), nanos need to be especially strategic when placing ingredient orders. Let craft beer industry veteran Audra Gaizunas show you how to use your past numbers and other planning strategies to order the right amounts of supplies while cutting down on costs to help your bottom line.

AUDRA GAIZIUNAS, *OWNER, BREWED FOR HER LEDGER, LLC*

TEST YOUR WAY TO BETTER BEER QUALITY

▶ *BREWERY OPERATIONS*

No matter how small your craft brewery might be, you need to run certain quality control tests on your beer. And don't worry, these basic tests don't require too much space, resources or cost. Brewery QC expert Audrey Skinner will walk you through the tests and equipment you need to make sure the beer you are selling to customers is the best quality it can be. And producing better quality beer will result in happier customers ordering more pints helping your business be more successful.

AUDREY SKINNER, *GASTRONOMICAL CHEMIST, IMBIBE SOLUTIONS*

LAST CALL – REGISTER NOW AT NANOCON.BEER

Taking and Using Brewing Notes

Get the most from your brew logs

story and photos by Jason Simmons

My biggest advice to any brewer is to take detailed notes on everything possible. It doesn't matter what type of brewer you are. You can be a beginning homebrewer making extract batches by yourself or with friends, a member in a homebrew club that brews together as a team, a nanobrewer running a one-man show, or a part of a pro brewing team at a production brewery. I understand that some homebrewers (and professionals) feel that they don't need to take notes, but I continue to preach that note-taking will greatly improve your understanding of beer and allow the proper changes to be made to improve the product.



However, taking detailed notes is only the first step. Next, we have to go through all of the notes and organize the data in a manner that makes reviewing all of that information easier to digest.

As a commercial brewer who still frequently brews small batches at home, I recently took time to review a few years' worth of my commercial brew logs and, upon learning quite a bit, I realized it may be valuable to share that journey with you.

I feel there are three primary types of notes with endless subgenres depending on your needs. The three most important to me are: General notes, brew logs, and daily journaling. As I further explain each, I'll show examples of how keeping these notes at Lindgren Craft Brewery has helped us increase efficiency and troubleshoot issues when they have arisen.

I. GENERAL NOTES

I love learning about beer and brewing, which is why I try to soak up as much information as I can. Over the years, I have subscribed to various brewing magazines such as *BYO*, read brewing books by current authors as well as older historical brewing books, listened to various homebrew and professional brewing podcasts, and soaked up a ton of valuable information in the thousands of conversations I've had talking with other brewers. These sources can help guide you on style specifications, ingredient recommendations, brewing processes, or a cool new technique or product to try. And when I learn something new or hear about something I want to dig into further, I write it down in a section of a notebook labeled "General Notes."

For me, the general note section is the most unorganized because I come across different information at different times and then quickly write it down before I forget. Every once in a while, it is worth taking a look at this section to see if anything applies to any current or upcoming projects you are working on.

I also include any equipment notes in the general notes (or even make a subsection for these). It is good to have notes on maintenance logs, stainless steel passivation logs, your chemical dosing rates, and mill gap settings. Grains like oats, wheat, and rye are much smaller, requiring a finer crush to expose the starch. If the starch isn't exposed, then you lose out on what that malt has to offer, resulting in a lower mash efficiency. Homebrew stores often have two separate mills to tackle this issue. If you have the ability to adjust your rollers, take note of the gap. Our mill has a roller adjuster with marked hatch numbers at 0.003-inch (0.076 mm) per line to help us easily adjust to specific settings. Make note of your mill settings! If you start to notice your mash efficiency dropping, your rollers might be slipping, and you may not be crushing at the gap you thought you were. At Lindgren, we mill our malt at 0.042 inch (1.07 mm), and oats, wheat, and rye at 0.030 inch (0.76 mm) with an average 85% mash efficiency with a 6% ABV beer and 90-minute boil with a target 12% boil-off rate. Those numbers are all in my notebook.

Calibration of equipment is extremely vital to hit targets, and recording when and how calibrations were done is just as important. At the brewery, we brew batches in 6-gallon (23-L), 12-gallon (46-L), 20-gallon (76-L), 3-barrel, and 8- to 15-barrel sizes and see the same volume issues no matter the size.

Most equipment is calibrated to the temperature it operates in. I learned the hard way that using homebrew buckets calibrated for cool wort at 68 °F (20 °C) does not measure accurately when using 175 °F (79 °C) water. Making soda with cane sugar, I was off my specific gravity and pH targets because I failed to use the correctly calibrated equipment, such as a kettle at that temperature. Water shrinks 4% from boiling (212 °F/100 °C) to room temperature of 68 °F (20 °C), so you have to choose the correct equipment to measure volume or keep in consideration shrinkage. Five gallons (19 L)



The author's brewing notebooks tell not just a story of the beers brewed, but the reasons for different outcomes, both good and bad.

of liquid at 68 °F (20 °C) will not line up the same as ~130 °F (54 °C) wort collected into the kettle, and will be drastically different at 212 °F (100 °C), which most kettles are calibrated to (if you have ever wondered why your measured water volume doesn't line up with the volume markings in your kettle, this is why.)

2. BREW LOG

This is everyone's favorite topic: Brew day notes! I have seen some basic notes that consisted of a brew date, brewing style, recipe, original gravity, and that's it. It's better than nothing, but with more detail, we can paint a better picture and plan for a better beer next batch.

Some of the other important things to record on a brew log include: Batch number, recipe ingredients with manufacturer, any substitutions if rebrewing a recipe, water volume, water chemistry, mash temperature, pH throughout the entire process, lauter and sparge volumes, mash efficiency, pre-boil volume and gravity, boil time, post-boil volume and gravity, knock out/yeast pitching temperature, volume into the fermenter, cellaring and carbonation notes, packaging information, and tasting notes.

Each of these topics is worth reviewing to see if actual brew data matches the recipe targets. As you grow in experience or if you find yourself brewing commercially, you will most likely add to this list. If you are repitching and looking at yeast health, things like yeast batch lineage, attenuation, cell counts, and viability will increase the notes you take.

Formulation Notes

I would also include in your brew log your recipe formulation notes. When I write a recipe, it is done by hand with equations to get answers. All topics and variables are accounted for and adjusted according to the end target. Check for math mistakes. One misplaced decimal or wrong number can send your IBU, gravity, and the rest of the beer far off target.

For those of you who use recipe calculators, write down or print out the data that you are entering. Things such as given ppg (points per gallon) for selected malts, pre- and post-boil volumes and gravities, target mash efficiency, target fermenter volumes, and target packaging volumes will give you more data to review against the actual brew day records.

Ingredient Specifications

I have had conversations on what the actual ppg is on various malts and grains. When writing a recipe, write the ppg you are using. If brewing with multiple people, get a list of agreed ppg numbers to be uniform. Using different or estimated numbers for the same ingredient ppg can cause your recipes to be off target. There are several online lists that serve fairly well; however, we have a procedure that I find more accurate:

The measurement of sugar content goes back in history to grapes and winemaking. Grapes contain sucrose sugar that is made up of equal amounts of glucose and fructose sugars. This is the same as table sugar, and both have a ppg of 46, or a specific gravity of 1.046. Ppg is the maximum extract you get when you mix one pound of an ingredient

with one gallon of water. I look up the malt by manufacturer, find the technical specifications, then locate the fine grind percentage number, which is the expected extract from this malt. You just multiply 46 by the percentage to get the ppg. I personally round down any decimals to better hit targets.

For example, Rahr Pilsner malt has a fine grind extract of 79.5%, so:

0.795 X 46 = 36.57
(rounded down to 36 ppg)

I run a mash efficiency check on every batch to see if it is on target with what was expected in the recipe. To do this, I multiply each grain poundage by its ppg to get the grain's gravity unit (GU). Add all the grains' GUs to get a total gravity unit, or TGU. Divide by the pre-boil gallons to get the maximum extraction GU. Lastly, multiply your actual pre-boil GU by the maximum extraction to get your mash efficiency. For example:

- Weyermann Bohemian Pilsner (36 ppg) X 10 lbs. = 360
- Simpsons Chocolate malt (30 ppg) X 2.5 lbs. = 75

So:
435 TGU / 7.5 pre-boil gallons = 58 Max Mash GU

Pre-boil gravity reading at 7.5 gallons 1.048 or 48 GU:
48/58 =
82.758% Mash Efficiency

Kettle and Knockout Volumes

The equations we use for writing recipes are all based on post-boil volumes. With that said, recipes can be adjusted to hit your in-fermenter target volumes by looking at trub loss first, then 4% thermal shrinkage to hit fermenter volumes. From reviewing our brewery notes, we have found that malty beers on average have an 8–10% loss in kettle trub, whereas hoppier beers are around 12–15% loss. With this information, we can plan backwards to make full use of fermenter space. Taking notes on your volumes can help guide you on being more efficient in using your fermenter space. Having 3.5 gallons (13 L) of wort in the fermenter versus the 5 gallons (19 L) targeted will make you want to revisit this section of loss.

Fermentation Volumes

The next area where we see beer loss is during fermentation. Beer losses are affected by several factors like dry hopping rate, yeast strain, original gravity (OG), fermenter shape, and cooling practices, and can range from 5–30%. Tracking your losses can be very handy.

Dry hopping is one of the biggest factors for loss, with heavy dry hopping resulting in more loss. Most of the time, we just roll with it and say that the loss is the price of making great beer; however, with today's innovation of hop products, there might be other ways to create the same beer with less loss. Products like Cryo Hops® and various hop extracts allow more beer to be put in your packaging. You must figure out what is an acceptable loss for you, and whether or how to use these advanced hop products to save volume.

Our records show the following average loss (this includes yeast reproduction and beer absorption during dry hopping):

- **No Dry Hop:** 5–7% average loss
- **2–2.5 lbs./bbl (1–1.3 oz./gallon or 7.5–10 g/L):** 10-16% average loss
- **4 lbs./bbl (2 oz./gallon or 15 g/L):** 22% average loss
- **5.94 lbs./bbl (3.07 oz./gallon or 23 g/L):** 26.31% average loss

While your results will surely differ, the point is that it makes sense to know how much loss you can expect before it is too late to account for it.

Volume loss due to dry hopping is common knowledge to many brewers, but taking notes on dry hopping took us down an interesting path. We make an IPA using Comet hops from our local hop farm, and in one particular batch we saw a significant loss of final volume on a 15-barrel batch. We checked the lot number (from our notes) and saw that it was different from the previous batch, so we gave all of our data to the hop farmers, and we were shocked at the results. Due to a difficult growing season with severe drought, the hop cones that were processed into T-90 pellets were drier than in previous years/lot numbers. The amount of unexpected beer loss as a percent equated exactly to what the difference was in the dried hop weight percentage.

It was really interesting to see in numbers the reason for so much absorption (loss). None of this would have been figured out without taking detailed notes.

Carbonation

For homebrewers, carbonation is fairly straightforward — if you keg, you apply carbon dioxide, and if you bottle, you either add carbonation drops or priming sugar at the amount the recipe calls for. This usually does the trick until you look deeper at how many volumes of carbon dioxide you are targeting for different beer styles. Also, what is the state of the beer you are about to carbonate?

At the brewery, we have equipment that can control temperature, PSI, take carbonation readings, and force-carbonate with CO_2 stones. We control all the variables and document them, as well as the final carbonation, to better dial in our process to hit targets. We learned that even batch sizes make a difference due to the hydrostatic pressure in a tank and the varied pressure adjustments needed to reach the target goals. We take notes on this every day and are still learning.

What about homebrewers that don't have equipment like that? If you keg your beer, be sure to note the temperature, pressure setting, and time at that pressure. This will help guide you if your beer is dispensed too foamy or less carbonated than expected. Review these notes and make proper adjustments to achieve that fluffy foam and carbonation saturation. When I homebrew, I do not have any type of fermentation control except for what nature provides me. Confirming with tests, after fermenting at room temperature of 68 °F (20 °C), a beer naturally absorbs roughly 0.8 to 1.0 volume of CO_2. Taking the safer road and assuming 1.0 volume

is absorbed, you can figure out what remaining volumes are needed based on your target saturation levels. If you are targeting 2.68 volumes of CO_2, assuming 1.0 volume in solution, you will need 1.68 volumes of CO_2. When using priming sugar, I like to do my own math to get the dosing weight to help ensure I stay on target.

1 °Plato drop creates 2.5 volumes of CO_2, or 1.0 volume CO_2 created for every 0.49 oz. table sugar per gallon. If you are using a different sugar source, then cross-divide the ppg to sugars (sucrose) 46 ppg to get the dosing variable.

It is important to record the volume of beer, as any assumption can result in incorrect numbers in your math formulas and inaccurate results. Example A:

Volume = 5 gallons/19 L
Target CO_2 = 2.68 volumes (with 1.0 volume in solution)
Sugar = sucrose (46 ppg)

(2.68-1.0) X 0.49 X 5 gallons =
4.116 oz. or 116.7 grams

Example B:

Volume = 5 gallons/19 L
Target CO_2 = 2.68 volumes (with 1.0 volume in solution)
Sugar = honey (38 ppg)

(2.68-1.0) X 0.49 X 5 gallons =
4.116 oz. or 116.7 grams
so:
4.116 oz. X 46 sugar ppg =
189.33 / Honey 38 ppg=
4.98 oz. or 141.25 grams needed.

Occasionally at the brewery, we will brew a beer to be conditioned with unique types of sugars to prime the kegs, bottles, or cans. This is no different than how I package with my homebrew calibrated bucket sitting on the porch. We have a carbonation device called a Zahm & Nagel (commonly called a Zahm) where we can check the final carbonation on our cans and bottles, proving that this method of carbonation is extremely accurate.

Lot Numbers

We had a period of time where our beer started to turn after a month or so, developing this subtle smoky ashtray character that soon became overpowering. We thought it might be yeast handling practices so we stopped repitching yeast and only used dry yeast. Seeing no change, we called the yeast manufacturer with clearance on all the lot numbers. It wasn't until I was listening to a *Brewing Network* podcast where they mentioned the smoke taint of hops from the wildfires in the Pacific Northwest during the 2020 growing season that it hit me. We immediately checked our brew log notes, and lo and behold, every single beer with this issue had lot numbers from 2020 with the smoke taint. We always smell and rub some hops when we use them, yet doing so showed no signs of smoke taint. We pulled all beers and isolated the hops with the 2020 lot numbers and started over. Everyone cheered when the problem was solved and fresh, non-smoky beer was back on tap. Write down your lot numbers.

If you are unable to locate a lot number or it's not easily available, as it often isn't in homebrew quantities, then just make note of your purchase order information. If you suspect anything being an issue, you should be able to backtrack the order from where you bought the item back to the manufacturer, which could assist with any questions.

3. DAILY JOURNAL

In this notebook, I write down every daily task that is performed at the brewery, which goes beyond the brew log. Anytime that I am working at the brewery or homebrewing, I have notes on the tasks that were done that day. For basic tasks like cleaning or sanitizing a fermenter and other equipment, the notes don't need to be an SOP (Standard Operating Procedure) of every single step. Documenting that task has been completed is sufficient, while leaving detailed notes for brewing, transfer, and packaging logs with any data that you collect during that task. I highly recommend this practice to every brewer.

Changes to Ingredients

We had equipment failure that put the brewery out of production for three months during the summer. We take a monthly inventory report, and I could have just said "we didn't use anything so it should all be the same," but I felt it was responsible to take the weights of the ingredients anyway. We noticed that each month the numbers kept changing and had no explanation until I charted out base malts, specialty crystal malts, and dark roasted malts. This showed the loss percentage within the grain while sitting during the summer with changing heat and humidity.

Upon an editorial review for this article, I was told about a study conducted by a reputable company using a much more scientific approach than my simple observations to figure out how temperature and humidity affected malt during storage in their warehouse. The results of their controlled experiment during a Texas summer contradicted my observations in an uncontrolled Pennsylvania summer. With that being said,

> "We immediately checked our brew log notes, and lo and behold, every single beer with this issue had lot numbers from 2020 with the smoke taint."

sometimes taking notes can take you to the rabbit hole, and if you want to go down that path, more detailed note-taking is required to properly solve a mystery.

A Story and Journey to Tell

Taking a daily journal of all brewing-related tasks allows you to look at the tasks completed in various categories such as weekly, monthly, yearly, etc. batch specs, batch variations, and the reasons that caused it. After a few batches there is a story to tell and the journey you took to get there. For myself there is no better example at our brewery than our journey on pH, which without a doubt enhanced all of our beers.

We took the topic of pH head-on with serious research and trials to dial in our process. We chopped pH into segments that we thought were worth monitoring and adjusting. We originally only adjusted the mash pH, but soon found that pH control was needed in every step of the process. We do a water chemistry analysis on every batch that tells us the ppm of calcium, sulfate, chloride, total hardness, alkalinity, residual alkalinity, magnesium, sodium, and pH. We noticed that with different water chemistries, mainly in regard to swings in alkalinity and residual alkalinity levels, the pH buffering acts differently. Depending on the alkalinity, residual alkalinity, and recipe (light colored malts vs. dark malt), we might need to adjust more or less acid to properly hit our targets. Looking at previous brew logs helps us dial that in based on past results. We then monitor pH of the mash, kettle pre-boil, post-boil, after whirlpool additions (hops, lactose, sugar, etc.), during fermentation, at terminal gravity, after fermentation additions (dry hop, purees, etc.), and a final brite tank, bottling bucket, or keg reading.

We first started using acidulated malt to dial in our mash pH with success. Acidulated malt was easy to use and accurate, but added 27 ppg to our gravity. We then tried to reduce the base malt by the amount of acidulated malt used so that the gravities lined up. After brewing a beer where we filled our mash tun to the fullest level possible, we had trouble dialing in the pH. At that point we decided to go liquid and chose phosphoric acid over lactic acid. We were given a formula that allowed us to hit our mash pH:

Phosphoric Acid (75% Solution): 750 g acid for every 1,000 kg of malt will give 0.1 pH drop

[___Pounds of grain / 2.205 = ___ kg]
/ 1,000 kg = ___ factor
___factor X 150g = ___ grams of phosphoric acid need to drop 0.1 pH

Once we were comfortable with the results, we moved on to the next pH adjustments in the kettle. We found the equation we had for the mash pH did not equate to adjusting a kettle full of wort. One of our brewers sat down and, through trial and error, figured out the correct dosing rate, then created a formula that we use for all pH adjustments on liquid like pre- and post-boil, whirlpool, fermenter, or packaging additions. Differences in alkalinity will slightly vary the result.

Phosphoric Acid (75% Solution) In Liquid: 0.2175 g/gallon = 0.1 pH drop

There are some IPAs that are so heavily dry hopped that the pH rises back up to 4.8 or even 5.0. Adjusting this back down to 4.0–4.4, has brightened our beers' character and enhanced drinkability.

Now that all segments of the beer are within target ranges, we moved our focus on pH adjustments to our hard seltzers and sodas. I used to look at big soda companies' ingredient lists and squawk about them using phosphoric acid. Now that I am making soda and understand the safety aspect of pH adjustments and the ease of using phosphoric acid with these formulas, I am a believer.

Weather

Over 15 years ago when I was one brewer among a team at a large brewery, a boss wanted to know which brewer brewed the last batch of packaged lager as it was full of Dimethyl Sulfide (DMS). That brewer happened to be me and I recalled the brew day being nasty — muggy, hot, and humid with a poor boil-off rate and constant boilovers to a point where I had to throttle the steam to the kettle.

Looking back at the records, we saw in the notes that our kettle fan in our stack malfunctioned and did not efficiently evacuate the steam, leaving DMS behind in the kettle. Ever since that day, I have taken the weather report with a screenshot of the pressures on brew day to create an overall understanding of how the weather affects a boil in regard to DMS removal, boilover safety, boil volume, and gravity/IBU targets. What I learned from those notes allowed me to present this topic at the 2026 Craft Brewers Conference.

DID WE LEARN ANYTHING?

The takeaway message is to review your notes when things go well, when things don't, and sometimes just because. Often you will find things you weren't even looking for. The more notes you collect over the years, the more trends you will pick up on, and easier it will be to identify the reason for any outliers.

Related Links:

• After recording all of the important information about your brew day, it is time to use that information and make your next batch better. Of course, that's just one part of improving a recipe. Learn more about techniques for continual improvements here.
www.byo.com/articles/continual-improvements

• What good are your notes if the equipment you're using is telling you the wrong information? Make sure you can trust your equipment by keeping it calibrated. We walk you through how to calibrate the most common homebrewing tools.
www.byo.com/articles/equipment-calibration-tuning-up-your-gear

2026 Label Contest Winners

Entries from across the globe flooded the *BYO* email inbox this year as homebrewers were eager to share their creative designs that adorn their bottles and cans. It meant a lot of time was spent sorting through them all and choosing our favorites — but we were up to the task. Check out the winners from our annual label contest on these and the following pages. A big thank you to all those who entered and especially the sponsors who generously donated the prizes that make this contest so attractive each year.



Lamla Mayekiso
Cape Town, South Africa

Lamla is Captain of a student-led team of brewers at Cape Peninsula University of Technology (Cape Town, South Africa). The group brews and creates labels for their beers that go on to compete against brews from other college brewing teams in Africa. Not pictured here, but the label for the back of the bottle tells a story of the Inyanga pictured on the front label: "Legend tells of an old herbsman who lived deep within the caves of the Muizenberg hills. The old Inyanga found that his sacred herbs were most effective when brewed into a golden liquor. His medical brews were sought far and wide to treat many an ailment. To ensure his own vitality the old Inyanga would sip steadily on his brew from morning till night, and although it's been a great many years since last he was seen, there are many who believe that he resides to this day deep within the mountain, sipping steadily on his brew."

PRIZES: 1-year BYO+ Membership from **Brew Your Own**; Gift card from **GrogTag**



Bailey Scott Cain
Piedmont, California

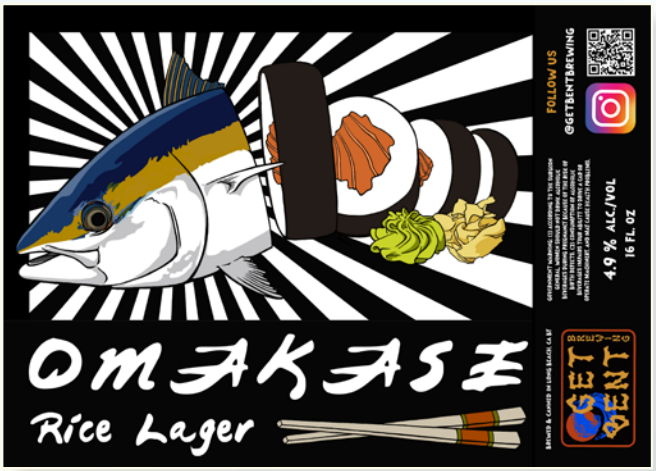
Kieran Galvin
Buffalo, New York

Claire Schwanauer
Houston, Texas

2026 LABEL CONTEST GOLD Winner

This label was created by a team of students in the Brewing Innovation Program at the University of Oregon, which uses brewing as a hands-on, experiential platform for building innovation skills that will empower students in any career. The beer "came to fruition to honor the historical significance of wild-fermented beer in the Andean Mountain region culture — a tangy beverage that united ancient communities. We designed the label with a vision of a modern beer whose flavors danced in such tasty harmony that it could similarly unite communities to drink it together and maybe boogie a little themselves! Inspired by Keith Haring's dancing figures, each major flavor component is highlighted by a unique icon on the label."

PRIZES: Standard Tilt™ Hydrometer & Thermometer from **Baron Brew Equipment**; Gift card from **GrogTag**; Brewer's Best® Zombiefest ingredient kit from **LD Carlson Company**



Cristina Casalicchio
La Habra Heights, California

2026 LABEL CONTEST SILVER Winner

This label design is inspired by a yellowfin tuna caught by the brewer behind Get Bent homebrews, Ben Wilson, off the coast of San Diego, California. The tuna was made into sashimi and sushi and paired with this Japanese rice lager. Named Omakase, which directly translates to "I leave it up to you," the beer pays homage to its namesake — a specially curated Japanese dining experience that delegates your culinary fate to the masters of their craft. Christina hand-drew the label that decorates the cans of Omaskase.

PRIZES: Gift card from **GrogTag**; Gift Card from **Keystone Homebrew Supply**; Homebrew gift box from **Lallemand Brewing**; Brewers Best® Holiday Ale ingredient kit from **LD Carlson Company**



Miquel Jardí Baños
Barcelona, Spain

2026 LABEL CONTEST BRONZE Winner

We'll let Miquel explain this adventurous brew and label: "This beer started life as a classic saison before I added fruit and *Brett*, with the intention of letting it evolve naturally for around eight months. A friend gave me 4 kg (9 lbs.) of bananas from the banana trees in his garden . . . I turned them into caramelized purée using a sous vide bath, and a couple of weeks before bottling I'll add banana peels toasted directly over charcoal to give the beer an extra funky layer. With a name like Peel The Funk, the beer deserved a label that felt just as wild as the project itself."

PRIZES: 1-year BYO+ Membership from **Brew Your Own**; Gift card from **GrogTag**



Maryann Stoorvogel
Clinton Corners, New York

2026 LABEL CONTEST
READER'S Choice

Maryann's label, which received the most votes in our Reader's Choice voting on Facebook, is an ode to a favorite beer from now defunct Rogue Ales. "Well, Dead Guy is no more. We loved it. So, in its honor, we tweaked three different recipes to produce our clone version of this beer. Original art and AI helped with the creation of a label befitting this memorable ale."

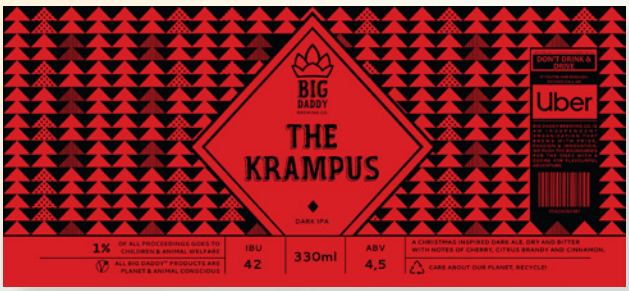
PRIZES: Gift card from **GrogTag**; Gift card from **Keystone Homebrew Supply**

2026 Label Contest
Honorable Mentions

PRIZES: Gift card from **GrogTag**



Allan Klar
Huntley, Illinois



Riaan Scholtz
Cape Town, South Africa



Adam Hess
Hughesville, Pennsylvania



Adam Retzlaff
West Bend, Wisconsin



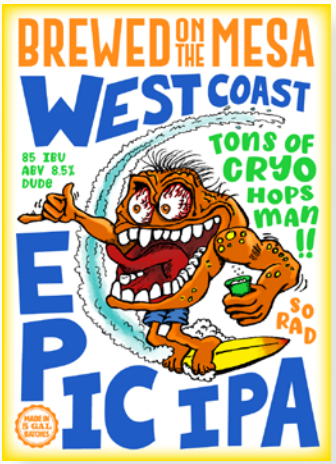
Mike Bechina
Overland Park, Kansas



Andy Mulinari
Perth, Australia



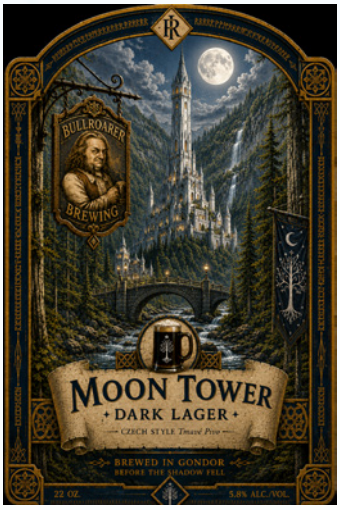
Cosmin Pazgu
Munich, Germany



Gary Smet
Costa Mesa, California



Jeff Pinzino
Chicago, Illinois



John Arnold
Del Mar, California



Joseph Eberhardt
Allentown, Pennsylvania



Mpumelelo Humphry Mbatha
Roodepoort, South Africa



Nikayla Locher
Hooper, Utah



Jarrod Lowe
Sebastian, Florida



Photos courtesy of Trillium Brewing Co.

THE HOMEBREWER BEHIND TRILLIUM

BREWING BOSTON'S FAVORITE BEERS

BY DAWSON RASPUZZI

> "I'll always be a homebrewer."

That was the last line of the email from Jean-Claude Tetreault — who, along with his wife, Esther, founded Trillium Brewing Co. in Boston, Massachusetts, in 2013 — when agreeing to our interview. It was a hefty request, including a behind-the-scenes tour at the brewery, taking pages from Trillium's recipe books, and reporting back for this story. The line struck me. Sure, JC, as he's known, made a name for himself in the early 2000s through his ahead-of-its-time homebrewing blog and sharing of information in online homebrewing forums with thousands of other passionate hobbyists. But 14 years removed from opening its first location in Boston's Fort Point neighborhood — and four years after opening their massive 140,000-square-foot (13,000-square-meter) production brewery in nearby Canton — Trillium is far from its homebrewing roots.

Or so I thought.

HUMBLE BEGINNINGS

Drawn to the idea of creating memorable experiences through food, JC grew up dreaming of becoming a chef. He found joy in cooking dinner for his family and preparing spreads for holiday gatherings, seeing food as a way to bring people together during life's special moments. But as he learned more about the demanding schedule of a professional chef, he realized it would mean missing many of the very moments he wanted to help create. Rather than pursue culinary school, JC changed course and enrolled at Sacred Heart University, where he studied biology and biochemistry. The subjects were a good fit for his curious nature, though the desire to create for others stuck with him.

If he couldn't scratch that itch professionally, JC found hobbies to help. Dabbling in different phases — from making sushi, ice cream, and more — JC eventually came to making beer. "And that's the one I really fell in love with," he recalled as he sat across the table from me in the restaurant attached to Trillium's production brewery. Sweat had already dampened the back of his shirt from the work that began in the brew house hours before I arrived. The restaurant and taproom had yet to open for the day, but he'd been living up to his reputation of having his hand in every aspect of the brewery and distillery (and as he waited for my arrival, he was pulling weeds that had grown through the mulch near the entrance). No chore is too small.

"The first beer I ever brewed was an oatmeal porter, and that's what our Pot & Kettle oatmeal porter is based on. That recipe is almost the same as the one when I was homebrewing," he says.

It didn't take long for JC to become enthralled with homebrewing. Always the tinkerer, he soon cobbled together an all-grain brewing system that met his needs and



Trillium Brewing Co.'s Founders Esther and JC Tetreault.



Trillium's original brewery in Boston's Fort Point neighborhood took two years from the time the lease was signed until it opened in 2013.

fit in his small condo just outside of Boston proper.

It wasn't just the brewing process JC found himself immersed in; it was everything around the hobby — from sharing beers with friends and family, the community he interacted with through homebrewing message boards and the Boston Wort Processors homebrew club, to exploring the unknown that drives curious minds.

The only issue — beyond a small brewing space in his kitchen and a lack of temperature control in the muggy summer heat — was the limited time his schedule allowed to devote himself to the hobby.

"I always felt like I did not have even close to the amount of time that I wished I could be putting into homebrewing," he said. The forums offered many benefits, from being a part of a larger group with similar interests to learning from what everyone else was doing. "It felt like it had this incredible multiplying effect where you could glean information, get validation, learn something new, or dispel rumors, which you couldn't do all on your own."

Soon he had a homebrewing blog (www.trilliumbrewing.blogspot.com, which is still accessible, though it has not been updated since 2011) where he detailed homebrewing experiments, equipment, techniques, and recipes. JC credits that blog for laying a foundation for his brewery plan. "The blog was really just me kind of taking notes and talking out loud to anybody who might want to listen," he says. "Obviously, I had no idea what it took from ingredients sourcing, quality checks, consistency, or any of those kinds of things, but I had kind of been doing R&D from day one as a homebrewer. Through my homebrewing blog, I was developing a brand, which, at that time, was really just an aspirational dream of, 'if I could open a brewery one day,' you know?"

Working a full-time job and dreaming of a career in brewing, it was Esther and JC's wedding that was the jumping board to going pro. With the help of a friend to create labels, JC brewed four beers for the wedding — Trillium (a farmhouse ale that would go on to become the first commercial beer released), Stonington Pale Ale (an early version of what is now Fort Point Pale Ale), Pot & Kettle oatmeal porter, and a Belgian wit with honey named Bumble.

"That's where it starts to come into more of a focus of what this brand would be," he recalls.

JC credits Esther with helping turn the dream into reality. Already an entrepreneur who had successfully launched her own business, Esther gave JC the confidence to believe that Trillium could become more than a hobby. With the momentum of the craft beer movement building across the country — though few breweries operating in Boston itself — and Esther's support of the idea, the couple began making business plans.

A lease was signed in 2011 for a 2,500-square-foot (230-square-meter) facility off an alleyway on Congress Street in the up-and-coming Fort Point neighborhood. After years of developing recipes as a homebrewer, the excitement of opening a brewery was quickly tempered by delays and seemingly endless red tape. Securing zoning approvals, licenses, and meeting the many regulatory requirements of the day took more than two years from the date the lease was signed. "We were pretty darn close to being out of money, and then not opening at all," JC recalled. While beer wasn't being made, the brewery was ready to go, featuring a 10-barrel direct-fire boil kettle and a mash tun fashioned from an old horizontal dairy tank by a fabricator who was given the direction to make one "as large as possible that would fit into



Trillium began with a 10-barrel boil kettle, a mash tun fabricated from a dairy tank, and two fermenters.



Trillium moved into its "forever home" in 2021, featuring a 50-barrel brew house it bought from the former Spencer Brewery.

the building."

Finally, Trillium opened its doors to customers in March 2013. By that time, the brewery was already cash-strapped, but they were about to discover Boston had an appetite for what Trillium was brewing.

TRILLIUM BREWING CO. IS BORN

"There really weren't very many new small breweries in the greater Boston area at that time, so there was a big, pent-up demand for what was kind of happening in the beer community across the country, and really, across the world," JC recalls.

Having made a name for himself with his homebrews, as well as brewing pilot batches in the months leading up to its opening, word had gotten out, and anticipation continued to grow for the months — and years — it took for Trillium to finally open its doors.

"I had made tons and tons of connections in the community. We were piloting at a place called Greentown Labs, which was a quarter mile from where our brewery was going to be. And every Saturday, I would go out there and meet up with a bunch of homebrewing nerds like myself. We'd make a one-barrel batch on their loading dock, and we'd do cellar work, we'd package it, condition it, and then serve it at their Friday night socials," he said. "So just by word of mouth in the Fort Point neighborhood, there was a huge amount of anticipation."

"Going into the second weekend we were open, we ran out of beer on Friday. So we didn't even make it to the second weekend."

Just two fermenters meant just two beers were available at a time (there were six fermenters in the original plan, but as cash dwindled during delays, so too did the plans). When beer ran out, it often took days until the next batches were ready for sale. Not being able to meet demand wasn't the only issue.

Without the ability to can or bottle, and state laws prohibiting consumption at the brewery, the only sales in those early days were growler fills. The slow nature of filling growlers on demand meant there were often lines out the door, around the corner, and down the street. Customers regularly had to wait up to 90 minutes to get their fill. Fortunately for Trillium, the beer was good enough that they kept coming back. Week after week. Line after line.

A DECADE OF GROWTH

Trillium's first expansion came in 2015 with a move to a 16,000-square-foot (1,500-square-meter) facility in Canton (distinct from its current Canton location). That brewery housed an upgraded 30-barrel brewhouse and, for the first time, allowed Trillium to serve beer on-site. Expansion continued with a seasonal beer garden on Boston's Greenway, followed by a brewery and restaurant in Fort Point, and later a taproom and beer garden in the Fenway neighborhood, just a few blocks from Fenway Park. Even with all the growth, JC said the brewery was never able to make enough beer.

"For the first eight or nine years that we were operating, we were chasing production capacity to keep up with demand," JC said. "We didn't open a brewery to say 'no' to people, and that's what we were kind of doing all the time."

The toll not being able to meet demand took is one of the reasons Trillium built the vast 140,000-square-foot (13,000-square-meter) brewery where nearly all of its beer (and spirits) is now produced. "That's one of the reasons why we built so much capacity here. Not just to help to maintain consistency and quality, but to eliminate some of the stress."

JC refers to the newest brewery as Trillium's "forever home." Previously housing the Reebok headquarters, the space was largely a blank slate when Trillium bought the building. JC and Esther designed the modern, industrial-style restaurant that doubles as

an event space and seats 750 (and up to 1,500 for special events). Next to it is a taproom and an outdoor beer garden. But the main attraction is behind all of that.

Made up largely of second-hand brewing equipment, the primary brewhouse has a 50-barrel capacity where double batches are brewed six days a week. Vertical fermenters tower nearby for all of Trillium's ales, while 120-barrel stainless steel horizontal lagering tanks are stacked beside them. A short walk from there is Trillium's sour program with barrels and foeders that age the brewery's revered wild ales. (JC wishes it were in a different building altogether to alleviate risk of cross-contamination, but there are strict policies in place about crossing from one side to the other.) On the other side of a wall along the brewery is Trillium's newest project — a distillery that includes a 30-foot (9-m) column still and 1,000-gallon 3,800-L) pot still. The spirits produced there make up the backbone of Trillium's ready-to-drink canned cocktails (read more about Trillium's distillery in the sidebar on page 39), not to mention serving as a feeder program for the brewery's barrel-aged beers.

Trillium's growth over the years has been astonishing, even to JC and Esther. "Nobody could ever possibly have planned for this," JC said. "Of course we were putting together five-year plans, but zero of them have lasted more than a year and a half."

While new locations have been added frequently over the past decade, JC says Trillium has reached its ideal size.

"Esther and I are not trying to take over the world," he says, letting out a chuckle.

WHAT'S BREWING?

While much of their beer is sold from its own locations — it's not uncommon for customers to drive to Trillium's taprooms and leave with a dolly stacked with cases of canned four-packs — in recent years Trillium has become widely available throughout Massachusetts. They also partner with a network of distributors in more than a dozen U.S. states, creating limited availability from coast to coast.

Living in a state where Trillium is not yet distributed myself — though Vermonters are just a few hours from Boston — I have always associated Trillium with their hazy pale ales, IPAs, and double IPAs. These smooth, aromatic hop bombs are what brought Trillium national attention through beer rating websites in the 20-teens, and are the beers most often found "in the wild." With inclusion on all of the "best breweries" and "best IPA" lists across the web and in beer appreciation publications being driven by hazies, it's easy to overlook that Trillium is far from just another New England IPA brewery.

Visible right after walking through the front doors in Canton is Trillium's pilot brewery — a 5-barrel Ss Brewtech brewhouse standing along a back wall with a dozen 5-barrel fermenters lined beside it. Brewed on two to four times a month for experimental batches as well as taproom exclusives, the team at Trillium produces just about every beer style there is. JC estimates Trillium creates over 100 unique beers a year — half of them being styles other than IPAs.

"I love them all, you know?" JC says, grinning. "I love the creative process. I love all these traditional styles that are a callback to a sense of place, agricultural roots, culture . . . and the newer styles where people are re-imagining what beer can be."

So, is there a style Trillium hasn't released, I asked?

JC had to think for a moment before offering a couple. "There are obscure styles, like Polish Grodziskie or sahti . . ."

Even with the bigger capacity, there are, of course, only so many hours in a day.

". . . But we probably will, at some point," he says, finishing his thought with a wry smile.

To this day, JC has his hands in



The 5-barrel pilot brewery is used for both experimentation as well as brewing taproom exclusives, which are often styles in less demand among average consumers, yet a welcome addition to any brewery portfolio for true beer nerds.

every recipe Trillium releases. It's a decision, he says, driven by a "continuity of intention." That's not to say there isn't collaboration among the brewing team.

"I'm absolutely taking feedback from others," he says. "At the same time, I'm making sure that everybody understands the intention for what we're trying to do . . . so, when I say I'm designing the recipes, I'm sort of designing the intention for the beer, and then we collaborate towards what contributes to that."

While offering beers and other beverages to meet every customer's taste is the goal, and partly why so many unique batches are released every year, there are a few beers that could be considered flagships that make up a disproportionate amount of Trillium's production. The three most popular include two longtime offerings: Fort Point Pale Ale — the beer based on a homebrew served at JC and Esther's wedding that is driven by huge Citra® hop additions — and the Galaxy®-based Congress Street IPA, which was first brewed in late 2013. The third is Party Pump, a newer, relatively simple American golden ale first released in 2024. In addition to being a fan favorite among those who want a more accessible beer that won't shock the taste buds, Party Pump serves a dual purpose as a beer that acts as a yeast propagator for the brewery's popular hazy IPAs.

"We're not harvesting yeast from our hoppy beer . . . so we needed a mechanism to have very high-quality yeast in the sufficient quantities that we wanted to be able to have at all times. So, having a beer that also is used for yeast propagation really serves two purposes," JC says.

Trillium will reuse yeast for 6–8 generations. Beyond that, JC says, they begin to see genetic drift. In addition to its hazy strain, Trillium uses up to a dozen different yeasts in a year — a requirement when brewing such a wide variety of styles.

HOMEBREWER AT HEART

There are two general mentalities among homebrewers — those who dream of turning their hobby into a

MORE THAN BEER



As patrons approach the main entrance of Trillium's massive headquarters in Canton, it isn't the brewhouse or towering stainless steel fermenters they see through the glass wall panels. Instead, it's a massive 30-foot-tall, 20-inch-diameter (9-m-tall, 50-cm-diameter) copper continuous column still. Next to it is a 1,000-gallon (3,800-L) hybrid pot still. The Trillium distillery, separated from the brewing space by a wall, produces spirits available for purchase by the bottle as well as those used in Trillium's ready-to-drink canned cocktails.

While the addition of a distillery coincided with the opening of Trillium's most recent location — and around the time the beverage industry began experiencing a downturn in beer sales and an uptick in ready-to-drink canned cocktails — the idea for a distillery began shortly after Trillium opened its first brewery location a dozen years ago.

"This isn't a reaction to what's happening in the broader beer world," JC said. "I think it was year two that I told Esther . . . you know, when you're a brewery, you're like 95% of the way there to being a distillery, too."

The majority of Trillium's whiskey is produced from the copper column still, doing in a day what would take a week in the pot still. Running one production cycle per week, whiskey mash is pumped into the continuous column still at a rate of 10 gallons (38 L) per minute, producing 12 casks of whiskey per run.

The hybrid pot system is used primarily to create other types of spirits, including traditional single-malt whiskey, vodka, and gin. Between the two stills, Trillium can produce just about any type of spirit they wish. Having learned from a decade of outgrowing brewing spaces, it is also sized to accommodate growth.

"The majority of the distillation team's work is in whiskey, but our diverse portfolio calls for us to be able to produce lots and lots of other different types of spirits as well," JC explained.

Much of the whiskey comes from corn grown on Trillium's 163-acre farm in North Stonington, Connecticut, where about 60 acres are dedicated to farming grain.

"The majority is in corn, which we use in Bourbon and our rye whiskey, too," JC said, adding that some corn is also used for beer production and cornbread found on the dining menus at Trillium's restaurants.

Also grown at the farm is 2-row winter barley, which is malted in Connecticut and used to produce single-malt whiskey.

Trillium now offers a line of canned cocktails — including options like Rum Punch and Cape Codder — as well as canned seltzers, teas, and lemonades, all of which are made with spirits created in-house. The selection has allowed Trillium tasting rooms to offer an option for anyone looking for an adult beverage even if beer isn't their first choice.

"We've set ourselves up to be able to meet the moment for whatever group of people, whatever community wants to come and enjoy what they want to enjoy," JC said. "There really isn't a lack of options or constraints around what that is."

TRILLIUM'S APPROACH TO HAZY IPAS

JC has shared tips with us on brewing great hazy IPAs in the past, which we encourage you to read, but beyond water chemistry and hop selection, we asked him to share what makes Trillium's IPAs different from other hazy IPAs. It's no surprise he said these styles begin with great hops. What was surprising is the lengths he goes to find them, which is more involved than visiting farms and doing the hop rubs most brewers talk about.

"When we first were able to start doing selection, we approached it like everybody else — rub the flowers of the brewer's cut, and you try to pick out the aromas and flavors that you really like, and then make sure the ones you don't like aren't in there," JC said.

But experience bore mixed results, as sometimes hops that presented well on the table didn't translate to the beer, and vice versa. "The rub, while important to rule out things like OG (onion/garlic), smoke taint, and things like that, to some level of specificity, was insufficient for us to understand the impact that the biotransformation process was going to have for hazy IPAs."

As a result, Trillium began performing benchtop fermentations after qualifying a number of lots to get a truer representation of how they would perform in beer. "And that's how we get what we think is a very distinctive Citra® hop, a very distinctive Mosaic® hop — just taking that extra step in diligence."

The other thing JC talks about on the ingredient side is a more recent swing toward the inclusion of chit malt, which in some newer recipes is used in place of some of the flaked grains Trillium traditionally relied on in its hazy recipes. "Chit malt is able to accomplish what people expect to come from flaked grains . . . the lower color, the lower impact of quote unquote malt, some of that fluffier texture on the palate. We feel like we get more of that from chit."

JC said Trillium has also changed how it does its biggest dry-hop charges. Double dry hopping, or DDH, is a common variant of Trillium's most popular hazies . . . but what does that mean?

"We initially produced double dry hop beers by doing two separate hop charges," JC explains. "It was probably two years or so until we were like, well, let's just try to do a single charge with twice as much."

In addition to exposing the beer to half the oxygen by only opening the conditioning tank once, the results showed a greater hop intensity and quicker turnaround that allowed for more time post-dry hop for cold conditioning. "We thought the beer was incrementally more aromatic and flavorful, it reduced the amount of oxygen, and allowed us to put out what we thought was a better conditioned product in the same amount of time." Ever since, that's how all DDH'ing is done at Trillium.

One final change from the early days — and this is related to all styles, not exclusively hazy IPAs — is Trillium has simplified its ingredients. No Trillium recipe is ever set in stone, and even the flagship beers like Fort Point Pale Ale and Congress Street IPA have been tweaked through the years. Often, those changes are a simplification or reduction of specialty grains or hop varieties in a single recipe.

While homebrewers often want to add more ingredients to each batch in search of complexity, JC advises they begin with more basic recipes and then evaluate the results. "Over time, we found that less is more in a lot of cases. It allows the majority of ingredients to be more prominent and to be more focused and show the breadth within themselves. Sometimes when you add more, it starts to muddle things — texture, character, aromas, or flavors," JC says.

profession and those who believe doing so would strip away the joy that drew them to brewing in the first place. JC firmly belongs to the first camp. Listening to him describe why brewing became the perfect outlet for his creativity, ambition, and desire to build something lasting, it's clear that for some, turning a hobby into a career doesn't kill their passion for it.

What keeps him excited to go to work each day?

"It's not different from the idea of making the beers for us at my wedding. It's to create something that I not only love, but I think other people will love. To go through that process, and, as a team, put together those things, and bring it into reality," he says. "And then watching people's eyes light up when they have the beer that we've made."

With the brewery, numerous taprooms and restaurants, a distillery, and a farm, Trillium has come a long way from filling growlers to a line of thirsty patrons extending out the Fort Point doors down Congress Street. JC is even further removed from squeezing in a brew day after work, boiling wort on a kitchen stove. And yet, the man behind everything the brewery does still has the same excitement and inherent curiosity homebrewers begin with.

"Brewing is one of those disciplines that the more you learn, the more you learn that you don't know," he explains. "That sense of wonder, and discovery, and passion that people will ascribe to being a homebrewer; it always feels that way for me, and it's a pretty important driving force for me."

Related Links:

In addition to the five clone recipes on the following pages, JC has shared three more Trillium clones with BYO *over the years. Check out our archive for homebrew versions of:*

- *Fort Point Pale Ale*
- *Sleeper Street*
- *Dialed-Out*

TRILLIUM BREWING CO.'S DDH CONGRESS STREET CLONE

(5 gallons/19 L, all-grain)
OG = 1.070 FG = 1.015
IBU = 70 SRM = 5 ABV = 7.2%

This Galaxy®-heavy IPA is based on a recipe from JC Tetreault's homebrewing days. No boil hops are added, and just a small whirlpool addition is used to add a slight bitterness. The dry-hop addition is double in this recipe (so cut it in half if you prefer the non-DDH version). Congress Street has been a crowd favorite since the early days.

INGREDIENTS

11.2 lbs. (5.1 kg) North American 2-row pale malt
1.7 lbs. (0.8 kg) flaked wheat
1.7 lbs. (0.8 kg) white wheat malt
0.25 oz. (7 g) Galaxy® hops (whirlpool)
16 oz. (450 g) Galaxy® hops (dry hop)
1 g Whirlfloc (15 min.)
Wyeast 1318 (London Ale III), White Labs WLP066 (London Fog), Imperial Yeast A38 (Juice), or LalBrew Verdant IPA yeast
¾ cup corn sugar (if priming)

STEP BY STEP

This recipe uses a "soft water" profile. If you have high total alkalinity or high mineral content water, dilute back with reverse osmosis or distilled water. Add back small quantities of calcium chloride and gypsum at a 4:1 ratio.

Add all of the crushed grains to the mash tun and perform a single-infusion mash at 156 °F (69 °C). Mash out and collect 6.5 gallons (24.5 L) of wort in the boil kettle. Boil for 60 minutes. Add the Whirlfloc in the last 15 minutes.

When the boil is complete, adjust pH to 5.0 with lactic acid, if necessary. Chill wort to 180 °F (82 °C) and add the whirlpool hop addition. Stir wort to create a whirlpool and then allow it to settle for 10 minutes before cooling wort to 66 °F (19 °C).

Oxygenate wort (if using liquid yeast) and pitch yeast. Ferment at 66 °F (19 °C). Within 24 hours of reaching terminal gravity, turn off any temperature control to ensure the yeast stays active and add the dry-hop addition. Open a fresh package of hops to ensure the best possible quality.

Cold crash after bioconversion is validated via a sensory panel, usually within 48–72 hours.

Rack the beer off of the hops into a keg and carbonate to 2.55 volumes. Plan to cold condition at 30 °F (-1 °C) for at least 14 days (21 days is better). Do not move or disturb the keg. Pour out trub from the faucet every two days starting at day 7 in the keg until no more is pulled through.

EXTRACT OPTION:

Replace the grains with 6 lbs. (2.7 kg) light dried malt extract and 1.75 lbs. (0.8 kg) wheat dried malt extract. Bring 6 gallons (23 L) of water to a boil and then turn off the heat. Stir in the malt extracts until fully dissolved, and then return to the heat.

Boil for 60 minutes. Add the Whirlfloc in the last 15 minutes. When the boil is complete, adjust pH to 5.0 with lactic acid, if necessary. Chill wort to 180 °F (82 °C) and add the whirlpool hop addition. Stir wort to create a whirlpool and then allow it to settle for 10 minutes before cooling wort to 66 °F (19 °C).

Oxygenate wort (if using liquid yeast) and pitch yeast. Ferment at 66 °F (19 °C). Within 24 hours of reaching terminal gravity, turn off any temperature control to ensure the yeast stays active and add the dry-hop addition. Open a fresh package of hops to ensure the best possible quality.

Cold crash after bioconversion is validated via a sensory panel, usually within 48–72 hours. Rack off of the hops into a keg and carbonate to 2.55 volumes. Plan to cold condition at 30 °F (-1 °C) for at least 14 days (21 days is better). Do not move or disturb the keg. Pour out trub from the faucet every two days starting at day 7 in the keg until no more is pulled through.



TRILLIUM BREWING CO.'S UPPER CASE CLONE

(5 gallons/19 L, all-grain)
OG = 1.083 FG = 1.015
IBU = 65 SRM = 6 ABV = 9%

This big double IPA is dangerously smooth, hiding its 9% ABV behind massive Mosaic®, Citra®, and Galaxy® dry-hop additions that contribute overripe mango, pineapple, and passion fruit aromas. The impression of tropical fruit leads into the flavor profile which is layered further by white wine, pine resin and grapefruit zest. Like many of Trillium's hazy IPAs, no hops are added until the whirlpool stage.

INGREDIENTS

15.2 lbs. 6.9 kg) North American 2-row malt
1.2 lbs. (0.5 kg) white wheat malt
14 oz. (400 g) flaked wheat
0.25 oz. (7 g) Mosaic® hops (whirlpool)
0.25 oz. (7 g) Citra® hops (whirlpool)
7 oz. (200 g) Mosaic® hops (dry hop)
7 oz. (200 g) Citra® hops (dry hop)
3.2 oz. (90 g) Galaxy® hops (dry hop)
1 g Whirlfloc (15 min.)
Wyeast 1318 (London Ale III), White Labs WLP066 (London Fog), Imperial Yeast A38 (Juice), or LalBrew Verdant IPA yeast
¾ cup corn sugar (if priming)

STEP BY STEP

This recipe uses a "soft water" profile. If you have high total alkalinity or high mineral content water, dilute back with reverse osmosis or distilled water. Add back small quantities of calcium chloride and gypsum at a 5:1 ratio.

Add all of the crushed grains to the mash tun and perform a single-infusion mash at 156 °F (69 °C). Mash out and collect 6.5 gallons (24.5 L) of wort in the boil kettle. Boil for 60 minutes. Add the Whirlfloc in the last 15 minutes.

When the boil is complete, adjust pH to 5.0 with lactic acid, if necessary. Chill wort to 180 °F (82 °C) and add the whirlpool hop addition. Stir wort to create a whirlpool and then allow it to settle for 10 minutes before cooling wort to 66 °F (19 °C).

Oxygenate wort (if using liquid yeast) and pitch yeast. Ferment at 66 °F (19 °C) until fermentation is complete. Within 24 hours of reaching terminal gravity, turn off any temperature control to ensure the yeast stays active and add the dry-hop additions. Open a fresh package of hops to ensure the best possible quality.

Cold crash after bioconversion is validated via a sensory panel, usually within 48–72 hours. Rack off of the hops into a keg and carbonate to 2.55 volumes.

Plan to cold condition at 30 °F (-1 °C) for at least 14 days (21 days is better). Do not move or disturb the keg. Pour out trub from the faucet every two days starting at day 7 in the keg until no more is pulled through.

EXTRACT OPTION:

Replace the grains with 8.25 lbs. (3.75 kg) light dried malt extract and 1 lb. (0.45 kg) wheat dried malt extract. Bring 6 gallons (23 L) of water to a boil and then turn off the heat. Stir in the malt extracts until fully dissolved, and then return to the heat. Boil the wort for 60 minutes. Add the Whirlfloc in the last 15 minutes.

When the boil is complete, adjust pH to 5.0 with lactic acid, if necessary. Chill wort to 180 °F (82 °C) and add the whirlpool hop addition. Stir wort to create a whirlpool and then allow it to settle for 10 minutes before cooling wort to 66 °F (19 °C).

Oxygenate wort (if using liquid yeast) and pitch yeast. Ferment at 66 °F (19 °C) until fermentation is complete. Within 24 hours of reaching terminal gravity, turn off any temperature control to ensure the yeast stays active and add the dry-hop additions. Open a fresh package of hops to ensure the best possible quality.

Follow the conditioning protocol from the all-grain recipe.



TRILLIUM BREWING CO.'S TRILLIUM CLONE

(5 gallons/19 L, all-grain)
OG = 1.047 FG = 1.000
IBU = 46 SRM = 3 ABV = 6.1%

This New England saison is one of Trillium's earliest recipes and utilizes local ingredients, including corn grown at Trillium's farm in North Stonington, Connecticut. Feel free to substitute ingredients local to you when brewing this recipe, though JC strongly recommends using Valley Malt's Danko rye malt, which is less spicy than most rye malts used for brewing.

INGREDIENTS

8 lbs. (3.6 kg) Valley Malt Pilsner malt
1.25 lbs. (0.6 kg) Valley Malt Organic Danko Rye malt
8 oz. (225 g) dent corn (milled into a powder)
10.8 AAU Sterling hops (first wort hop)
(1.2 oz./34 g at 9% alpha acids)
0.5 oz. (14 g) Saaz hops (whirlpool)
1 g Whirlfloc (15 min.)
Wyeast 3724 (Belgian Saison), White Labs WLP565 (Belgian Saison I), or SafAle BE-134
1 cup corn sugar (if priming)

STEP BY STEP

The corn will require a cereal mash. Combine the corn and 1 lb. (0.45 kg) of Pilsner malt into a pot, mix well, and add 1.25 gallons (5 L) of 125 °F (52 °C) water. Slowly raise the temperature to 205 °F (96 °C), stirring regularly. Be careful not to allow the bottom to scorch. Rest at 205 °F (96 °C) for 60 minutes, stirring every 10 minutes or so.

The primary mash uses a "soft water" profile. If you have high total alkalinity or high mineral water, dilute back with reverse osmosis or distilled water. Add back small quantities of gypsum and chloride at a 3:1 ratio.

Combine the cereal mash with the main mash to hit a temperature of 142 °F (61 °C) and slowly raise to 162 °F (72 °C) over the course of 60 minutes. Alternatively, if you are unable to heat your mash tun, do a single-infusion mash at 146 °F (63 °C) for 60 minutes. Then stir in boiling water to bring the mash temperature back to 146 °F (63 °C) for another 30 minutes (for a total mash time of 90 minutes) to try to drive as much attenuation as possible.

Mash out and collect 6.5 gallons (24.5 L) of wort on top of the first wort hops in the kettle. Boil for 60 minutes, adding the Whirlfloc in the last 15 minutes.

When the boil is complete, adjust pH to 5.0 with lactic acid, if necessary. Chill wort to 180 °F (82 °C) and add the whirlpool hop addition. Stir wort to create a whirlpool and then allow to settle for 10 minutes before cooling wort to 72 °F (22 °C).

Pitch yeast and allow the fermentation to free rise quickly to the low 80s °F (upper 20s °C), then gradually climb to high 80s or low 90s °F (low 30s °C).

When fermentation is complete, rack off the yeast and (preferably) bottle condition in thick glass bottles to 3.5 volumes with dextrose (or force carbonate in a keg). Keep bottles at 85 °F (29 C) for three weeks. Be sure to use bottles capable of handling higher carbonation levels. Validate attenuation is complete before chilling bottles. Bottles should be kept in a fridge for at least a week before enjoying. Pour decisively in a tulip to allow enough room for the foam to rise and set.

TIPS FOR SUCCESS:

Find a partial mash version of this recipe online here.

Many rye malts will have too harsh a rye spice flavor. If not using Danko Rye, JC recommends reducing the rye to about 8 oz. (225 g) and making up the difference with Pilsner malt. Substituting flaked maize is an option if you cannot get finely milled dent corn in the all-grain recipe.

JC recommends pitching about half the cell count of a normal ale fermentation per degree Plato when using the Dupont strain. This strain is notorious for the "Dupont stall," where fermentation appears to stop before reaching final gravity. The yeast should pick back up again if following the temperature increases laid out in the instructions. If you do not have a temperature-controlled chamber, try wrapping a blanket around the fermenter, using a heat pad, or other means. "Do whatever you need to keep the temperature going up. There's a very long tail of attenuation, and if any kind of cooling happens, it'll prevent the yeast from fully attenuating to 0 °Plato (1.000 SG). Sometimes it takes 10 days, sometimes 3+ weeks," JC said.



TRILLIUM BREWING CO.'S NORTH STONINGTON NEW ENGLAND LAGER CLONE

(5 gallons/19 L, all-grain)
OG = 1.047 FG = 1.008
IBU = 40 SRM = 3 ABV = 5.2%

Brewed for Trillium's 12th Anniversary, this lager is named after the town in Connecticut where Trillium's farm is located and was brewed using Trillium Farm-grown corn. Pouring a straw-yellow, North Stonington Lager presents notes of biscuit and corn chips with a moderate noble hop aroma and a light-to-medium body.

INGREDIENTS

8.7 lbs. (3.9 kg) BestMalz BEST Heidelberg malt
14 oz. (400 g) dent corn, milled to a fine powder
9.4 AAU Magnum hops (60 min.)
(0.75 oz./21 g at 12.5% alpha acids)
2 AAU Spalter Select hops (20 min.)
(0.5 oz./14 g at 4% alpha acids)
0.5 oz. (14 g) Spalter Select hops (whirlpool)
1 g Whirlfloc (15 min.)
Favorite German or Czech lager yeast
¾ cup corn sugar (if priming)

STEP BY STEP

The corn will require a cereal mash. Combine the corn and 2 lbs. (0.9 kg) of Heidelberg malt into a pot, mix well, and add 1.25 gallons (5 L) of 125 °F (52 °C) water to make a cereal mash. Slowly raise the temperature to 205 °F (96 °C), stirring regularly. Be careful not to allow the bottom to scorch. Rest at 205 °F (96 °C) for 60 minutes, stirring every 10 minutes or so.

The primary mash uses a "soft water" profile. If you have high total alkalinity or high mineral content water, dilute back with reverse osmosis or distilled water. Add back small quantities of gypsum and chloride at a 3:1 ratio.

Combine the cereal mash with the main mash to hit a temperature of 154 °F (68 °C) and keep at this temperature for 40 minutes, then mash out at 174 °F (79 °C) for 10 minutes before lautering.

Collect 6.5 gallons (24.5 L) of wort in the boil kettle. Boil for 60 minutes, adding hops as indicated and the Whirlfloc in the last 15 minutes.

When the boil is complete, adjust pH to 5.0 with lactic acid, if necessary. Chill wort to 180 °F (82 °C) and add the whirlpool hop addition. Stir wort to create a whirlpool and then allow it to settle for 10 minutes before cooling wort to 46 °F (8 °C).

Pitch your favorite German or Czech lager yeast and ferment at 46 °F (8 °C) until the gravity drops to 1.024, and then raise the temperature to 50 °F (10 °C). If able, spund when the gravity drops to 1.018. Around day 14, confirm there is no diacetyl character and then drop the temperature 4 °F (2 °C) per day until reaching 30 °F (-1 °C). Rack to a purged, pressurized, cold-sanitized keg to lager for 60 days. Go slow to prevent off-gassing.

The beer should be brilliantly clear, though you can add a fining agent at the end of lagering if desired. Carbonate to 2.8 volumes. Cold condition another week or two before serving. Pour off any trub and rack as necessary to ensure the beer is perfectly bright. Keeping it cold for another 30+ days from the last intervention will make it even better.

EXTRACT OPTION:

Replace the malt and corn with 6 lbs. (2.7 kg) Pilsner liquid malt extract and 8 oz. (14 g) unflavored corn syrup. Heat 6 gallons (23 L) of water to a boil and remove from heat. Stir in extract and corn syrup until dissolved, and then return to heat and boil for one hour. Follow the remainder of the all-grain recipe.

TIPS FOR SUCCESS:

An alternative step in this all-grain brewing process is performing a single decoction to bring the wort temperature up to the mash-out temperature of 174 °F (79 °C). If doing that, pull about one-third of the grain from the mash and bring it to a boil in a separate kettle. Shortly after reaching a boil, return the decoction portion to the main mash. JC said Trillium has never done decoction mashes — yet. "We will give it a go in 2027 and decide if we think it improves the beer . . . but we're already real happy with where it is now!"



TRILLIUM BREWING CO.'S PM DAWN CLONE (+ COCONUT VARIANT)

(5 gallons/19 L, all-grain)
OG = 1.119 FG = 1.050
IBU = 25 SRM = 70 ABV = 9.1%

INGREDIENTS

13.3 lbs. (6 kg) light Munich malt
4.8 lbs. (2.2 kg) North American 2-row malt
1.8 lbs. (0.8 kg) flaked wheat
1.3 lbs. (0.6 kg) English chocolate malt
1.3 lbs. (0.6 kg) English crystal malt (45 °L)
11 oz. (310 g) Simpsons DRC® malt
8 oz. (225 g) Simpsons brown malt
8 oz. (225 g) English black malt
8 oz. (225 g) English crystal malt (35 °L)
8 oz. (225 g) Weyermann melanoidin malt
5 oz. (140 g) Weyermann Carafa® Special Type II
5 oz. (140 g) English roasted barley
8.4 AAU (any moderate alpha hop) (60 min.)
(1.2 oz./34 g at 7% alpha acids)
3.5 oz. (100 g) coarse ground coffee
1 g Whirlfloc (15 min.)
1 tsp. yeast nutrients
Favorite characterful, attenuative British yeast
¾ cup corn sugar (if priming)

STEP BY STEP

This recipe uses a "soft water" profile. If you have high total alkalinity or high mineral content water, dilute back with reverse osmosis or distilled water. Add small quantities of calcium carbonate back into the mash to buffer the acidity of the roasted grains.

Add all of the crushed grains to the mash tun and mash at 160 °F (71 °C). Add rice hulls to the mash if you struggle to lauter imperial stouts. Mash out, collecting 6.5 gallons (24.5 L) of wort. Boil for 60 minutes. Add the hops at the start of the boil and the Whirlfloc and nutrients in the last 15 minutes.

When the boil is complete, take note of the knockout pH to assess if more calcium carbonate or *small* amount of sodium bicarbonate is needed to soften roasted malt acidity. Chill wort to 66 °F (19 °C). Pitch lots of yeast and oxygenate the wort if using liquid yeast. On day two, allow the temperature to free rise to 72 °F (22 °C). When fermentation appears nearly complete, allow the fermenter to reach room temperature to ensure yeast stays active.

After two weeks at terminal gravity, bag the coffee and place it in a sanitized, purged keg, and then rack the beer on top. After 24–36 hours (based on taste), rack the beer off of the coffee into another sanitized and purged keg, and cold crash to 30 °F (-1 °C). Carbonate to 2.4 volumes. Plan to cold condition at 30 °F (-1 °C) for at least 30 days. Do not move/disturb. Pour out trub from the faucet every two days starting at day 30 until no more is pulled through.

COCONUT VARIANT:

Trillium uses this base PM Dawn recipe for a number of variants, including one of our favorites — Coconut PM Dawn. To brew that beer, follow all of the same recipe instructions, but after racking off the coffee, add the following ingredients in bags to the keg the beer is racked to:

1.5 lbs. (0.68 kg) toasted unsweetened coconut flakes
8 oz. (225 g) toasted sweetened coconut flakes
8 oz. (225 g) untoasted coconut chips

Trillium recirculates the beer in their tanks for full coconut extraction. To mimic this on a homebrew scale, pick up and invert the keg 5–6 times daily over the course of a week while the beer conditions on the coconut. After a week, transfer slowly into the final keg to get as much beer out of the coconut as possible. Proceed with the cold conditioning described in the PM Dawn recipe.

TIPS FOR SUCCESS:

It is not advised to brew an extract version of this recipe due to the grain bill. The hop variety is not very important in this recipe, though JC recommends using one with moderate alpha acids (6–9%) to help layer in texture.

Trillium uses a custom roast coffee blend from Barrington Coffee Roasting Co., though JC suggests Barrington's Commonwealth, Monsooned Malabar, and Kalledevalapura are all good options. They use a coarse grind (i.e., French press or a number 8 grind) ideally ~1 week after roasting to off-gas less desirable volatile compounds (yes, JC says coffee can be too fresh). If using whole bean, double the amount of coffee used and allow the beer to sit on the whole beans 3–5 days. BYO

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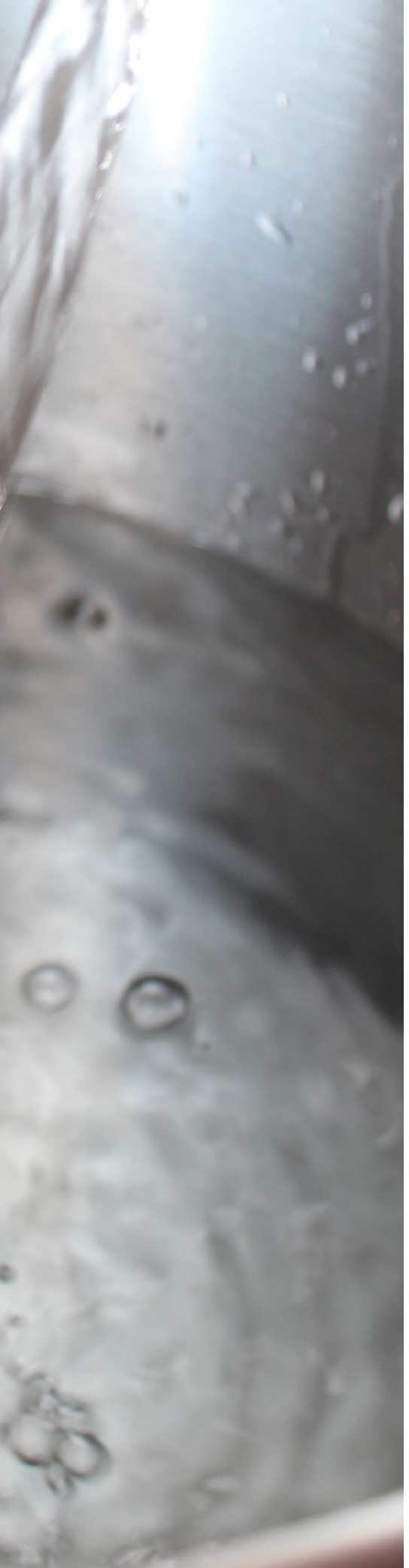


Water, Simplified

The fundamentals of water adjustments

by John Palmer

The primary reason that brewers adjust their brewing water with salt and acid additions is to achieve good mash chemistry. A better mash makes a better wort, which makes a better beer — it's as simple as that. However, it doesn't seem simple, does it? Fortunately, basic water adjustment is easier to understand once you break it down into the basic processes and steps. In this article, I will explain how to adjust your brewing water for any beer style.

Let's start with a definition of what we are trying to achieve, that being: Good mash chemistry, better wort, and better beer. Good mash chemistry means that the barley and adjunct proteins and starches enzymatically break down into essential amino acids and fermentable sugars. Generally, the mash always works. Crush the grain, put it in hot water, and you will get wort. A good analogy is doing laundry. Take dirty clothes, put them in hot water, move them around, take them out, and they will be cleaner than when you started. Of course, the question is, how clean are they? We can improve the results by adding detergents and spot removers. It's the same with the mash — we can improve our results by adding salts and acids. Again, this may seem complicated, but it really isn't. According to historic brewing journals, brewers have been adjusting water for hundreds of years before the invention of pH. They were able to adjust their water by observing the changes in clarity, flavor, and process time. The invention of pH in 1909 just enabled brewers to better gauge their results.

DEFINING THE GOAL

The enzymes in the mash rely on good conditions of temperature and pH. The preferred temperature range for good starch conversion is 149–158 °F (65–70 °C). The preferred range of pH is 5.2–5.6, as measured on a wort sample that has been cooled to room temperature (the official standard procedure). pH is a measure of chemical activity in the mash the same way that (room) temperature is a measure of activity at a high school dance. The temperature of the room doesn't cause the activity, but there is a consistent correlation between the number of people dancing and the temperature. The mash pH does not drive the enzyme activity; the chemistry of the mash drives the activity, and when conditions for the enzymes are favorable, the pH is generally in the range of 5.2–5.6. (Actually, the enzymes are more active at pH 5.6–6.0, but so is tannin extraction, so brewers have habitually used a lower but still efficacious pH range to get better beer flavor.) So, the question becomes, how do we create these fa-

"According to historic brewing journals, brewers have been adjusting water for hundreds of years before the invention of pH."

vorable conditions in the mash? Usually, the answer is by adding calcium salts and reducing the alkalinity of the brewing water.

DEFINING THE PROBLEMS

Fortunately, the mash generally works all by itself. You crush the grain, add hot water, and chemistry happens. Enzymes are released from the malt that break down storage proteins in the kernel, creating lots of smaller proteins, peptides, and amino acids. Phosphates in the malt react with calcium and magnesium in the water (and from the malt) to produce hydrogen ions that make the mash more chemically active. In other words, calcium and magnesium react with malt phosphates to produce favorable conditions for enzymatic activity. However, two problems arise. First, the alkalinity of the water — basically bicarbonate and hydroxide ions — absorbs the hydrogen ions as they are produced. This is called buffering — the alkalinity in the water buffers the calcium-phosphate reaction and reduces the creation of favorable conditions, which we measure as pH. The solution is to reduce the alkalinity of the water with acid additions. Brewing water software can calculate the correct amounts of specific acids to do this for you.

The second problem is generally not enough calcium. The reaction stalls out because there is not enough calcium in the water to react with all the phosphates. This is why we are usually adding calcium salts to the brewing water. These two problems and solutions come together in a concept we call residual alkalinity. We compare the amount of calcium and magnesium in the water with the total alkalinity and calculate its effect on the mash. A positive value of residual alkalinity means that there is more alkalinity than hardness in the water and the alkaline buffering will keep the mash pH above our target range. A negative value of residual alkalinity means that there is more hardness than alkalinity and the calcium phosphate reactions will push the pH towards our target range. Those calculations are thoroughly covered in my books, *How To Brew* and *Water – A Comprehensive Guide for Brewers* (co-authored by Colin Kominski), but modern brewing software and apps will do this for you.

However, there is another side of this equation that we have mostly ignored up until now, and that is the chemistry of the malt. In addition to the malt phosphates, malt has naturally occurring acids and buffers that also affect the overall chemistry of the mash. And this is where the chemistry really does get complicated, but we can take a step back and look at the overall effect instead.

The color of the malt is a generally good indicator of how acidic or alkaline it is. Base malt tends to be slightly alkaline — if you mash it in distilled water (i.e., zero minerals), you will generally get a mash pH of 5.8 to 6.0, which is a bit higher (more alkaline) than the target range of 5.2–5.6. As you toast the malt, such as the Vienna and Munich malts, the color of the malt deepens due to the creation of melanoidins and more acidic buffering compounds that will help move the mash pH to the target range. This is especially true of the caramel malts, which can have a distilled water mash pH of ~4.6, for example. As the color of the malt increases, the acidity increases, from moderate but useful values for C20, C40, etc., all the way to C120 (120 °Lovibond). After 120 °L, though, the higher kilning and roasting temperatures start to pyrolyze (burn) the acidic buffering compounds, making them less effec-



Photo courtesy of Shutterstock.com

Mash chemistry is the result of water chemistry and malt chemistry, so the grains in a recipe must be taken into consideration when making water adjustments.

tive. The acidity of roasted malts like chocolate malt and roasted barley is less than the darkest caramel malts but more than the lighter. Generally, the acidity of roasted malts does vary with malt color and lies in the middle of the range of the acidity of caramel malts, but is still lower than our target mash pH range.

ORGANIZING THE SOLUTION

The most common advice for adjusting water is simply to add calcium salts. The goal of adding these salts is to get in the range of 50–150 ppm (mg/L) in the water going into the mash. I will discuss which calcium salts to add and why later in this article. Remember, we are adjusting the water to improve the mash chemistry. The mash chemistry is the result of the water chemistry and the malt chemistry. The water chemistry is the result of the effects of water hardness (calcium and magnesium) reacting with malt phosphates to bring the mash pH down and the water alkalinity buffering that reaction. Therefore, we generally want more hardness than alkalinity in our water. The malt chemistry is the weighted sum of the malt bill's alkalinities and acidities, and we estimate this by looking at the overall color (both hue and intensity) and strength (OG) of the wort. We could measure all this in the lab, but generally looking at the overall color is sufficient to get us in the ballpark.

The basis of making your water adjustments is understanding this balance: Hardness (calcium and magnesium), alkalinity, and recipe color. Generally speaking, your pale beer recipes (base malt only or low specialty malts) need help getting the pH to the target range, often requiring acid neutralization of the water's alkalinity in addition to the calcium addition. Amber beer recipes (beer color of 7–15 SRM or 15–30 EBC) generally will hit the target mash pH range without acid additions, but calcium additions are generally recommended. Dark beer recipes, on the other hand, often need alkalinity additions in addition to the calcium additions to balance the overall acidity of the grain bill. Getting a feel for this interaction and balance takes experience and practice, but brewing software can help you navigate these waters.

Here are some general brewing guidelines to help you:

- Calcium levels in the brewing water should be at least 50 ppm for good mash chemistry. Between 50–100 ppm is generally better, and up to 150 ppm is good for robust pale styles like West Coast IPA.
- The total alkalinity level in the brewing water should be 0–50 ppm for pale beers (but usually 0), 50–75 ppm for amber and copper beers, and 75–125 ppm for brown to black beers.
- My recommendations are for the residual alkalinity to be –100 to –25 ppm for pale beers, –25 to 50 ppm for amber beers, and 50 to 100 ppm for dark beers.
- The actual amount of adjustment you need will vary with the total percentage of specialty malts and the OG of your mash (i.e., hue, intensity, and OG).
- These are rules, which are meant to enforce the guidelines, that are derived from the principles that suffice until you really understand how it works. In other words, relax and just see what happens this time. But be sure to take good notes.

Your brewing software can calculate these values for you based on the water report for your source water and your salt and acid additions.

THE SECOND REASON WE ADJUST BREWING WATER — FLAVOR

The minerals in the water support the flavors of the beer. This should be obvious. Brewing is cooking, and the dissolved salts in the water are the seasoning. Let's keep this in perspective — the primary reason we adjust water is to improve the starch conversion in the mash, and we generally do this by adding calcium salts. But our choice of salts can have secondary effects on the overall beer flavor, and that is what we are going to discuss now.

The first aspect of these secondary effects is the sulfate-to-chloride ratio. The typical brewing salts that we add to water are calcium sulfate (gypsum), calcium chloride, magnesium sulfate (Epsom salt), sodium bicarbonate (baking soda), and sodium chloride (non-iodized table salt). Each of these salts contributes a primary ion that affects pH (calcium, magnesium, or bicarbonate) and/or a secondary ion that subtly affects flavor (sulfate, chloride, and sodium). Sulfate dries out the mouthfeel of a beer, making it more "crisp" and making the hop character more assertive. Chloride accentuates the malt character of the beer, making it rounder, fuller, and slightly sweeter. Sodium can go either way — it can accentuate the malt character in conjunction with chloride, or it can accentuate the dryness with sulfate. It depends on which of the two is more dominant. Too much sodium with chloride will taste salty, and too much sodium with sulfate can taste minerally or even metallic.

The sulfate-to-chloride ratio helps us understand how our calcium salt additions will affect the flavor balance of our beer. A 2:1 ratio of sulfate-to-chloride will taste drier and crisper than a 1:1 ratio. A 1:2 ratio of sulfate-to-chloride will accentuate the malt character and make the beer taste rounder and slightly sweeter. You can go higher with the sulfate-to-chloride ratio, such as 4:1, and this would be appropriate for an assertive beer like an IPA. I don't recommend going higher in the other direction, such as 1:4, because these beers can often seem flabby or cloying, but it can work for styles like hazy IPA or milkshake IPA.

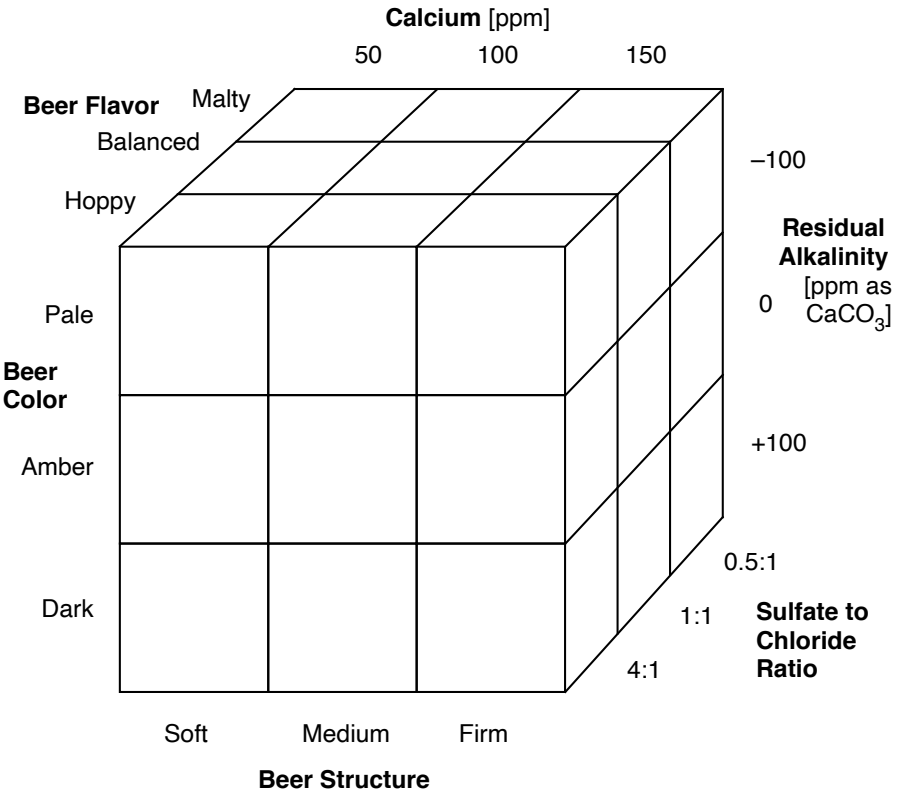
The final aspect of how these salts affect flavor is one of magnitude. How much seasoning are you adding to the water and to the beer? We characterize this aspect by looking at our final dissolved calcium level. Zero to 50 ppm is a low concentration, 50–100 ppm is medium, and 100–150 ppm is high. These levels can be equated

to light, medium, and heavy seasoning. I think of them as soft, medium, and firm mineral structure that support the flavors of the beer. Most beer styles are in the soft and medium categories; only a few like Dortmunder export, Burton ale, and West Coast IPA really fall in the firm category. The same goes for your sulfate and chloride levels. Generally, you don't want to exceed 150 ppm of anything, but sulfate is the exception. Levels up to 300 ppm are still palatable, though I rarely see levels exceeding 200 ppm, even for West Coast IPAs. Chloride levels in hazy IPA and milkshake IPA can hit 200 ppm, but beyond that does not really add any more flavor.

Do not try to adjust your water primarily on these secondary effects! Yes, these secondary effects should be part of your decision process, but the first goal is achieving target mash pH. Once you have dialed that in with your brewing software, you can tweak your sulfate and chloride levels and the overall mineral structure to suit the style.

BRINGING IT ALL TOGETHER

Figure 1 is from my book, *How To Brew* (Brewers Publications, 2017). I call it the Brew Cube, and its purpose is to help you visualize how water profile parameters relate to style parameters. The overall color of the beer style or recipe indicates the malt chemistry that will combine with the residual alkalinity of the water to help achieve the target mash pH range. For example, an amber beer style likely has enough malt acidity from specialty malts to achieve mash pH if the water's residual alkalinity is near zero, which is to say (–)25 to +25, maybe even up to +50 depending on the grain bill. The flavor balance of the style — malty, balanced, or hoppy — corresponds to the sulfate-to-chloride ratio, and the beer structure — soft, medium, or firm — corresponds to the total amount of calcium in the water, both what was there to begin and your additions. The total amount of sulfate and chloride in the water most often depends on your calcium salt additions. The brew cube shows how these factors relate and why water adjustment for a particular style can be relatively simple.



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The Brew Cube illustrates how your water profile can be matched to the beer style. The beer color correlates to the residual alkalinity of the water. The flavor balance of the style correlates to the sulfate-to-chloride ratio. And the calcium level correlates to the mineral structure of the style. Water adjustment doesn't need to get more specific than this. There is no single perfect recipe for a style because everyone's taste preferences are different. The important thing to see here is how style parameters and water parameters relate to one another to help you make the best beer possible.

For example, let's look at a Kölsch. This is a soft, malty but dry beer that is perfect for a sunny afternoon at an outdoor café. We will need to neutralize the alkalinity in the water with acid or start with distilled water (which is what I would do). Next, we want to add a blend of calcium salts to achieve a more balanced sulfate-to-chloride ratio of 1:1, softly malty yet dry. I would aim for about 75 ppm of total calcium. This would also yield about 75 ppm of sulfate and chloride if you add gypsum and calcium chloride equally. Without getting into the calculations (see your favorite brewing software), this would yield a residual alkalinity of about –50 ppm as calcium carbonate, which should get us into our target range of 5.2–5.6 pH. However, you should verify your result with a pH meter. One or two milliliters of acid (such as lactic or phosphoric) may be needed to get closer to the 5.2 end of the range, which tends to be better tasting for these lighter, primarily base-malt styles. The mash will work regardless; we are just trying to improve it and entertain our creative/mad-scientist persona.

Take these recommendations with a grain of salt and try it. Brewing is cooking, and you are the chef. No matter what happens, it will be beer, but it may be the best beer you have ever made. BYO

Related Link:

If you want to take your beers to the next level, master some of the ways to get your post-boil wort's pH within the happy range of around 5.1–5.5.
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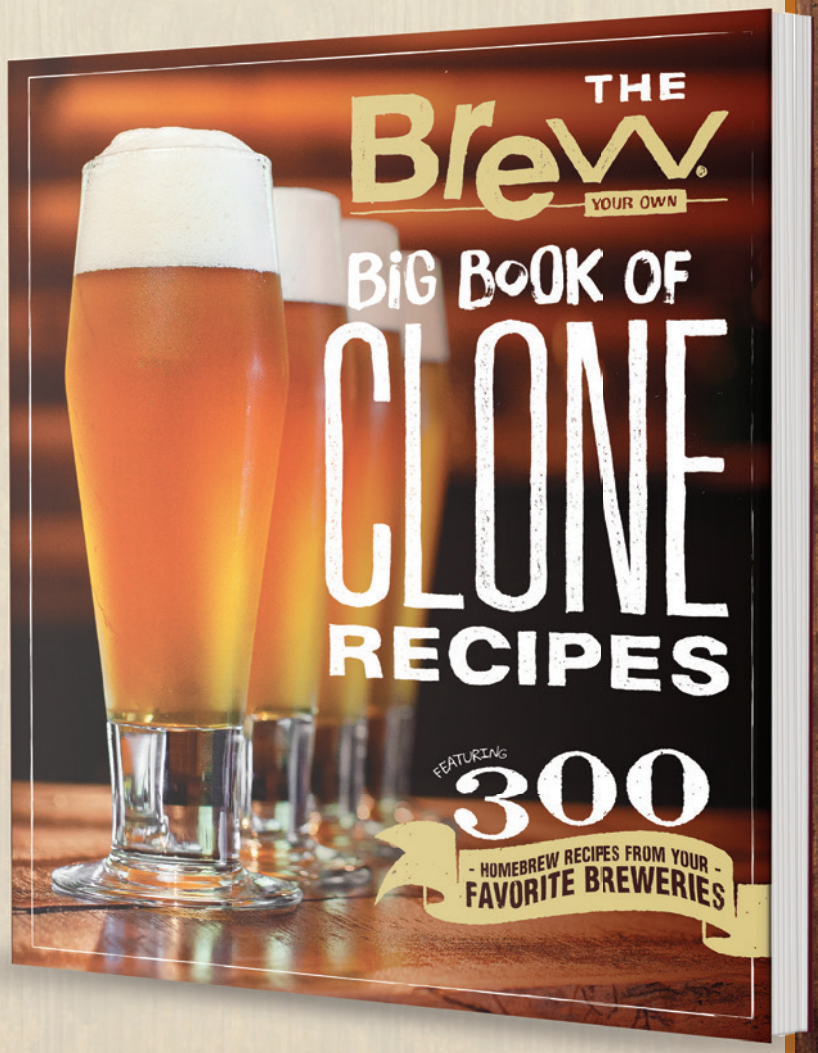

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BY DREW BEECHUM & DENNY CONN

STUCK ~~SPARGES~~ LAUTERS

Why they stick and how to unstick 'em

Of all the brew day steps fraught with anxiety, the worst is a dropped glass carboy. Now, if you follow our recommendations and don't use carboys anymore, the dreaded stuck sparge gets promoted to the top spot. You open the mash tun valve (or your preferred mechanism to officially let the wort fly), but instead of being greeted with a steady flow of sugary malt goodness, you are confronted with a disappointing drip of no joy. The gremlins have struck!

But no need to look to the sky for Mash-Man to come rescue you. You are a complete brewer. You have the tools to ensure a free-flowing mash.

We're not worried about a stuck sparge — we're worried about a stuck lauter.

IT HAPPENS TO THE BEST OF US

We speak of this from experience — or at least Drew does, with one of his early batches. Picture this — it's February 2001, a bright SoCal winter's day of 60 °F (16 °C), and Drew decided to join an early morning crew for a club brew. It started with big plans: "Let's make a double decocted Bohemian Pilsner with proper undermodified Moravian Pilsner malt!" Look, these are the bets you make with yourself from a place of blissed-out ignorance because the crew thought "we'll just put this through a low rest and a high rest, and beer!" Turns out that "undermodified" thing was important and the batch stuck.

When Drew says "stuck," you might be thinking "oh, it flowed really slowly and it just took a while." Dear reader, when Drew says stuck about this batch, he means half shy of concrete. It was barley goo. Not a drip dripping! Nothing doing. The crew tried most of the things spelled out in the article and finally had to accept 20ish gallons (~75 L) of imperial Pilsner (1.127 OG) instead of the 40+ gallons (150+ L) of 1.060 Pils they intended.

Also, instead of the intentionally long brew day ending around 5 p.m., Drew closed up the clubhouse at midnight. This might be why he remains allergic to decoction mashing two and a half decades on!

WHY DO WE DO THIS?

All things considered, what we think of as the typical "mash/lauter/sparge" routine is a relatively recent trend. For millennia, brewers brewed slightly settled "porridge" filtered via straw (ala Akkadian, Babylonian, and Egyptian). Medieval brewers used techniques like woven baskets driven into the mash with wort dippered out. And more modern practices used multiple mashes to create several beers instead of lautering (which we recommend everyone try at least once – see partigyle brewing).

In the early 1800s, the Germans popularized what we think of as fly sparging — rinse the grains, save money by extracting every bit of sugar, and combine the wort into one kettle for energy and labor efficiency. This, FYI, is a gross simplification of history and the many varied techniques still in use around the world today.

And for the longest time, all-grain homebrewers copied the fly sparging brewing technique <points at the big brewery kettle> "because that's how it's done." But, naturally, homebrewing is a different cup of tea, and we can do things that aren't practical on the big scale. Large stainless-steel vessels are serious expenditures of capital and space on the commercial scale. For homebrewers, what's the difference between a 5- and 10-gallon (19- and 38-L) pot? So, homebrewers rediscovered different ways to sparge



Photo by Charles A. Parker/Images Plus

The grains you use and how they are crushed both impact how wort flows through the mash.

and lauter — like batch sparging or the even more heretical full-volume Brew-In-A-Bag (BIAB) mash.

Given the de-emphasis on sparging, you may wonder why we are still devoting a full column to the subject? Simple, because we're not worried about a stuck sparge — we're worried about a stuck lauter. Whether or not we rinse the grains matters not a single whit, just whether we can separate the liquid from mash solids.

WHAT WENT WRONG?

On a normal brew day, you expect that as the mash ends, you can open a valve or lift a basket or bag, and wort freely flows from the confines of our barley gruel. If we're sparging at all, we'd expect the water to flood the mash and soak through all the nooks and crannies to extract all the sugar we've just shepherded into creation. But clearly, it's all gone wrong, and we must put on our very best thinking caps to suss out why.

The Mechanical

The first thing to check is the dreaded "duh" check. Are we sure the system is set up correctly? Are all the appropriate valves open? Have the vital pumps been primed? Is the filtering mechanism still in place? We cannot tell you the number of times we've accidentally knocked loose a vital hose or pipe in the process of enthusiastic mash stirring. So, first step — stop, take a breath, and physically use a finger to trace the flow path. Are there any hoses kinked or closed connections?

Next is the dreaded blockage. Are your valves clear and flowing? Particularly with earlier model all-in-one setups, the included pumps could easily get jammed with grain, which caused recirculation problems. And ball valves are notorious for their tendency to jam. An easy way to tell if there's a blockage is to work backward through the system, unhooking connections one at a time. (Keep a pitcher in hand to catch any drips or sudden dramatic dam bursts.) Speed is another concern here — did you attempt to fleetly flow like a champion thoroughbred out of the gate? You could have inadvertently created a massive suction event that compacted the grain bed with enough vigor to stymie all flows. This is particularly a problem if you have a pump on your mash tun and aren't careful! Try reflooding and remixing the grain bed, then start with a gentle stream instead of a raging torrent.

One last thing to check — were you trying to exceed the weight rating of your mash filtration device? When we used to use braids for filters, this could be a real problem. Get enough wet mash on top of a flimsy braid or plate, and it will collapse, cutting off your flow. (The solution: Remove some of the mash and filter it separately!)

Goo Factor Ten

Assuming that your mechanicals are sound, the next step is to break into the mash itself and understand why we've made a big ball of dough instead of a happy-go-lucky barley soup. Starting with the basics — did you actually add enough water to the mash? If the mash is too thick, it won't flow. Remember that grain will soak up approximately a half pint of water per pound of grain (which at a typical mash ratio is ~20–25% of your strike liquid). Normally this shouldn't be a problem since the average recipe design will account for it. But when you're being a daring and intrepid brewer and doing extreme things (like a super high-gravity brew or squeezing every last pint of capacity out of your system), you'll be tempted to short the mash water-to-grain capacity. Our recommendation is don't go below 1 quart/pound (2 L/kg) to avoid this and other problems that may arise from a stiff mash.

The Grain Itself

Barley has been specifically tailored by brewers to be the perfect grain for making beer. With modern malts and proper mashing routines, the barley shouldn't be an issue. (For the exception, see Drew's story at the jump, "stupid old-fashioned malts needing to be mollycoddled with a beta-glucan rest of 105 °F/41 °C.") It's when you step outside the modern barley zone that things become more worrisome. With so many of today's recipes calling for large doses of wheat, oats, rye, and more, you may run into trouble. Oats and rye, in particular, can lead to very gummy mashes from the complex starches and proteins in the grains. Think about how sticky a bowl of oatmeal gets and imagine trying to pull water from that mass!

At recommended usage levels (0–20% for rye/oats, 70% for wheat in Bavarian hefeweizen — eep!), you usually won't see much of a problem — there's not enough goo and more than enough husk material to keep your mash flowing. Remember, barley has the all-important husk material where brewing oats, rye, and wheat generally don't. When you start going above these levels, an addition of rice hulls is cheap insurance to keep your hair attached to your scalp and the wort flowing through the grain bed.

I've Cracked and Lost My Groove

We may have overstated how easy working with barley is. It can also be problematic, but generally only when we make a mistake by crushing the grain too fine. (Homebrewers more commonly have the opposite problem — a too coarse crush that never converts completely and keeps starch and sugar to itself). While our motto is "crush until you're scared, and then crush a little more," you can overdo it. You want the barley crushed into tiny grit with some powder and mostly intact barley husks to serve as liquid conduits. Too much flour and you will create a husky barley flatbread dough. Word of advice: Set your mill, but always double-check your crush before mashing in! Think cornmeal, not all-purpose flour!

HOW DO I FIX IT?

By now, you've come to one of two conclusions — "Aha! That's the culprit," or "Dude, I literally do not care, just get me out of this situation." Either way, let's find out what solutions we have for you. First, stop and take a moment. You have time to frizzle away the frazzle. Maybe a sip or two of beer, and then onward.

Preventative Measures

It's better to prevent a problem than to fix it. To that end, if you have any worries or paranoia, use rice hulls. When Drew and the Maltose Falcons ran a large 55-gallon (210-L) brew system, the rule of thumb was always to add rice hulls to prevent problems from the weight of the mash. For home use, adding a pound (0.45 kg) of the flavorless husk material that costs a couple bucks to a 5- or 10-gallon (19- or 38-L) batch prevents your brew day with $50+ worth of ingredients from becoming a dreaded hassle.

You can mix them into the grain, sprinkle them on the bottom or stir them into the mash (even a stuck one). Some advocate for soaking or cleaning the hulls first, but we've never bothered. They also work great with a brew-in-a-bag/basket setup.

Hindsight Isn't Helping

You didn't add rice hulls, so now what? Let's run the list of potential fixes from gentle to meaningful violence. After these techniques, you'll want to recirculate the run-off as you're intentionally disturbing the mash bed. Make sure to start with a slow run-off to avoid resetting the bed.

- **Cut & Stir** – A gentle cutting of the mash or a stir, all the way to the filter mechanism, may be enough to break whatever has clogged the filter bed. (And you can add rice hulls here, too.)

- **Blowback** – Sometimes pushing water, air, CO_2, etc. through the outlet can clear a blockage in the filter mechanism/valve. Be wary though, this is often a very temporary fix with 10–30 seconds of flow. It could even unseat an internal connection.

- **The Float** – A more intense form of the blowback. Push a gallon (4 L) or more of water back through the outlet, give a quick stir, and go. You could just add water to the mash and stir, but underletting is used in a lot of professional setups as a way to clear the lauter.

- **The Hail Mary** – None of the previous steps have helped? Well, that's no good. We've crossed the line from gentle solutions to full-on manhandling. It's time to get "violent," and by violent, we mean carefully and gently removing the mash, checking the whole system, rewarming the mash with hot water infusions and rice hulls. Basically, at this point you're trying to create a new lautering bed. It may work. It may not. There may be hot-side aeration. There may be tears.

The other thing to stop and consider at this point is whether the labor is worth the end product? You'll notice that Drew's first story ended up with a shorted volume at higher gravity. The crew decided to wait and see what they could slowly collect over the course of hours before boiling. For Drew's first "Winter Saison" project, he and a brew partner got into the same world of hurt, and instead of collecting 11 gallons (42 L) of 1.080 wort, they sat, ate a burrito, drank a Fantôme, and decided to throw in the towel — only to discover 5.5 gallons (21 L) at 1.120 wort waiting to be boiled!

And finally, you might just have to bite the bullet and realize "well, I done goofed and wasted a day." And that's OK. There isn't a single one of us who gets through life being perfect with an unblemished record. Take it as a chance to learn so you hopefully, maybe, don't make the same mistake again.

REFLECTIONS ON A FAILED MASH

1. Did something change in your system? Maybe something obvious like a new false bottom or mill, or something less "mash-oriented" like a pump.
2. Did you change your process? A little change — including things like changes to water chemistry, the way you began your run-off, or your milling process. The number of times milling has bitten us in the butt is too great to count. Always watch your crush so that it's not too fine (making a claggy mash ball) or too coarse (leading to low efficiency).
3. Did you use a new ingredient? Remember at the jump with Drew's hellish decoction mash and a previously unused "undermodified" malt. They should have done some reading first to know what it needed!
   a. Don't be afraid to reach out to a malt company as well. They can usually tell where a grain can steer you wrong. They have a ton of scientists on staff specifically to understand what their product needs!
   b. On that undermodified malt bit – other than romanticism, there's relatively little practical flavor reason to use them these days, but if you feel the calling — the yearning for the olden days of brewing — look up older mash schedules that include rests in the 95–100 °F (35–38 °C) range to activate enzymes that will remove the gum.
4. Lastly, consider: Did you anger the beer gods recently? Consider repenting by brewing a simple batch to prove your humbleness (and prove out your process again).

Remember, the brewing war story may not be worth the time, tears, aggravation, and sweat. It's OK to toss in the towel. We're hobbyists — this is our downtime. This is fun, and if you're not having fun, it's OK to chuck the mash and come back another day. There's no great brewing professor in the sky grading your efforts to determine what beer you get in the afterlife!

So, our last lesson, the last fix in the list — give yourself some patience. Give yourself some grace. And maybe give that stuck lauter one more gentle stir. BYO

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- *Learn more about the ideal crush size for your grain and how it impacts your brew:*
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BY JULIE RHODES

SOCIAL MEDIA FOR NANOBREWERIES

A welcome mat, not a cash register

You didn't get into brewing because you love making content. You got into it because you love making beer. So, here's something that might surprise you coming from a marketing professional: Social media is not the most important marketing you'll do for your beverage brand. It's necessary, don't get me wrong. It's also mostly free, which is exactly why so many small breweries lean on it way too hard.

Here's the big problem with building your whole plan on Instagram: It's rented land. If Meta shut down tomorrow, how would you reach your fans? You don't own your followers. You can't contact them whenever you want. The platform decides who sees your posts, the algorithm changes overnight, and if your account gets hacked or suspended, good luck finding a human to help you. But don't panic and start deleting your handles after this paragraph. What you want is a balance: Social media to build brand awareness, plus other channels that let you actually own your audience. You need both — so think of social media as your welcome mat, not your cash register. Its job isn't to ring up sales; it's to build community, put your brewery in people's heads, and guide potential customers over to the channels you do own. Paired with email and a decent website, it becomes a real brand growth engine. Used alone, it's a treadmill. Let's talk about how to stop running in place.

SOME BASICS FIRST

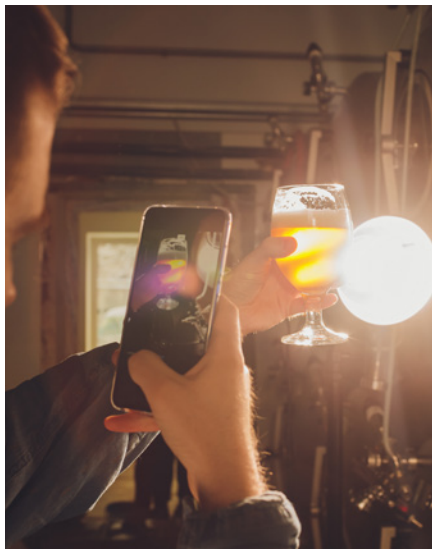
For the folks with no marketing background, let's tackle some building blocks first. The term you'll hear the most is "brand awareness." As in, "I need to build brand awareness for my nanobrewery." I have a marketing degree, and even I think most of this vocabulary is overcomplicated, so here's the plain version. All "brand awareness" really means is how well people know and remember your brewery. Brand awareness leads to visits, and visits lead to revenue; it's that simple. The first type of awareness is recognition. Picture this: Someone is scrolling their phone on the couch, your label or taproom flashes by, and their brain goes "hey, I know that place." The second type of awareness is recall, and this one is the real moneymaker. A great example of recall is when people in a group chat are deciding where to go this Friday night, and someone mentions your brewery by name.

What this means for your social media content is that every post you make is a deposit towards one of those two moments. And you need both of these things, because people buy from brands they know, like, and trust. Social media is where a small brewery starts building all three through brand awareness.

PICK YOUR CHANNELS BASED ON WHO YOU'RE TRYING TO REACH

Deciding where to post on social media should be based on the audience you're trying to reach, not on which apps you happen to use personally. Every platform skews and performs differently. Instagram is your visual storefront for roughly the 25-to-45 crowd. Facebook still quietly drives event attendance, community groups, and the 40-plus market. TikTok and YouTube Shorts reach the under-30s who are still forming their brand loyalties. Even LinkedIn has a use if private events and distribution sales are a revenue stream for you. You don't need them all. One or two

What you want is a balance: Social media to build brand awareness, plus other channels that let you actually own your audience.



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channels with real attention behind them beats five neglected ones every time.

SOCIAL MEDIA IS THE NEW SEARCH ENGINE

A big chunk of consumers, and more than half of Gen Z, now skip Google entirely and search directly on Instagram, TikTok, and YouTube. When someone new to town types "breweries near me with a patio," your profile could be their search result (that's what you want), so treat social media like a search engine. Put your city and neighborhood in your profile bio. Write captions with the words real customers actually use: "family friendly," "dog friendly," "live music," "food truck," your town's name, and yes, beer styles too. Before you hit post, ask yourself: Is this something my customers would actually search for or talk about? Somebody searching "hazy IPA in [your city]" should land on you if that's your thing. Hashtags work the same way; they're keywords, not decoration or fancy marketing; they serve a purpose. Mix broad ones (#craftbeer, #hazyipa), local ones (#yourtownbeer), and specific ones like your brewery or beer names.

Don't forget that occasions are searchable too. Your customers aren't necessarily hunting for "West Coast-style IPA with Simcoe® hops and a 40 IBU finish." They're looking for a patio beer, somewhere to take the in-laws, a spot to wind down after kickball league night. So put the occasion right in the caption and hashtags: "post-trail pints" with #patioseason, or "date night, but make it flights" with #datenightideas. Talk about when and where your beer fits into their lives, not just what's in the tank. Save the deep hop chemistry conversation for the beer nerds at the bar. We love them, but they've probably already found you; we're trying to reach the customers that haven't discovered you yet.

QUALITY OVER QUANTITY, AND SCRAPPY BEATS POLISHED

The old social media advice was to post every day and feed the machine. Forget that; the algorithm has evolved since then. The platforms now reward content people actually engage with, which means one thoughtful post that starts conversations will outperform five throwaways. Posting less but posting better is a legitimate strategy, and for a lean team it makes perfect sense.

Now, "better" does not mean fancier. Short-form video keeps earning more reach than anything else you can post, and audiences have gotten very good at smelling stock photos, overproduced gloss, and "AI slop." What stops the scroll is a real human doing a real brewery thing: You in your boots dry-hopping a tank or pulling the first pint of a new batch. You do visually interesting work every day that most businesses would kill for. Prop your phone against a bucket, film 20 seconds, talk like you'd talk to a customer at the bar, done. No editing, no polishing, just hit publish.

Not sure what to film? Short-form video tends to perform best when it hits one of four themes:

- **Education:** How to pour a proper pint, or what dry hopping actually does.
- **Entertainment:** The unglamorous reality of cleaning kegs, or your dog supervising the brew day.
- **Inspiration:** The story behind a recipe name, or your first janky setup next to what you run now.
- **Social proof:** A packed trivia night, or a stellar taproom or beer review.

And nobody needs acting lessons for any of this. If talking to a camera feels painful, shoot a time-lapse of a brew day and lay your own audio over it, or just capture the small, intimate tidbits of brewery life nobody else gets to see. Authentic beats scripted, every single time.

CONVERSATIONS AND CONNECTION BEAT LIKES AND VIEWS

Repeat after me: Followers, likes, and views are vanity metrics. They feel good and give you that sweet shot of serotonin, but literally tell you almost nothing about whether your marketing is working. What actually matters — to the algorithm and your bottom line — is engagement: Comments, shares, saves, and direct messages. A like takes zero effort. A comment, a share, or a DM takes real effort, and effort (engagement) is what builds a bond with your brand. So build posts people can respond to: Ask questions, run polls, tell them to tag their friends. Give every post a job: Tag the friend you'd bring, vote in the comments, click the link to RSVP, subscribe through the link in our bio. If a post doesn't ask your audience to do anything, they'll do exactly that and keep scrolling.

Then show up in the conversation yourself, because engagement is something you do, not just something you collect. Follow this rule: You have to give what you want to get. Spend 5–10 minutes a day being a good digital neighbor. Reply to comments and DMs; most people now expect a response within a day, the same way they'd expect a bartender to acknowledge them at the rail. Comment on posts from the coffee shop down the street, your food truck partners, or the local run club. Their followers see your name pop up again and again, and recognition starts before anyone tastes a drop of your beer, and community is the key to success for beer brands and social media.

EVERY SO OFTEN, POINT THEM TOWARDS CHANNELS YOU OWN

The social media "welcome mat" has a very important purpose: It leads people through the door. On social channels, that means occasionally steering followers toward your owned channels, where you can actually track a sale when it happens. Promote your email list with a real reason to join, like early access to releases or a birthday pint, and make signing up easy with a link in your bio and a QR code on the tables. Push event RSVPs to your website. If Instagram disappeared tomorrow, your email list and website are what's left standing, so treat every social follower as a future subscriber and regular customer.

DOING ALL THIS IN A FEW HOURS A WEEK

None of this matters if it doesn't fit your actual bandwidth, so here's my teacher-hat moment. Build a social media content bank. Decision fatigue can kill your consistency, so

stop deciding from scratch every day. Keep a running list of themes: What's on tap, behind the scenes, staff spotlights, the story behind a recipe name, upcoming events, how to pair or serve your beers, to-go options. When it's time to post, pick from the list instead of staring at a blinking cursor. Using this system, you will post higher quality content and not feel so stressed about what to post.

Batch and schedule. Once or twice a month, sit down with a beer (quality control, obviously) and build a few weeks of posts in one sitting (start with one week — baby steps, my friends). Canva can help you edit photos and graphics, and a scheduler like Publer, Later, or Meta's free Business Suite can publish while you're mashing in or doing payroll. Plan about 80 percent of your content ahead of time and leave the rest for spontaneous, real moments. Snap a couple of photos or videos each week and dump them in a folder. Future you will say thank you.

LET YOUR CUSTOMERS DO THE TALKING

A stranger trusts a customer's photo or video of your full patio far more than they trust your marketing. So ask for it. Put a small sign by the register: Tag us, show us, get a sticker or a discounted flight. Repost every customer photo you're tagged in; it costs nothing and makes that customer feel like a regular. This is called user-generated content and is a boss move for any emerging brand. Create a branded hashtag, print it on your menu, and let the community drive it in the algorithm. Do the same with Google reviews; the more the better, even the bad ones; bonus points for responding to reviews too, because the internet search engine bots love a good business listing with a lot of reviews and engagement.

LAST CALL

If you remember one thing, make it this: Social media was never designed to be your cash register, and the breweries that treat it like one end up frustrated, burned out, and convinced that marketing doesn't work. I watch it happen every year. Marketing does work. It just works in a specific order: Pick the one or two channels where your people actually are, show up as your real, unpolished, unmistakable self, start conversations instead of collecting likes, and keep walking those followers toward the land you own; your email list, your website, and, ultimately, your taproom.

Related Link:

• *Social media is just one part of marketing your brewery. Should you be spending money through other marketing outlets? Get advice for budgeting for marketing:* **www.byo.com/articles/marketing-spend-how-to-plan-and-budget-for-your-nano**

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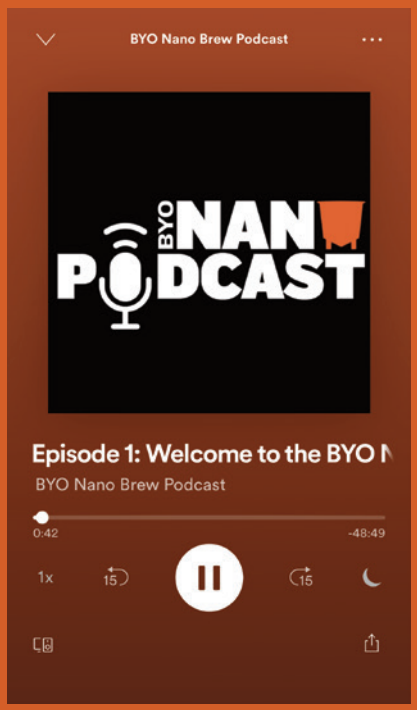

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BY DARLYN VICTOR

FROM POT TO PODIUM

A homebrew's journey to craft glory

In 2019, a blonde ale I named Chargie was my very first attempt at homebrewing. Today, that same blonde ale holds an achievement I could never have imagined when I brewed that first batch: A gold medal-winning beer at the 2026 World Beer Cup and the title of Best Blonde Ale in the World.

My first batch of Chargie included malt extract and grains. At the time, I knew very little about water profiles or recipe development. My goal was simply to complete a brew day from beginning to end and understand the process. The resulting beer was mediocre at best, but the experience accomplished something much more important — it made me want to understand why beer turns out the way it does.

I dove into brewing science, particularly water chemistry and mineral profiles. I had started with a small MoreBeer! brewing kit, but by my second batch of Chargie, I had already upgraded to an Ss Brewtech 20-gallon (76-L) electric brewing system.

Batch number two was an entirely different experience. First, Chargie became an all-grain beer. I maintained precise mash temperatures, continuously recirculated the mash for the full hour, and sparged for the first time. That batch went on to win second place in a homebrewing competition.

From there, I resisted the temptation to constantly reinvent the recipe. Instead, I made small, deliberate changes, learning from each batch and dialing in the beer one variable at a time. I entered it into homebrew competitions throughout our area and it repeatedly took first place.

Eventually, my wife, Ana Rodriguez de Vera, and I decided to turn our passion into a career by opening Hopsized Brewing Company in Bonita Springs, Florida. Only four months after opening our doors, we entered Chargie and two other beers into a statewide brewing competition. All three won gold, helping Hopsized earn the title of Best Small Brewery in Florida for 2023. We continued entering Chargie in subsequent years and continued earning medals.

One challenge I had feared — scaling a homebrew recipe to a professional brewhouse — proved surprisingly straightforward. Using BeerSmith, we scaled Chargie to our professional Ss Brewtech system while maintaining the recipe's percentages and ratios. That allowed us to preserve the character of the original beer while brewing it consistently at commercial scale. We continue using BeerSmith today.

In 2026, we decided to put Chargie on the biggest stage and entered it into the World Beer Cup. When Chargie was awarded gold, recognizing it as the world's best blonde ale, it was an incredible full-circle moment. The beer that began as a mediocre extract plus grains batch in my home had become a world champion.

My background as a full-time practicing physician has influenced how I approach brewing. Science is central to our recipe development, water chemistry, and brewery microbiology program. I also enjoy digging deeply into hop selection — understanding oil composition, survivable compounds, and how individual varieties contribute specific aromas and flavors.

If Chargie's journey has taught me anything, it is that great beer comes from understanding the why behind every ingredient and process. Clean brewing practices and meticulous cold-side sanitation can produce good beer. Thoughtful recipe development can make it better. But understanding your grains, hops, fermentation, and water can take a beer from good to great — and perhaps even from an introduction to homebrewing to the best in the world. For me, that progression represents years of curiosity, experimentation, consistency, and willingness to keep learning with every brew. BYO

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Photo courtesy of Hopsized Brewing Co.

Chargie began as a homebrew recipe in 2019. It was refined over the years, brought to the commercial side, and was voted the Best Blonde Ale at the 2026 World Beer Cup.

Oktober

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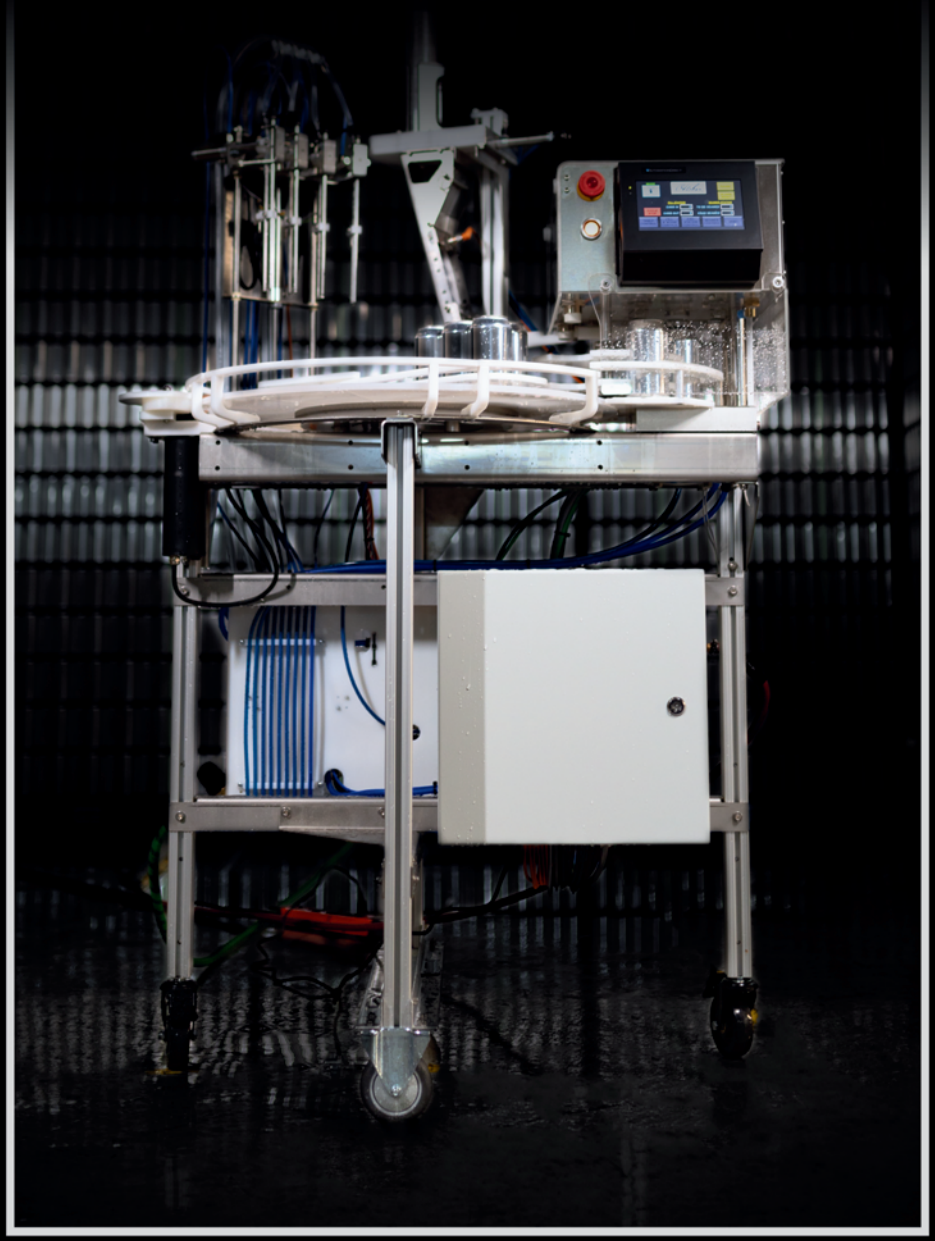

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