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JANUARY-FEBRUARY 2023, VOL.29, NO.1

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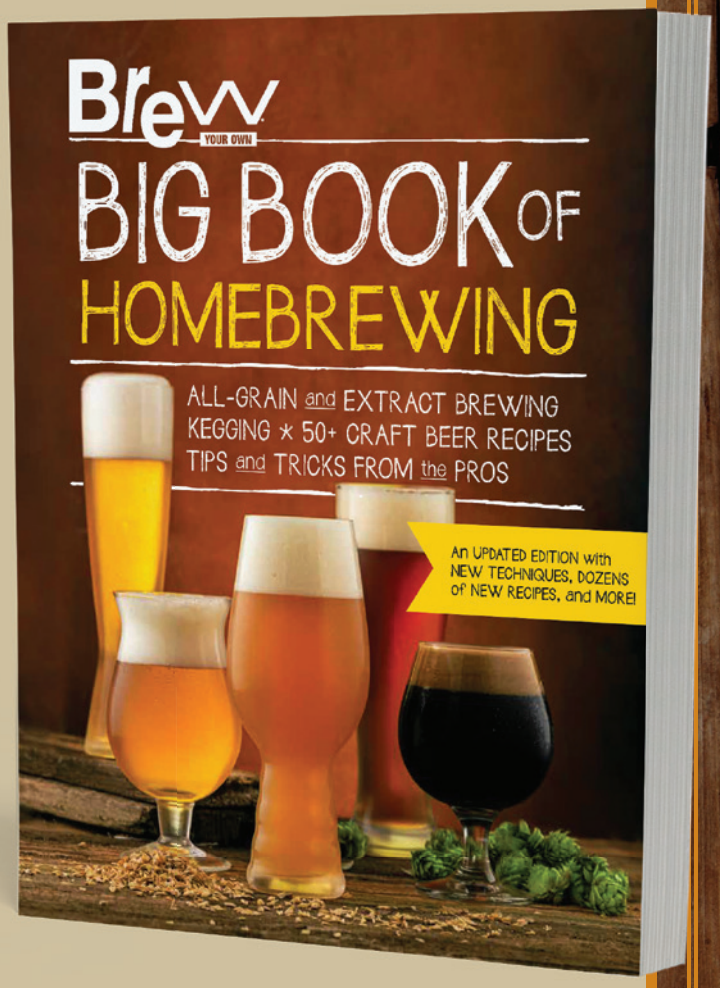

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Brew YOUR OWN THE HOW-TO HOMEBREW BEER MAGAZINE

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JANUARY-FEBRUARY 2023, VOL.29, NO.1

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Brew Your Own
THE HOW-TO HOMEBREW BEER MAGAZINE

departments

where to find it

RECIPE INDEX

RECIPE STANDARDIZATION

EXTRACT EFFICIENCY: 65%
(i.e. — 1 pound of 2-row malt, which has a potential extract value of 1.037 in one 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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Cover Photo:
Charles A. Parker/Images Plus

Q What's Your Brew Year's Resolution?

2023 marks my 30th full year of homebrewing so my Brew Year's Resolution is to dust off my older brewing notes and rediscover some of my earliest favorite recipes. It will be like opening up a time capsule I can actually drink! Of particular interest is re-brewing the very first homebrew I ever made. I quickly learned with batch number one – later named Cherry Bomb Stout — that cherry pits can get stuck in the airlock resulting in a middle-of-the-night carboy geyser coating the kitchen ceiling. Hopefully after 30 years my 2023 Cherry Bomb Stout will be a fun way to relive the past – this time without having to mop the ceiling!

To brew more Belgian styles of beer and get back into bottling (call me crazy but I believe Belgian beers deserve bottles).

My Brew Year's Resolution: Brew more beers my wife likes! *She's watching over my shoulder as I type this …*

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The Trap Door Keezer

Tap towers can be a design challenge for home draft system builders. Enter the trap-door lid design, allowing access to the keezer without having to move the tower. https://byo.com/project/the-trap-door-keezer/

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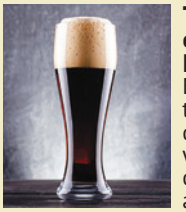

The History of Dark Lagers

Explore the mysterious history of dark lagers; from when they were dark unintentionally to purposely, and the rise of bottom-fermented beers in Bavaria. Plus: 6 dark lager recipes. https://byo.com/article/the-mysteries-of-dark-lagers/

Design Extract-Based Recipes

Extract-based recipes were at one time the most popular format of homebrew recipes. If you're having trouble finding some basics of crafting your own extract-based recipe, we've got pointers. https://byo.com/article/designing-extract-based-recipes/

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Kellerbier, The Real Lager of Germany

While popular in its indigenous region of Germany, kellerbier has often been a poorly understood style. Gordon Strong explores the intricacies of this Franconian "Real Lager." https://byo.com/article/kellerbier-the-real-lager-of-germany/

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MAIL

INDUCTION BREWING

I am writing in regard to the "Induction Brewing" article written by Josh Weikert in the January-February 2018 issue (which can be found online at https://byo.com/article/induction-brewing). The article was a follow up to a 2014 article and presentation at the National Homebrew Conference on the same subject. He mentioned in the 2018 article that he was looking forward to what another four years would bring for induction technology in homebrewing. I was curious if there has been any advancements or further adoption of induction in homebrewing. For example, with the all-in-one systems (BrewZilla, Foundry, Grainfather, etc.) they all continue to utilize more traditional heating elements. Has there been any work toward incorporating induction technology into those systems? I still have doubts about durability with an induction cooktop when boiling 10 gallons (38 L) of wort (80+ pounds of liquid, plus 10 pounds for kettle/40+ kg total). Any updated information you have on induction technology being incorporated into the homebrew process would be fantastic, as well as any equipment made specifically for homebrewing?

Chris Mull • *via email*

Story author Josh Weikert responds: "I'm not aware of any of the traditional equipment manufacturers incorporating/developing induction into their lineup. That being said, I don't share your concern about the weight issue on either the Avantco IC3500 or the Mai Cook 3500W elements: Both are solidly constructed, and if one wanted to be very risk-limiting there's always the option of fabricating some supports (½-inch/13 mm copper or brass pipe fittings would do the trick and not react to the element) to rest the kettle edges that overhang and keep the full weight from sitting on the element. Though as I say, I've seen 15-gallon (57-L) kettles making 10-gallon (38-L) batches on the bigger elements, and they bear up."

DEFINING AAUs

I was thinking of brewing a recipe that I found on the BYO website. Sorry for my ignorance but I'm not sure about the first few hop additions and wonder if you could translate for me? For example: What does "1.8 AAU Centennial" mean, as this recipe calls for at the start of a 60-minute boil? It's not just 0.18 oz., is it?

contributors

Ryan Hansen is an avid homebrewer in central California who was formerly the Head Brewer of a 10-barrel brewery. He holds the coveted brewing and distilling certification from the Brewing and Distilling Center in Knoxville, Tennessee, and is a proud member of the Central Valley Craft Brewer's Guild. On top of homebrewing, Ryan teaches beer tasting and appreciation classes, sells his homebrewing master class at homebrewerpro.com, and does brewery consulting for everything from business overview, marketing plans, recipe creation/troubleshooting, and anything else a brewery may need to achieve success. You can follow Ryan's brewing adventures on Instagram at @BigPopBrewing or reach him at Ryan@homebrewerpro.com.

In his first article for *BYO*, beginning on page 28, Ryan explains the similarities and differences in the all-grain and extract brewing methods to help those new to the hobby better understand which may fit their goals.

Scott Burgess, Founder of Bierkeller Columbia in South Carolina, grew up in the Carolinas (with a brief stint in the United Kingdom), and spent nearly a decade studying and working in Bamberg, Germany, and environs. Originally planning to study comparative literature through the University of South Carolina exchange program and a subsequent Fulbright grant, Burgess instead found his true love — and calling — in learning about the hundreds of small breweries and their beers. Bierkeller is the culmination of his life's work. Bierkeller brews authentic takes on a handful of Franconian favorites Burgess found over the years.

Beginning on page 38, Scott shares the history and what he has learned about Bavaria's unfiltered lager meant to be consumed young — kellerbier.

Dan Russo began working for Oakshire Brewing in 2013 as the Opening Manager of its Eugene, Oregon, Public House. In 2014 he was awarded a scholarship to the American Brewers Guild from the Glen Hay Falconer Foundation. Upon completing the program, he moved onto Oakshire's production team to chase his dream of creating delicious fermented libations. Dan took the helm as Director of Brewing Operations at the beginning of 2017 and has since curated a brewing program that creates over 50 new beers a year. In his spare time he loves to camp, see live music, and run a burger pop-up with his partner, Diane.

Starting on page 44, Dan explains the similarities and differences of the most popular dark lagers brewed around the world, and how you can brew them at home.

MAIL

It looks like all of the hop additions added during the boil are listed as AAU amounts. Would you please clarify?

Rich Peters • *via email*

AAU stands for "alpha acid units" and are a way to indicate the amount of bitterness hops will contribute to a recipe. This is important because you may find Centennial hops at 8% alpha acids (AA) from one supplier and at 11% from another (or variation from year-to-year or crop-to-crop from the same supplier). Adding the same weighted amount of each of these may result in a significant difference in hop bitterness in the resulting beer. So, AAU helps clarify how much bitterness you are looking for. AAUs are calculated by multiplying oz. x % alpha acids. In the example you cite, for instance, it calls for 1.8 AAU Centennial at the start of the 60-minute boil. That means you'll add 0.18 oz. if the hops are indeed 10% alpha acids as the recipe indicates. However, if the Centennial hops you have are actually 8% AA, then you'll want to add 0.225 oz. (1.8 AAU / 8% AA). The reason you won't see AAUs listed for the flavor/aroma additions is because they won't contribute significant bitterness — for instance, if you dry hop with Centennial hops at 8% AA or 11% AA it shouldn't have a noticeable impact on bitterness, and therefore the weight is the key to getting the aroma from the dry hop addition, not the percent alpha acid. Hope this clarifies things for you.

MORE FRANK

The Grand Prize-winning label is awesome! Would love to see more labels with Frank.

diybrewing • *via Instagram*

This message came in after sharing the winning homebrew labels in our 2022 Label Contest. Frank, the dog, is featured in most of Joe Smaldone's labels. And we're here to give the people what they (and we) want — more Frank!

BEGINNER'S BLOCK

BY DAVE GREEN

SUGAR SYRUPS

A staple in many Belgian and English beer styles, sugar syrups provide key characteristics to several of them. Learning when and how to use them to your advantage as well as the various techniques to produce them can help you achieve new heights in many of your recipes.

So what are sugar syrups and why are they beneficial? Well first off, as the name implies, they're a solution of sugar and water. Sometimes additives are included to raise or drop the pH, which is meant to affect key chemical processes while cooking the syrup. Others may add something like dried malt extract to allow some melanoidin reactions to take place as well. The best thing to do is to read up on others' experiences creating their own versions, then buying a big bag of sugar (corn or table sugar) and start experimenting on your own.

So what are the benefits of using sugar syrup versus just dumping sugar in straight from the bag? The main goal of using darker syrups is to gain color and flavor characteristics due largely to caramelization reactions that take place during the cooking process. In the brewing process we mainly talk about Maillard reactions and their melanoidin products. Melanoidins can give us baked bread, toasted nuts, and even coffee characteristics. Caramelization products can provide more of a dried dark fruit and caramel . . . well-fitted for a Belgian dubbel or English mild.

Another benefit may be found in the yeast's ability to more easily ferment syrup that has been cooked compared to unaltered table sugar. That is because table sugar is comprised of sucrose, which yeast need to break down into its components, fructose and glucose, before yeast can ferment it. When sugar is heated into a syrup, sucrose will naturally start this hydrolysis process of splitting, something we call inverting the sugar. Inverting sugar also means that the sugar will not easily recrystallize after cooling.

TIMING YOUR SYRUP ADDITION

You can add the syrup in either the boil or the fermenter. When brewing lower gravity beer, I generally advise adding the syrup directly to the boil kettle. It's easy, it assures it will be sterile, and it gives yeast simple sugars to work with to begin fermentation. But when brewing bigger beers like a Belgian quad or a barleywine, then I will hold off on adding it until I notice peak fermentation has passed. Too much sugar in solution at the beginning of fermentation can cause problems for yeast. So sugar is best fed to them to minimize this osmotic shock.

MAKING SIMPLE SYRUP

The most basic form of sugar syrup is to make simple syrup. This would be clear in color and best utilized in those Belgian golden ales, saisons, or West Coast IPAs. To make one is fairly simple; you are adding anywhere from 4 parts sugar to 1 part water all the way up to 2 parts sugar to 1 part water. You may want to add a little acid here to help speed up the acid hydrolysis reaction that will invert the sugar, maybe a squirt of lemon juice or a bit of acid blend. Add heat to dissolve the sugar in the liquid and to sterilize the solution. I usually just bring it up to a boil and then turn off the heat. Make sure to filter your water or use distilled water if there are any chlorine compounds in your tap water.

MAKING DARKER SYRUPS

Making darker syrups are going to be more involved. You may also consider utilizing a few more ingredients and I highly recommend that it be performed using either a candy thermometer or other way to gauge temperature up to about 350 °F (180 °C). The fact is there are many ways to get good results. You can simply try using sugar and water. You may want to add a nitrogen source in order to increase Maillard products. You may want to increase or decrease pH depending on your goal. These variations are dependent on the characteristics you are after in your final product.

In order to produce what I am after in, say, a Belgian dubbel, I use the following: Starting with 1 kg (2.2 lbs.) sugar add just over one cup (250 mL) of water and stir over medium-low heat until a slurry is achieved. Bring to a boil, stirring, but be careful of spatter. I highly recommend using silicone or brewer's gloves when performing this task as well as some form of eye protection. Add ½ tsp. of DAP (diammonium phosphate), available at any homebrew shop, and stir to mix in. Insert thermometer and continue heating over medium to medium-low heat until the temperature rises to roughly 290 °F (143 °C), then remove from heat and add about 12 oz. (350 mL) of water. Once again, take care of spatter from the pot, as the superheated solution will try to quickly boil off the liquid.

I like to perform this task just prior to cooling and adding direct to either the kettle or fermenter. Typically, I have used just common cane sugar, but feel free to experiment with other types of sugar like a raw, jaggery, demerara, or panela sugar if a little molasses character might be beneficial. Finally, I highly recommend checking out the following blog post: https://ryanbrews.blogspot.com/2012/02/candy-syrup-right-way-hint-weve-been.html

It explores some alternative methods and ingredients. Again, there is no right way . . . just better ways.

BYO READER PROJECT

EQUIPMENT TOWER

JOE GEIGER • CLINTON, MASSACHUSETTS

Photo by Joe Geiger

I needed a way to mount my pump and hot-side gear to get it off the floor and provide a fixed access point to keep everything organized. I'd seen some commercial brew towers but they were overkill for what I needed. Then I found grainger.com that sells lots of different industrial components and it's where I found the parts needed to build the stand. The 4-ft. (1.2-m) tall — 3-in. x 3-in. (8-cm x 8-cm) aluminum framing column was best for my application. It's lightweight and I can mount stuff to any side of it. For the base I found a steel-motor mount from the Grainger closeout bin.

The first thing I did was tap out holes in the bottom of the column. You must be very careful as the tap can bind and break off. Gently turn the tap so it cuts threads into the aluminum. If you feel it starting to bind, back off a turn and then continue tapping. I used 5⁄16-in. x 1-in. (8-mm x 25-mm) bolts with lock washers to securely join the column to the base. I also purchased a plastic end plate to cover the column top, which also gave me the perfect template for drilling holes through the base.

Most of my hot-side brewing gear is from Blichmann Engineering and they have accessory mounting plates for use with their tower systems that work perfectly with the column I purchased. My brew pump mounted directly to the column bottom through attach points on the pump base. I mounted the chiller just above it to offer some splash protection to the pump as well as keeping the weight low, adding stability to the whole structure. Next I attached the HopRocket™ mount mid-way up the column, which I utilize as a RIMS (recirculating infusion mash system) heater plugged in from the bottom.

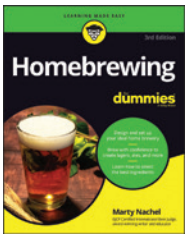
For a future project I've installed a weatherproof outlet box and switch that I plan to wire the pump with so I can turn it on and off and get rid of the outlet strip I've been using to control it. I'd also like to add a holder for the oxygen bottle and some casters so I can tilt it back to roll it around easily.

All-in-all with the mounts and stand materials, I spent about $200 (USD) and four hours of my time. It makes my brew day much more organized.

WHAT'S NEW

SAFBREW BR-8

Fermentis has announced the release of the first dried *Brettanomyces bruxellensis* strain called BR-8, available in 100- and 5-gram packaging. Selected specifically for secondary fermentation in bottles or casks, it produces phenolic compounds that create a distinctive finishing touch and evolve over time as the beer is aged, with funkier notes (barnyard, horse, leather, etc.) balanced by fruity notes. Optimal temperature for the strain is cited to be 59–77 °F (15–25 °C) and it should not be rehydrated in beer. https://fermentis.com/en/product/safbrew-br-8/



HOMEBREWING FOR DUMMIES 3RD EDITION

This new edition keeps pace with the rise of brewing small-batch beers. It also got updated with the latest at-home brewing equipment, software and apps, and resources you can tap to make a better beer. Author Marty Nachel also introduces how to make your own hard seltzers, flavored malt beverages, and juice drinks. Get recipes and instructions for brewing lagers, porters, and other beers at home. Enhance the quality of your small-batch brews and make your operations more eco-friendly. https://www.dummies.com/book/home-auto-hobbies/food-drink/beverages/beer/homebrewing-for-dummies-294449/

Ss BREWTECH SINGLE VESSEL BREWING SYSTEM

A new single vessel brew system has been announced from the folks at Ss Brewtech. Their SVBS (Single Vessel Brewing System) has several unique features. Starting with the mash basket's ultra-precise photochemical etched screen, it is much finer than traditional punched-steel baskets. A 4600W Halo Element heats it and an integrated pump is hard-plumbed to allow for mash recirculation, whirlpool, and knockout through their Pure Flow Valves. The touch-screen controller allows the brewer to operate the system at a safe distance from the vessel and can be detached for cleaning or storage. https://www.ssbrewtech.com/pages/svbs

Photo courtesy of Shutterstock.com

HOP COMPOUNDS MAY INHIBIT ALZHEIMER'S DISEASE

A new study has linked compounds found in hops to protection against Alzheimer's disease, a disease that affects roughly 11% of the population 65 and older. One of the biggest ways to combat the disease has been nutraceuticals, which utilize foods that have some medicinal or nutritional function. While the science behind what causes Alzheimer's is still a little murky, the clumping of amyloid beta proteins has been associated with the outset of the disease. The study looked at four different hop varieties and their ability to inhibit the clumping of these peptides that create plaque deposits on neurons. One of the difficult aspects of Alzheimer's is that symptoms appear often years after the plaque deposits begin. So preventative measures are considered the best ways to avoid it.

What the study showed was that hops should most likely be added to the list of nutraceuticals, most notably Tettnang hops due to their high polyphenol count. They also looked at Saaz, Cascade, and Summit™ hops. So enjoy that altbier tonight . . . it may be saving your brain! https://pubs.acs.org/doi/10.1021/acschemneuro.2c00444

Upcoming Events

HOMEBREW ALLEY XVII

February 4, 2023

New York City Homebrewers Guild is hosting their 17th annual Homebrew Alley competition on February 4, 2023 at Wild East Brewing Company in Brooklyn, New York. This is an AHA/BJCP-sanctioned competition with approximately 500 entries anticipated for this year. The goal in holding the competition is to provide valuable feedback to all entrants and promote the appreciation of craft beer. For more information check out https://www.homebrewalley.com/

BYO REPLICATOR

BY DAVE CLARK

DEAR REPLICATOR, I recently did a tour of Akron-area breweries. I made stops first at Thirsty Dog, Hoppin' Frog, and Bell Tower breweries. But my highlight of the tour was a Belgian tripel I had at Paradigm Shift Brewing in Massillon, Ohio. The lemon character and smooth drinkability for such a high-ABV beer really stuck with me, and I'd like to brew this beer at home. Can you help me craft a version of my own?

John J. Zajac Jr.,
Dayton, Ohio

This may be a guide to brewing an award-winning Belgian tripel, but the real story lies in how the beer and the brewery came to be.

FROM HOMEBREWER TO PROFESSIONAL

It all started with the Society of Akron Area Zymurgists (S.A.A.Z.), a popular homebrew club based in Akron, Ohio. A group of people with a common love for craft beer and brewing, S.A.A.Z. brought great local beer minds together to share their knowledge and collectively raise the quality of their homebrewed beers.

The members competed regularly in competition, hoping to gauge their progress as brewers while receiving constructive feedback on their beers. Mike Malinowski, a mid-30s hobbyist, had great success in competition, including winning back-to-back best of show awards.

Often asked when he was going to go professional, Malinowski laughed it off, believing it wasn't in the cards. He had a full-time career he intended to stick with until retirement. Well, that was the plan until a corporate buyout found Malinowski unemployed at age 55 and unexpectedly at a career (and life) crossroads.

Wasting no time, Malinowski fought through the self-doubt facing any soon-to-be entrepreneur and decided to plunge forward as a brewery owner. The result was Paradigm Shift Brewing Company of Massillon, Ohio, a suburb of Akron.

A PARADIGM SHIFT HAPPENS

"The Paradigm Shift name reflected my career path in corporate America, as a 'Lean 6 Sigma Blackbelt'," said Malinowski. "It was all about continuous improvement, such as streamlining processes and eliminating waste. My goal was, and is, to get people to think differently when it comes to beer — to make a *paradigm shift* — away from mass-produced beers and over to craft."

Doing it on his own without partners, Malinowski relied on his varied background that included construction and an undergraduate degree in business accounting . . . not to mention over a decade of homebrewing experience. He took his entire retirement fund and invested in himself.

Not only did he accomplish his goal, Malinowski may have set some kind of speed record opening his doors just five months from the day he signed his lease. That included having six beers brewed and ready to serve.

"I had to stay laser focused," said Malinowski. "I had three beers brewed before my bar was even built and glassware arrived only on the night before we opened. I had help from family and friends to accomplish the buildout in record time. I've got a picture of my 101-year-old grandmother sanding a door at one point. Hard work runs in my family."

It was the competitive spirit of homebrewing that gave Malinowski the confidence to take his hobby to the professional level.

"You look at all the competition at the homebrew level, you had to have your A game to compete," said Malinowski. "To win medals, you had to be a solid brewer. And what is great is that so many homebrewers went pro in this area that are willing to share knowledge and continue to learn from each other at the next level of brewing."

NEIGHBOR GIRL

One of the award-winning homebrew recipes that Malinowski took to the commercial level was a Belgian tripel called Neighbor Girl.

"There was a girl always walking her dog when I'd be out homebrewing," said Malinowski. "I got to know her and she'd stop by occasionally for a beer. She told me she loved the Belgian tripel style and asked if I had one. I did, but it had no name, so I called it Neighbor Girl."

After the whirlwind opening, Malinowski's laser focus turned to his first major beer competition, just nine months after opening. At 2018's Great American Beer Festival (GABF), Neighbor Girl came home with a bronze medal. Inspired by first-hand knowledge of European beers during an Army stint in the mid-80s, Malinowski created his own take on the classic Belgian style.

Continental Pilsner malt makes up the majority of the base with a few specialty malts for character. The secret ingredient to this 8.2% ABV, 3.7 SRM tripel is a heavy-handed addition of Belgian candi sugar, accounting for 12.7% of the overall grist. Neutral Magnum is used for bittering, then a combination of Saaz and Lemondrop™ hops provides a soft, floral, citrusy, lemon pepper essence. Ardenne yeast brings it all together to create an authentic Belgian classic made stateside with a character that makes some swear that lemon zest was added.

Neighbor Girl is best served in a Belgian goblet at 45–50 °F (7–10 °C), paired with any lemon-based pasta dish, such as shrimp scampi. Now you can brew your own and share it with your favorite neighbor girl.

PARADIGM SHIFT CRAFT BREWERY'S NEIGHBOR GIRL TRIPEL CLONE

(5 gallons/19 L, all-grain)
SG = 1.070 FG = 1.009
IBU = 29 SRM = 4 ABV = 8.2%

A classic, easy-drinking, high-alcohol Belgian tripel with a soft, elegant lemon pepper essence.

INGREDIENTS

11.5 lbs. (5.2 kg) Belgian Pilsner malt
0.4 lb. (181 g) Belgian white wheat malt
0.4 lb. (181 g) biscuit malt
1.5 lbs. (0.68 kg) clear Belgian candi sugar
6.6 AAU Magnum hops (60 min.) (0.5 oz./14 g at 13.25% alpha acids)
1 oz. (28 g) Saaz hops (0 min.)
1 oz. (28 g) Lemondrop™ hops (0 min.)
Wyeast 3522 (Ardenne Ale), White Labs WLP550 (Belgian Ale), or SafAle BE-256 yeast
¾ cup corn sugar (if priming)

STEP BY STEP

Mash in using a fairly thick mash and achieve a single infusion mash temperature of 150 °F (66 °C). If needed, add lactic acid to ensure a mash pH of or near to 5.4. Mash for 90 minutes or until converted. Recirculate and sparge. Collect 7 gallons (26.5 L) of wort in the kettle. Boil for 90 minutes, adding bittering hops at 60 minutes. If you choose, add a yeast nutrient and a clarifier such as Irish moss or Whirlfloc® with 10 minutes remaining, along with the candi sugar. At knockout, add the Saaz and Lemondrop™ hops then begin to whirlpool and allow it to spin down for a total of 20 minutes.

Cool quickly to 66 °F (19 °C), pitch yeast and oxygenate. Primary ferment for four days at 68 °F (20 °C) and then let it free rise to finish out. This should add extra pleasant esters in the finished product. Total fermentation should take about two weeks. Crash cool, then carbonate to 2.6 volumes or prime and bottle condition.

PARADIGM SHIFT CRAFT BREWERY'S NEIGHBOR GIRL TRIPEL CLONE

(5 gallons/19 L, partial mash)
SG = 1.070 FG = 1.009
IBU = 29 SRM = 4 ABV = 8.2%

INGREDIENTS

6 lbs. (2.7 kg) Pilsen dried malt extract
1 lb. (453 g) Belgian Pilsner malt
0.4 lb. (181 g) Belgian white wheat malt
0.4 lb. (181 g) biscuit malt
1.5 lbs. (0.68 kg) clear Belgian candi sugar
6.6 AAU Magnum hops (60 min.) (0.5 oz./14 g at 13.25% alpha acids)
1 oz. (28 g) Saaz hops (0 min.)
1 oz. (28 g) Lemondrop™ hops (0 min.)
Wyeast 3522 (Ardenne Ale), White Labs WLP550 (Belgian Ale), or SafAle BE-256 yeast
¾ cup corn sugar (if priming)

STEP BY STEP

Before you get started, separately pre-boil and chill about 3.5 gallons (13.25 L) of water so you can add that to top up the wort later.

To get full access to the sugars bound up in the malt's starch, a partial mash is needed before adding the extract. We will use 1 lb. (453 g) of Pilsner base malt to help convert the white wheat and biscuit malts.

Using about 1 gallon (4 L) of water, achieve a single infusion mash rest at 150 °F (66 °C). Insert the crushed grains inside a mesh bag for easy removal later. Mash for 60 minutes or until converted. Remove the grain bag, allowing the liquid to drain out. Do not squeeze the bag to avoid leaching tannins into your wort. Add water to create 3 gallons (11 L) of wort in the kettle. Next, raise to near-boiling temperatures, then remove pot from heat and slowly stir in half of your extract until thoroughly dissolved. Return to the heat source and raise to boil. Boil for 60 minutes.

Add bittering hops at the beginning of the boil. With 10 minutes remaining, remove again from the boil and add the rest of the extract and the candi sugar. If you choose, add a yeast nutrient and a clarifier such as Irish moss or Whirlfloc®. At knockout, add the Saaz and Lemondrop™ hops then begin to whirlpool and allow it to spin down for a total of 20 minutes.

Cool quickly to 66 °F (19 °C) and transfer the wort to your fermenter, topping up to a volume of 5.5 gallons (21 L). Pitch yeast and oxygenate. Primary ferment for four days at 68 °F (20 °C) and then let it free rise to finish out. This should add extra pleasant esters in the finished product. Total fermentation should take about two weeks. Crash cool, then carbonate to 2.6 volumes or prime and bottle condition.

TIPS FOR SUCCESS:

There are many different colors of candi sugar. Be sure your candi sugar is clear to maintain the color of a typical Belgian tripel. You don't want a strong flavor contribution from it. BYO

BY DAWSON RASPUZZI

KEEP IT COOL

Fermenting and conditioning lagers

Three brewers crafting award-winning lagers share cool tips on fermenting and lagering that homebrewers can employ on their own homebrew setups.

We use two lager strains here at Working Draft. We use what is essentially the Pilsner Urquell strain for all of our Czech-style lagers and the Weihenstephan lager yeast strain for everything else. The Czech strain is less attenuative, creates more diacetyl, and seems to pull less bitterness from the wort; thus creating a maltier and more bitter beer with a little more complexity. The Weihenstephan strain creates a very clean, crisp, and dry beer. Both strains create a nice sulfur note when fermented at cooler temperatures (50 °F/10 °C and lower), which I think is an important component to European-style lager.

We typically pitch yeast about 8 °F (4 °C) cooler than our target fermentation temperature, then when they're 40–60% attenuated, we will cool the fermenter 2–3 °F (1 °C) per day back down to our pitching temperature and then hold it there for 7–10 days or until it passes a forced diacetyl test. After that we continue to cool 2–3 °F (1 °C) per day down to 30 °F (-1 °C) and hold there for 3–8 weeks depending on the beer. In general our pale lagers top out at 48 °F (9 °C) and our darker lagers top out at 52 °F (11 °C). Darker worts tend to have a more complex sugar profile and thus are a little tougher for the yeast to ferment, so that extra couple degrees helps them get the job done. Other instances in which we may ferment a touch warmer is when we'll need to harvest a substantial amount of yeast for subsequent brews or when using a fresh pitch as it often takes a generation to acclimate to your brewery conditions.

The length we lager is dependent on the beer style and starting gravity. In general, higher gravity beers will need more time to clean up and mature. For example, we will aim to have our doppelbock lagering at 30 °F (-1 °C) for 6–8 weeks, whereas with a standard strength pale lager we'd be comfortable lagering for only three weeks.

Great lager is the product of doing a million little things right. It's getting pH, temperature, pitch rate, oxygenation rate, mash chemistry, yeast health, wort clarity, trub settling, etc., all dialed in. Great lager has much more to do with process and less to do with recipe. Keep your recipe simple and if you're looking for authentic European lager then use European ingredients. Homebrewers with a temperature-controlled fermentation chamber capable of sitting at lagering temperatures will have a huge advantage. Additionally, having Corny kegs could allow you to perform a very traditional fermentation process.

Here are more tips for better lagers:

1. Perform a decoction or step mash. On the homebrew scale all you need is a decent insulated mash tun, a kettle, heat-proof gloves, and a scoop/pitcher to transfer mash and you're good to go. Step mashing with boiling water additions takes a little trial and error but once you figure it out it's not so bad. We utilize this in our brewery for most of our lagers since we lack a heated mash mixer. These steps are certainly not necessary but are some of the small things that can take your lager from good to great.
2. Do a vigorous boil to ensure proper volatilization of S-Methyl Methionine and Dimethyl Sulfide.
3. Minimize trub carryover from kettle to fermenter. Excess cooked hop matter in your fermenter will lead to a harsher bitterness and less drinkable lager. There's not much to hide behind in these beers and this is a small detail that I don't hear people discuss often, however, dialing this in at Working Draft has made a substantial difference in the quality of our lagers.

Great lager has much more to do with process and less to do with recipe.

Clint Lohman is the Co-Owner/Head Brewer of Working Draft Beer Company in Madison, Wisconsin. He's worked for various breweries around Wisconsin for 10 years, the past five at Working Draft, a 7-barrel brewery and taproom that opened in March 2018 and focuses on brewing European-style lagers and American-style hoppy ales.

Photo by WestOf Newspaper

Adam Goodwin started his brewing career at Tired Hands before becoming a brewer at Trillium. He went on to open Charles Towne Fermentory in Charleston, South Carolina, in 2016.

For nearly all of our lagers we use the Weihenstephan lager strain, which is a great option if you're looking for a "house" lager strain. It can be super clean or you can push some nice character out of it when you really want it to shine. It is also a very forgiving yeast. We will push it as low as 48 °F (9 °C) and as high as 58 °F (14 °C) depending on the character we're after. Then when we get a few points from terminal gravity, we'll let the fermentation free rise up to 68–70 °F (20–21) for a diacetyl rest. When I add dry hops to a lager, I do it between 65–68 °F (18–20 °C) heading into the diacetyl rest.

We average about four weeks of lagering after transfer to horizontals. For some of the cleaner lagers, like an American light lager, that time might actually come down a bit as it gets bright pretty quickly. Some of the more characterful or classic lagers may require a little extra time to clean up post-fermentation, so they may head closer to the 6–8 week mark or longer. At this point, it comes down to sensory. At a small commercial scale (or homebrewing) you have some wiggle room with your production schedule, so no need to rush it out before you are happy with it.

This schedule mirrors what I did as a homebrewer, but it doesn't have to be done this way. Temperature control is crucial for these types of yeasts, and lagering is obviously a critical aspect of making lagers. Do I think you can still make great lagers, otherwise? Definitely. I am all for efficiency, especially when you are brewing just for yourself and friends. I tend to ramp up the temperature of my lagers during primary fermentation. If the beer tastes clean not long after crashing, then I'd say it's ready to drink. That being said, if I'm making a classic lager style, I like to stick to the traditional processes as it would be pretty hard to get a clean bright beer within a few days. At the end of the day, if the beer tastes how you want it to, that's the most important thing.

The signs of a great lager brewer are often patience and consistency. Do your best to be true to classic style if that is your aim, but don't be afraid to play around with methods and ingredients to get the characteristics that you want in the beer in an amount of time that you are willing to dedicate in your fermentation chamber or keezer.

Ryan Wibby is the Co-Founder and Brewmaster at Wibby Brewing in Longmont, Colorado. He worked at numerous breweries and received his brewing education in Berlin, Germany, before opening the brewery with fellow Ithaca College alum Ted Risk in 2015.

When looking for a "house" lager strain I want one that can ferment high- and low-gravity lagers in a relatively short period of time without producing tons of off-flavors. Our preferred yeast is a proprietary lager strain, but there are many from yeast labs that will do the job — Wyeast 2308 (Munich Lager) is a great one.

All of our recipes and processes started at the homebrewing level and everything has been scaled up from my homebrew setup to our commercial setup. I think the only difference between the two setups is that on the commercial scale we are able to lager the beer under CO_2 pressure.

We ferment our lagers at 52 °F (11 °C) for two weeks and then perform an extended diacetyl rest on all of our lagers, allowing the beer to free rise to 54–55 °F (12–13 °C) for a week or so.

We lager for at least two weeks. We try to lager the beer longer if we are able to but with demand so high we generally need to package the products after two weeks of lagering. For our hoppy lagers we don't lager for longer than two weeks as we have found that the hoppy aroma begins to deteriorate quickly during an extended lagering period. We don't dry hop any of our lagers.

I am aware of the so-called "fast lagering" methods homebrewers debate sometimes. In fact, I learned about them in school and know several international brewers who use these techniques. However, I am of the belief that if you are trying to make a great lager you need to schedule the time to make a great lager. Lager brewing isn't about moving beer quickly but rather allowing the lager to tell you when it is ready. Patience is the best characteristic of any great lager brewer.

These three pros had a lot more to say than we have room for on these pages. Check out even more of their lagering tips at: https://byo.com/article/fermenting-and-conditioning-lagers BYO

BY ASHTON LEWIS

SPARGE TEMPERATURES

Also: Overcarbonation, frozen beer, and brewing calculations

Q I'M CONFUSED. SPARGING IS SUPPOSED TO BE DONE WITH A GRAIN BED AT 170 °F (76 °C). A LOT OF ARTICLES SAY TO USE SPARGE WATER AT 170 °F (76 °C). IF MASHING IS AT 152 °F (67 °C), THE GRAIN TEMPERATURE WILL NEVER GET UP TO 170 °F (76 °C). I'VE BEEN USING BOILING WATER TO GET THE GRAIN BED UP TO 170 °F (76 °C). IS THIS WRONG? WHAT IS THE CORRECT METHOD?

BARNEY HELLER
NORTH WALES, PENNSYLVANIA

A Hi, Barney. Based on your question I am assuming you are either relatively new to all-grain brewing or starting to question basic practices brewers follow. One thing I wish I knew when I began brewing is that there are lots and lots of different ways to brew great beer. And by extension there are no "correct" methods, just lots of options. Your question mixes best practices from infusion and multi-temperature mashing into a single goal that is out of sync with infusion mashing.

In your case, you are infusion mashing at 152 °F (67 °C). The term "infusion" mash can be confusing because it means different things to different brewers. I like the phrase "isothermal mash" because it leaves no room for miscommunication. German brewers use the term infusion to mean mashing that does not include mash boiling; infusion mashes may be isothermal or stepped mashes covering a broad range of temperatures, with or without a mash-off step. Like I said, this can be a bit confusing.

In a typical isothermal, commercial mash at 152 °F (67 °C), there is no increase in temperature before the onset of sparging because commercial infusion mash tuns are not equipped with heating jackets. The norm is to sparge with water at ~170 °F (76 °C) and allow the mash to heat up to some temperature between 152 °F (67 °C) and 170 °F (76 °C). Why? Because that's how it's done! There may be a more reasoned answer than that, but it's not much different. And the answer is that the hot water tank is maintained at 170 °F (76 °C) because that's a great strike water temperature for mashes at 152 °F (67 °C) and it's also really handy to have strike and sparge water stored in the same tank.

I am sure some readers are thinking about astringency and not wanting to sparge too hot. Yeah, yeah, but what about brewers using stepped mashing and/or decoctions? These brewers typically heat their mashes to ~170 °F (76 °C) at the end of the mash to fully convert the mash, stop enzymes, decrease viscosity, and to boost extract yield. They also sparge with 170 °F (76 °C) water.

Both methods work well and, in practice, infusion mashers usually leave a bit more extract in the spent grain bed for a variety of reasons, including their lower mash temperature during sparging. I like your method because it makes sense and does not just randomly heat up the mash. You are targeting 170 °F (76 °C), achieving your temperature boost with hot water, and then sparging normally.

If you ever want to get a little

Decoctions are always described to be a royal pain, but a single decoction at the end of a single temperature mash is pretty darn easy.

Photo by Paul Mietz Egli

For decades brewers were taught very specific rules in regards to sparging. Turns out a lot of the rules are rather inconsequential.

crazy and uber traditional at the same time, consider boiling about a third of your mash at the end of your rest at 152 °F (67 °C), then mixing this single decoction into your rest mash to achieve your mash-off temperature. Decoctions are always described to be a royal pain, but a single decoction at the end of a single temperature mash is pretty darn easy. And there are several benefits brewers can enjoy including a bump to your extraction yield and it can add some nice malt flavors that isothermal mashing may not lend on its own.

Q WHEN I KEG MY BEER, I FORCE CARBONATE FOR TWO WEEKS AT 14–15 PSI. AT THIS TIME, I HAVE FOUND CARBONATION IS RIGHT WHERE I LIKE IT AND I GET JUST THE RIGHT AMOUNT OF HEAD IN MY GLASS. THIS CONDITION LASTS UNTIL I GET ABOUT HALF WAY THOUGH THE KEG (APPROXIMATELY 1½ MONTHS LATER) WHEN I START GETTING HALF BEER AND HALF FOAM. THIS TENDS TO BE WORSE WITH HOPPIER BEERS. THE 14–15 PSI IS WHAT I CALCULATED TO RESULT IN 12 PSI AFTER PRESSURE LOSS THROUGH MY LINES. MY DISPENSING LINES ARE ABOUT 5–6 FEET LONG. ANY IDEAS WHAT MAY BE CAUSING THIS?

MARC KOVACH
DOVER, PENNSYLVANIA

A Your problem is caused by overcarbonation that is slowly occurring over time. Let's dig into what you are observing over time beginning with your method of carbonation. Based on your question, I am assuming that you are not using the shake and bake method of carbonation where beer is shaken at some pressure to increase the rate of gas absorption. Your method is the set it and forget it method where gas slowly diffuses into beer from the headspace above the beer. I like this method and have no critique of the method. Your problem is your chosen pressure.

Another assumption I am making is that your target carbonation level coincides with the 12 psi at the tap you mention. This is a normal pressure for beers carbonated to 2.57 volumes of carbon dioxide and stored at 38 °F (3 °C) (see the Zahm & Nagel CO_2 solubility in beer chart for reference). Carbonating through the headspace is a relatively slow process, where the rate of CO_2 flow into beer slows as the dissolved concentration approaches equilibrium with the headspace pressure at whatever temperature the system is set to. In other words, your beer quickly picks up CO_2 early in the process, pours well and tastes like you want it to, then it slowly picks up more gas than you want until equilibrium is reached at ~14.5 psi; if your beer is in a 38 °F (3 °C) keezer, the carbonation level is 2.8 volumes of CO_2. For readers who prefer g/L of carbon dioxide and bar for pressure, this condition translates to beer at 1 bar pressure and 5.5 g of CO_2 per liter, and for the sake of easy reading I am opting to not repeat this conversion going forward.

If I have misinterpreted your question, hang with me because this general explanation doesn't have to be correct for the remedy to work … but I think I am following what you are doing.

Now let's look at your draft system. Seems that you have matched your 5–6 feet (1.5–1.8 m) of draft line to match up with 12 psi of pressure; you should be balancing the system to match the equilibrium pressure and temperature of the beer. If you do indeed want 2.8 volumes of carbon dioxide in your beer (great for some styles of beer like weizen or many Belgian-style beers), 14.5 psi at 38 °F (3 °C) is your number. However, your draft line is too short to balance this condition and explains why your beer slowly becomes foamy when poured after a few weeks. In short, your draft system is out of balance. The solution for this particular problem is to increase your draft length to balance the 14.5 psi condition. Based on my explanation above, I don't believe this is the solution to your problem.

What you need to do is carbonate beer to a typical level of 2.57 volumes (5 g/L) by decreasing your CO_2 setpoint to 12 psi (0.8 bar). Assuming you are using $\frac{3}{16}$-in. ID beer line, your current draft line length fits this system. I am personally a fan of flow-control beer faucets that allow for a bit of fine-tuning when pouring. These faucets provide the best control when the draft line is a bit shorter than calculated because the shorter-than-calculated lines leave a bit of excess pressure to scrub using the flow control faucet. You may find that carbonating to 2.57 volumes takes longer when pressure is reduced to 12 psi, so you may want to do a little beer shaking or rolling the Corny keg to start your carbonation cycle.

Finally, that observation about more challenges with hoppier beers makes sense because these beers often contain very small haze particles from the reaction between hop polyphenols and malt proteins; these little dudes act as nucleation sites for gas breakout during dispense. I hope this helps you solve your dispense issues so that your brews pour properly!

Q MY PROBE ACCIDENTALLY CAME OUT OF MY LAGERING FREEZER AND I ENDED UP FREEZING TWO FULL KEGS OF BEER. CAN THEY BE SAVED?

BOB BURKHARDT
CAMERON PARK, CALIFORNIA

HELP ME, MR. WIZARD

A The good news is that frozen kegs can be saved! I hope you decided to keep your beers, let them thaw, and enjoyed them post arctic chill. Accidentally freezing beers is a common occurrence, even in large and small commercial breweries with, what may seem like, ideal equipment.

Beer freezing can occur from a range of issues. In your case, your temperature probe was somehow pulled from your freezer and your controller did what it is designed to do by telling your freezer's compressor to keep on chugging. Unfortunately, the controller was operating off of faulty data and continued running until you discovered the issue. Given enough time, the beer in your kegs would freeze to the point where the freeze-concentrated beers' freezing points equaled the freezer temperature. You're questioning the effect of freezing on your beers. Well, it depends on what you did after spotting the condition.

Some brewers intentionally freeze-concentrate beer by chilling beer to some temperature where water freezes to ice until the freezing point of the beer equals the environmental temperature (if the vessel is located in a cold environment) or when the beer temperature matches the cooling setpoint and glycol cooling valves shut. So-called freeze point depression and boiling point elevation are examples of colligative properties of water and explain why the freezing point of beer changes as beer becomes more concentrated when water is removed from the liquid system in the form of ice. Your goal was clearly not freezing your beer, but depending on how much ice was removed, you may have decided to convert your beers into unintentional ice beers, whatever that really means!

The traditional ice beer that most brewers know about is eisbock; this style is freeze-concentrated. In the mid-90s, golden-colored ice lagers were all the rage in North America. Labatt developed the Ice Brewing™ process and introduced their Labatt Ice to the world in 1993. This beer contains 5.6% ABV compared to Labatt's Blue at 5% ABV. U.S. brewers began brewing ice beers shortly after the release of Labatt Ice, but were not permitted to freeze-concentrate beer because of U.S. law.

One thing that may have been interpreted as hype with these beers was the smoothness marketed with just about all ice beers. Unlike some marketing, smoothness is actually a thing with ice beer because the cold temperatures and ice crystallization removes polyphenols from beer and reduces astringency. In other words, ice beers have a smoother mouthfeel and finish. The takeaway here is that if you allow your beer to slowly thaw, it very well may end up being improved by the error.

Beer can also freeze because of poorly placed temperature probes or not covering all probes when filling tanks. This is not common for homebrewers, but is a frequently observed occurrence by commercial brewers. How do commercial brewers observe freezing when their tanks are all stainless steel? They see ice chunks in tank bottoms when preparing the tank for cleaning, or hear these ice chunks fall from the tank when racking a tank and hearing large chunks of ice fall from the upper surface of the tank and crash into the bottom of the vessel. In tall tanks, these falling chunks of ice can do real damage to thermal probes and even the bottom of tanks. And many brewers these days have in-line instrumentation or sampling procedures that may reveal freezing. For example, beer color, density, and alcohol readings change when beer is removed from a frozen tank because the top of the tank contains water from melted ice and the bottom of the tank contains beer that is darker in color, more dense, and higher in alcohol than the beer samples at the end of fermentation.

Long story short, frozen beer is not uncommon and allowing a tank to thaw and moving on with your normal brewing process is not the end of the world for affected batches. One freezing scenario that can cause real quality problems is when packaged beer freezes and thaws, especially if there are numerous freeze-thaw cycles. Chill haze, permanent hazes, beta glucan gels, and particulates in the bottom of a bottle or can are some of the things that form in freeze-damaged packages.

Always check on your temperature probe to help prevent similar issues from recurring. Happy brewing and stay chill!

Q AN IMPORTANT PART OF MY HOMEBREWING HOBBY IS THE DEVELOPMENT OF WEB-BASED BREWING CALCULATORS. THE BIGGEST CHALLENGE IS FINDING GOOD TECHNICAL INFORMATION. WEB SEARCHES OFTEN YIELD VAGUE RESULTS, FORMULAS WITH ERRORS, OR FORMULAS BASED ON NON-METRIC UNITS. WHERE DO PROFESSIONAL BREWERS FIND HIGH-QUALITY TECHNICAL INFORMATION? WHICH BOOKS WOULD YOU RECOMMEND FOR TECHNICAL REFERENCE PURPOSES?

GARY FISK
AMERICUS, GEORGIA

A I also consider developing my own calculation tools a key part of my hobby and, previously, part of my job as a commercial brewer. I have a pretty handy collection of calculations and will touch on what has been valuable to me along my tool-making journey, starting with your question about sources used by professional brewers. The short answer is brewing school. Whether brewers take brewing classes in universities like Weihenstephan, UC-Davis, KU Leuven, Oregon State, Heriot-Watt, Auburn, and Virginia Tech, or through private brewing schools like Siebel and the American Brewers Guild, the same basic beer math is taught. And these days, it's all taught using the metric system.

Perhaps the most fundamental group of brewing calculations are those related to wort and brewhouse yield. All schools teach students that kg extract is equal to liters of wort multiplied by the product of wort specific gravity (kg per liter) and wort Plato (kg of extract per kg of wort). This basic relationship opens up a whole set of calculations related to

mash calculations and efficiency. Textbooks like Kunze's *Technology Brewing and Malting* and *The Comprehensive Guide to Brewing* (Gabriela Basarová, Jan Savel, Petr Basar, Pavlína Basarová, Tomás Lejsek) include examples of these equations and how they are used. Another really helpful book is Steve Holle's *A Handbook of Basic Brewing Calculations* published by the MBAA (Master Brewers Association of the Americas) in 2003.

When it comes to hop math, there is really only one equation universally used and that is how to calculate hop charges based on some level of bitterness in terms of international bitterness units (IBUs). Unfortunately, the golden key that makes hop calculations tick is the elusive utilization term; most brewers refer to tables relating utilization to boil time, wort gravity, and hop preparation type. Some brewers calculate oil contribution based on hop analytics, but this is not commonly used.

There are also a range of brewing calculations related to mashing-in, mash heating and boiling, wort heating, boiling and cooling, and beer blending and dilution. These calculations are all based on fundamental math used in food engineering/processing. Much of this is left out of brewing texts and is the sort of topic often left to classroom lectures. The good news is that $Q = MC_p\Delta t$ is the key to all of the heating and cooling equations (Q is heat energy, M is mass, C_p is specific heat, and Δt is temperature change). The only obscure constant that can be hard to find is the specific heat of malt. The specific heat of malt and other brewing grains is about 1.8 kJ/kg*Kelvin (0.43 BTU/lb.*F).

Another great source of information about brewing calculations is found on brewing ingredient and process aid specification sheets. My brewing calculation workbook includes separate tabs for usage rates of beer finings, enzymes, and nutrients. These are the sorts of tidbits of information that can easily be added to your library of nuggets as you try new things.

And finally, there is water. I am a picky user of tools and really don't like any water calculator that I have trialed and wrote my own water tool based on the water basics first laid out by Paul Kolbach in the early 1950s. BYO

BY GORDON STRONG

SIMPLY SAISON

A family of farmhouse beers

Saison has a long history, but as with most styles like this there is some disagreement about the origins and how the style has changed over time.

SAISON
BY THE NUMBERS

OG:	1.048–1.065
FG:	1.002–1.008
SRM:	5–14
IBU:	20–35
ABV:	5–7%

Photo by Charles A. Parker/Images Plus

Saison is a difficult style to write about because there are so many modern variations – it's like today if you asked someone to "tell me about IPA." I find it easiest to think of it as a broad family of beers that happens to have a most common version. The family members have much in common, but will vary in both strength and color. It doesn't help that the style also is interpreted in different ways, or used as the base style for other experimentation. These factors make the style interesting to the beer enthusiast but challenging for a beer judge or someone developing a sensory profile for the style.

Since there is essentially a flagship version of the style, my explanation begins around defining that example before discussing all the possible variations. That type is the pale, standard-strength version most popularly typified by Saison Dupont — indeed, a great beer, but one of many world-class examples. The 2021 BJCP (Beer Judge Certification Program) Style Guidelines includes saison as Style 25B in the Strong Belgian Ale category along with Belgian blonde ale and Belgian golden strong ale. This category contains stronger, pale, well-attenuated beers driven mostly by yeast character.

HISTORY

Saison has a long history, but as with most styles like this there is some disagreement about the origins and how the style has changed over time. Large and/or modern breweries often create histories that favor their products, or at least show them in the best light. So it can be difficult to be precise about origins and developments of styles before such things as styles existed.

In the craft beer era, saison is thought of as a *farmhouse ale,* a term not typically used in its place of origin. It is meant to invoke an image of a beer brewed on local farms for field workers and to present an artisanal image. It is here where I normally interject that farmhouse does not mean barnyard and that one should not assume that the beer was made in dirty conditions or that it has some kind of funky character. It simply means that it was produced using a variety of grains that might be grown on local farms.

Saison means "season" in French, and is likewise meant to describe a beer brewed "in season" during cold weather and stored as a provision, or stock ale, for consumption during warmer weather. Some have taken it to mean that there are different examples for each season, but that is more of a modern interpretation popularized by the Fantôme brewery.

If you consider these last two paragraphs together, you see there is a conflict in the characterizations. Beers brewed as provision ales tend to be stronger, but why would you want to get your field workers liquored up? I think maybe there are different beers being lumped together for story-telling purposes, although I do believe each statement is individually true. It's just that they may not be describing the same thing.

Beers certainly were produced in the agricultural region of northern France, including what is now Belgium (and especially Wallonia, the French-speaking part of Belgium), since at least the 15th century. The name saison is associated with the provisional beers that were not always produced on farms, but in breweries (that could, in fact, be on a farm) with skilled craftsman who could make beer that would keep for many months without spoiling.

Farmers could make low-strength beers for workers as a preferred drink instead of potentially contaminated water. The imagery of this farmhouse example seems to have been combined

with the historical style in modern times by larger producers after World War I. Saison Dupont was first made in the 1920s, for example. The general trend of larger breweries supplanting local artisanal breweries continued through World War II and most modern examples are made in larger breweries.

In the 20th century, different variations of the modern saison were produced. Dupont began making a stronger version (Moinette) in 1954 and a brown version in the 1980s. Fantôme started making the seasonal saisons in 1988. Modern craft saisons tend to be in the image of Saison Dupont, with possible variations of strength and color. The lower-gravity versions (including grisette, a type of beer popular with miners) have enough similarities that they can be considered within the same style family for judging purposes, even if historians might cringe at their grouping.

SENSORY PROFILE

I spent quite a bit of time creating the overall impression for this style for the BJCP Style Guidelines, so I'll just use that as my main reference since I think it really hits the highlights well. A saison is a family of refreshing, highly attenuated, hoppy, and fairly bitter Belgian ales with a very dry finish and high carbonation. They are characterized by a fruity, spicy, sometimes phenolic fermentation profile, and the use of cereal grains and sometimes spices for complexity. Several variations in strength and color exist.

The BJCP style definition includes three strength variations — table (3.5–5% ABV), standard (5–7% ABV), and super (7–9.5% ABV) with two color variations – pale (gold to amber) and dark (copper to brown). The type of character grains used (wheat, rye, spelt, oats, etc.) may be declared. These variations allow grisette to be defined as a table-strength, pale saison with wheat as the character grain, for example.

For me, I look for a saison to be very dry with a low final gravity (more important to me than the percentage attenuation) and a very high carbonation that helps form a dense, rocky head. These two qualities make the beer refreshing. The body should be light to medium-low, which also keeps the beer from being heavy.

SAISON

(5 gallons/19 L, all-grain)
OG = 1.055 FG = 1.006
IBU = 28 SRM = 5
ABV = 6.5%

INGREDIENTS

9 lbs. (4.1 kg) Pilsner malt
8 oz. (227 g) pale ale malt
8 oz. (227 g) Munich malt
8 oz. (227 g) wheat malt
1 lb. (454 g) flaked rye
6.5 AAU Pacific Jade hops (first wort hop) (0.5 oz./14 g at 13% alpha acids)
0.5 oz. (14 g) Pacific Jade hops (5 min.)
Wyeast 3711 (French Saison), White Labs WLP590 (French Saison), Wyeast 3726 (Farmhouse Ale), or LalBrew Belle Saison yeast
1 cup corn sugar (if priming)

STEP BY STEP

This recipe uses reverse osmosis (RO) water. Adjust all brewing water to a pH of 5.5 using phosphoric acid. Add 0.5 tsp. of calcium chloride and 0.5 tsp. calcium sulfate to the mash.

This recipe uses a step mash. Use enough water to have a moderately thick mash (1.5 qts./lb. or 3.1 L/kg). Mash in the malts at 131 °F (55 °C) and hold for 15 minutes. Raise to 144 °F (63 °C) and hold for 60 minutes. Raise the temperature to 158 °F (70 °C) and hold for 15 minutes. Begin recirculating, raise the mash temperature to 169 °F (76 °C) for mash out then recirculate for an additional 15 minutes.

Put the first wort hops in the boil kettle, then sparge slowly and collect 6.5 gallons (24.5 L) of wort.

Boil the wort for 60 minutes adding hops at the time indicated in the recipe ingredients list.

After the boil is complete, chill the wort to 72 °F (22 °C), pitch the yeast, aerate if using a liquid yeast strain, and ferment at this temperature until complete.

Rack the beer, prime and bottle condition, or keg and force carbonate to 3 v/v.

SAISON

(5 gallons/19 L, extract only)
OG = 1.055 FG = 1.006
IBU = 28 SRM = 5
ABV = 6.5%

INGREDIENTS

4 lbs. (1.8 kg) extra light or Pilsen dried malt extract
2 lbs. (0.91 kg) weizen/wheat dried malt extract
6.5 AAU Pacific Jade hops (first wort hop) (0.5 oz./14 g at 13% alpha acids)
0.5 oz. (14 g) Pacific Jade hops (5 min.)
Wyeast 3711 (French Saison), White Labs WLP590 (French Saison), Wyeast 3726 (Farmhouse Ale), or LalBrew Belle Saison yeast
1 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). Turn off the heat. Add the malt extracts and stir thoroughly to dissolve completely. Turn the heat back on, add first wort hops, and bring to a boil.

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

After the boil is complete, chill the wort to 72 °F (22 °C), pitch the yeast, and ferment at this temperature until complete.

Rack the beer, prime and bottle condition, or keg and force carbonate to 3 v/v.

Photo by Michael Tonsmeire

The aroma and flavor are dominated by yeast and hops, with peppery phenols more than clove, and fruity notes associated with citrus-type fruit, or sometimes apples, pears, or apricots. Hops are continental, showing herbal, floral, or spicy notes. The malt character is relatively neutral, but can have grainy, sometimes rustic, notes. The bitterness level is moderate to high and the finish should never be sweet. Alcohol, if detected, is light.

The table strength versions have a similar character but less intensity. Stronger versions can have a little more body and alcohol noted, but still retain the refreshing quality. Darker versions add more malt character associated with darker grains, but usually more toasted and caramelly flavors and not roasted or burnt.

Some commercial versions have some sourness but this is not traditional. Those that are sour tend to be less bitter since sourness and bitterness clash on the palate. Some craft producers in the U.S. use *Brettanomyces*, although this is also not traditional. Those examples are better judged in the *Brett* Beer category under American wild ales.

BREWING INGREDIENTS AND METHODS

Following the farmhouse image, saisons typically use some cereal grains such as wheat, oats, spelt, or rye in the grist. Pale base malts, pale ale or Pilsner-type, are common for the rest — Belgians will of course use local grains as their first choice. Darker versions use more highly kilned malts or darker sugars for color and flavor. Pale sugar may be used as an adjunct to increase attenuation.

Some form of step mash to increase attenuation and dryness is typically employed, often with multiple steps. The use of cereal grains often dictates the need to use lower temperature rests to break down some of the more complex starches in grains that have not been malted. Other types of mashing can be used, as long as the mash schedule is designed to encourage fermentability and high attenuation in the final product.

Hops are typically European, with Belgian, French, English, or German varieties common. Many varieties can be used as long as the sensory characteristics work with the chosen yeast variety. Hops typically described as herbal, spicy, or floral will work best. A bitterness addition that produces a balance on the bitter side is desired — the beer should not seem sweet due to low bitterness. Flavor additions and aroma additions are common, but should not overwhelm the yeast. Think complementary as the goal. Dry hopping is possible in this style.

The yeast selection is critical for a saison with specialized yeasts usually with saison in the name rather than a more generic Belgian strain. Many of these yeasts have a genetic variation that makes them high attenuators of beer, so if you see *diastaticus* or STA1 in the details, you have the right one. These yeasts should produce the desired flavor profile (spicy and fruity), not just be high attenuators. As previously noted, *Brettanomyces* is not typically used to produce this style. The diastatic yeast can do the job on its own. That said, *Brett* versions often are quite enjoyable but should be best entered in the *Brett* Beer category with saison as the base style.

Some Belgians might use herbs and spices (Saison Pipaix is known for using a touch of black pepper, for instance) but most do not use these additions. Between the yeast and the hops, the beers will usually have plenty of spicy notes. If spices become individually noticeable, the beer may be better entered in the Spice, Herb, and Vegetable Beer category instead.

While I often have more concrete examples of ingredients used in style descriptions, I've kept these recommendations intentionally vague. Phil Markowski, in his dated but still excellent book *Farmhouse Beers*, says that "almost anything goes" when it comes to formulating these recipes. To be overly prescriptive limits that well-known Belgian creativity. I think having the style goals in mind when you make your choices is the best way to approach recipe development for this style.

HOMEBREW EXAMPLE

I like my saisons like my cocktails, with some rye in them. In this case, I'm using some flaked rye but malted rye can be substituted. The bulk of the grist is Pilsner malt and, for a saison, I like to use grain from a Belgian or French maltster like Dingemans or MFB. Some additional character base malt like wheat malt, Munich malt, and a pale ale malt like Golden Promise round out the grist. I think using some of these additional character-type malts gives a stronger, grainier flavor, which seems to fit the farmhouse tradition.

I've played around with a variety of mash programs in a saison and I think a traditional step mash is quite reliable. The lower rests help with unmalted starches while the main rest temperature encourages maltose production that subsequently makes the beer dry when fermented out. The mash program, combined with the yeast I describe later, helps the beer finish at a lower gravity. If you find that you cannot reach the lower final gravity levels, try adding some white sugar or turbinado sugar.

For the hops, I'm using a more modern variety, Pacific Jade from New Zealand. The description talks about lemon rind and black pepper flavors, which is what I want from my saisons. If you substitute hops look for something that is described as citrusy and peppery. Avoid yeast that produce clove-, smoke-, or plastic-like phenolic compounds. First wort hopping provides a smooth bitterness and moderate hop flavor followed by a late addition to provide some additional aroma.

My favorite saison yeast is Wyeast 3711 (French Saison), which is a *diastaticus* yeast strain – meaning it can ferment additional carbohydrates that normal brewer's yeast cannot, which leads to a drier finish. If you substitute yeast, look for one described as diastatic or having the STA1 gene. The other strains I list in the recipe also have this characteristic. I found the French saison yeast to work at normal to warm room temperature and not requiring any special fermentation procedures.

Remember, the final balance of the beer should be dry, highly attenuated, and fairly bitter with a fruity and spicy yeast and hop character. The low final gravity creates more alcohol so be careful about increasing the starting gravity — it will make a bigger beer, but also may give it more body and less perceived dryness. Finally, a high level of carbonation accentuates the dryness and spiciness of the beer, so be sure to use heavier bottles or keep the beer in a keg. BYO

Photo by Charles A. Parker/Images Plus

The Paths to Homebrewed Beer

Extract & all-grain brewing

by Ryan Hansen

In case you haven't noticed, it's the best time in history to be a homebrewer! Not only has the craft beer industry grown exponentially in the last 30 years, but the access for homebrewing ingredients and equipment has also increased significantly. This is a great thing if you want to get into the hobby or want to level-up your brewing abilities and recipe control by moving from extract brewing to all-grain.

It was not a surprise to see the 2022 brewing survey results from the Brülosophy crew that showed that 70% of brewers started as extract brewers, but up to 95% of respondents are now all-grain brewing (https://brulosophy.com/2022/08/04/2022-general-homebrewer-survey-results/). I fall into that statistic, making my first batch from a dry malt extract 1-gallon (4-L) stovetop kit, immediately falling in love with the hobby, and jumping straight into five-gallon (19-L) all-grain brewing for my second batch after binge-watching hundreds of hours of YouTube videos about it. While this article may have tips handy for those who have followed this route and are now all-grain brewing, the primary audience it is intended for is those curious about all-grain brewing or even curious about homebrewing in general. Got a friend who may enjoy the hobby? Pass this issue to them when you are done reading it!

Photo by Les Jörgensen

Maltsters do the mash process for you and then dehydrate the wort to create malt extract, which saves time and requires less equipment for homebrewers using extract instead of doing their own all-grain mash.

We will cover the basics of the two brewing styles, name the equipment needed for each, and list some pros and cons. If you're brand new to brewing I hope this is informational enough for you to decide which level to jump into the hobby. We will also go over the basics of the whole brewing process and you'll see that the extract vs. all-grain decision will only affect the first phase of brew day: The mash.

An understanding of the basic brewing process is necessary for either brewing style. Fundamentals like cleaning and sanitation, process, and temperature control are non-negotiable parts for any brewing you're doing. If it is your first brew day then pay close attention to your kit's instructions for cleaning, sanitizing, and setting up to brew.

BREWING WITH EXTRACT

The primary difference between extract and all-grain brewing is how we go about making the wort. Wort is the "sugar-water" that will ferment with yeast as it turns into beer. In extract brewing we make wort by adding malt extract, either dry or liquid, to water. Liquid malt extract (LME) is a syrup that usually comes in large cans, plastic jugs, or thick foil pouches. It's added directly to the hot water you've prepared and you stir it until it's completely dissolved. It's just like dissolving honey or molasses into hot water. Aside from the potential of scorching on the bottom of the kettle (just turn off your heat source when stirring in the extract) there's not much that can go wrong during this step, unless you're clumsy like me and get the sticky mess on the counter/clothes/hands — this stuff can turn your kitchen into what looks like a crime scene real quick if you're not careful. LME is made by professional maltsters who use base malts, specialty malts, and sometimes unmalted grains to a make a mash, then separate the wort from the spent grains, and then they dehydrate that wort until it's a highly concentrated "wort in a can" that is very shelf stable and consistent. So they've done the mash process for you and then concentrated it so it's easier to store and ship to you.

Dry malt extract (DME) works in almost the same way, but instead of being a molasses-like liquid, it's dry and looks like a very finely ground flour. Adding this to your brewing water can be a bit of a clumpy mess at first, but it does dissolve into the water and gives you the same wort you'd have gotten from LME.

My recommendation for mixing in either DME or LME is to use a large whisk instead of a traditional spoon or mash paddle. It'll help them dissolve faster and the goo won't stick to your whisk like it will a spoon. Once you've created your wort you can check its pre-boil gravity to make sure you're on the right track for the recipe you're following. However, the extract kits that you can get nowadays are very consistent and trustworthy, so checking gravity is not required, it's just a spot check.

Many extract-based recipes call for steeping a small amount of specialty grain, which is necessary for adding characteristics that aren't available in extract form. Most beer styles that require crystal malts, for example, will call for steeping milled grains for 15–30 minutes in a "hop sock" or mesh bag. This step allows extract brewers to add specific flavors, colors, or mouthfeel to a recipe that has an extract base malt. If this is your first time brewing an extract kit, do not be surprised when you open the box and find a pound or two (0.45–0.9 kg) of milled grains.

A hybrid model of brewing found somewhere between extract and all-grain is called "partial mash" brewing. This method requires mashing

diastatic grains akin to all-grain brewing, but also uses extract to get the majority of the fermentable sugars. This would be typical for brewing styles that require grains with unique characteristics that aren't available in extract form but require conversion of the starch, such as dark Munich malts, aromatic malt, smoked malts, etc. Partial mash does require the traditional mashing steps that allow the starches to convert into fermentable sugars, but generally on a smaller scale so you may still be able to get away with doing these mashes in your kettle with the grains in a bag.

ALL-GRAIN MASHES

Before we talk about the next step, bringing your new wort up to a boil, let's cover the mashing phase for all-grain brewers. All-grain brewing is the method that gives the brewer full control of brew day variables. In this method the brewer is extracting the sugars, proteins, and carbohydrates from malted barley, specialty malts, and unmalted grains, instead of getting these from concentrated, premade wort (extract).

My typical all-grain brew day starts the night before when I mill the grains for whatever recipe I'm going to make. A typical 5-gallon (19-L) batch of beer will have anything from 6–15 lbs. (2.7–6.8 kg) of grains depending on the recipe, and generally speaking, the bigger the "grain bill" (what we call all the grains in a recipe when they're together) the more fermentable sugar will be extracted, meaning more potential alcohol. There are exceptions to that, of course, but a good example would be a 7-lb. (3.2 kg) grain bill for a 5-gallon (19-L) batch of Munich helles (a very light lager) will yield an approximate ABV of 4.5%, whereas my DIPA recipe with a 14-lb. (6.4-kg) grain bill will get me a nice 8% ABV. Recipes generally start with a base malt like pale 2-row or Pilsner malt. The base malt delivers the majority of the sugars that the yeast will later feast on. All-grain brewing also gives the brewer access to a very wide range of specialty grains; things like crystal malts, blackened malts (think coffee and dark chocolate flavors), and a huge variety of other ingredients that will add flavor, color, mouthfeel, and aroma to the final beer. These are the same specialty grains that one may find in a partial mash extract recipe.

The first step of the mash process is to mill the grain that the grain bill calls for. This can happen either at the local homebrew shop, the warehouse of your online retailer, or at home (more on grain mills when we talk about equipment). The goal of milling is to crush the grains just enough to expose the inside of the kernels to the steeping water. You should visually see the husks separated and the grains split, but not pulverized, which would make separating the grains from the wort after mashing difficult or impossible.

The crushed grains are then added to the mash tun. Mashing can be done in a number of ways. One of the most popular these days is the "brew-in-a-bag" or "BIAB" method where you line the kettle or cooler with a large nylon mesh bag, add the grains to the mash water that is held between 148–155 °F (64–68 °C) for approximately an hour. The grains can be stirred occasionally and at the end of the mash the bag can be removed like a giant tea bag, leaving behind the new sweet wort. You now technically have the same product that you had after stirring in the LME or DME when extract brewing.

Another mashing method can either use a false bottom, which is a steel slotted base that goes under the grains, or a slotted manifold. Both allow the liquid to flow through the grain bed and recirculate back over the top of the mash. This is basically a homebrew-size mash vessel that imitates the method used in profes-

Photos by Charles A. Parker/Images Plus

There are many different mashing methods when brewing all-grain recipes, including using a cooler with a false bottom as a mash tun or the brew-in-a-bag method where the grains are bagged and mashed in the same kettle used for boiling and easily removed when the mash is complete.

Photo by Les Jörgensen

Circulating cold water through an immersion wort chiller is an easy way to get your hot wort down to fermentation temperature post-boil.

sional brewing. This method allows the grain bed itself to act as a filter as it settles at the end of the mash. It is more efficient than BIAB, but is also more time-consuming and requires additional equipment. The kettles and false bottoms are also heavier and often take more time to clean than the BIAB method.

More recently has come the innovation of electric all-in-one systems that allow us to mash, recirculate wort during the mash, and then boil all in the same kettle. Just a bit of research and you'll see the specs that make these systems available from numerous manufacturers all a bit unique (*BYO* did a roundup of these products in the October 2021 issue, which digital members can find online at https://byo.com/article/electric-countertop-brew-systems/). The all-in-one systems are large enough to hold the mash water and the grain bill. At the end of the mash, we lift out the malt pipe (cylinder with a false bottom), BIAB, or basket from the wort and that will allow the grains to drain before we discard the spent grains. Some of these systems do require the addition of sparge (rinsing) water once the grains are lifted out because they can't hold the full volume of water and grains.

WHERE EXTRACT AND ALL-GRAIN CONVERGE

Once the grains are removed, we move to the boil step of brew day. This is the same for both extract and all-grain brewers. For 5-gallon (19-L) batch sizes, the most common homebrewing volume, we have two main methods of reaching and maintaining a boil: Gas or electric. Either way, we get the wort up to a boil and then follow the recipe's directions on adding hops and possibly other ingredients. The recipe will dictate how much hops, which varieties, and when to add them. A typical boil lasts one hour and most styles call for an early hop addition for bitterness and aroma hops added later in the boil or even after the boil is complete but prior to cooling.

The last step on brew day is to chill the wort to proper yeast-pitching temperatures and add the yeast. As we like to say, brewers make wort, and yeast makes beer! Pitching is just an industry term for adding the yeast. This can be dry yeast or liquid yeast, and the style of beer you're making will dictate which of the many available strains of yeast to use. For a typical ale you'll want your wort to be at or below 75 °F (24 °C), ideally 68 °F (20 °C), but each yeast comes with a recommended temperature range for fermentation. Lager yeasts will require temperatures in the mid-50s °F (11–14 °C), which may take more gear than the beginning brewer has at the start of their hobby. There are multiple ways of getting your wort down to fermentation temperature, but the basic 5-gallon (19-L) homebrewing kit will likely include an immersion chiller that circulates hose or tap water through a copper or stainless coil that sits in your wort. It doesn't require other gear like pumps, and it is a very effective method to use. For smaller 1-gallon (4-L) batches it's easy enough to set your pot into an ice bath in a sink or tub. One note at this phase is that everything that touches the wort after it's done boiling has to be clean and sanitized: The fermenter, stirring spoons, tubing, and everything else.

Once you've moved the chilled wort and transferred to the sanitized fermenter you can store it in a dark closet, spare bathroom, or other space where the temperature is as close to the desired fermentation temperature as possible with little fluctuation throughout the day. Direct light can have an adverse affect, so dark spaces or wrapping a blanket around the car-

boy is recommended if using a glass fermenter. Fermentation can take anywhere from five days to a couple of weeks. Most kits will recommend the full two weeks. Your homebrew starter kit will come with either an airlock or a blow-off hose that will lock into the lid so that the CO_2 created during fermentation will be able to escape while no bugs or outside air can get into the fermenter.

Bottling day is next. You're on the home stretch and just a few short weeks away from enjoying your new beer! Follow the instructions in your brewing kit on how to use a bottling cane to rack (transfer) your beer into the sanitized bottles. Some kits recommend transferring your new beer to a secondary fermenter, but doing so adds chances for oxidation or infection. While transferring to a secondary fermenter used to be common practice a decade ago, many homebrewers skip this step or only do it in highly hopped beers in order to separate the beer from the massive hop matter at the bottom of the primary fermenter before packaging. If you skip transferring to a secondary fermenter, instead, just add the recommended dosage of priming sugar directly to the primary fermenter and keep your siphon above the trub (hop matter, yeast, and other particles that sink to the bottom of the fermenter) when bottling. The key in this phase is to be as gentle as possible with the beer, not splashing or stirring, because you want to reduce the amount of oxygen exposure as much as possible. Oxidation is likely the most common fault for homebrewers and strips the beer of flavor while adding a Sherry-like taste. As you advance in the hobby, you'll find that there are tools and techniques that allow us to reduce or remove oxygen exposure completely.

You'll cap the bottles and the beer will referment a little more because of the priming sugar that was added, which is how the beer will carbonate. The CO_2 produced during this refermentation is trapped in the bottle and is absorbed in the beer.

After two weeks of storing the new beer in the same temperature-controlled and dark place that it first fermented, you can chill them in the fridge and now you get to enjoy your creation. You did it!

SO, WHICH METHOD IS BETTER FOR YOU?

With the primer on brewing methods behind us, let's now consider which approach may be better for you. The answer is not necessarily the same for everybody. As you've read, the differences are all on the mash-side. The boil, cooling, fermentation, and bottling processes are all the same whether brewing all-grain or starting with extract.

The pros of using malt extracts for making your wort are significant:

1. Ease. The learning curve is much smaller when brewing with extract. Think of this method as similar to making brownies from a box where

you just add a couple of ingredients, mix, and bake. Much of the hardest work has been done for you.

2. Equipment investment. You don't need the equipment for mashing. A 5-gallon (19-L) batch of beer can be done in a kettle as small as 3-gallons (11.5-L) if doing a partial boil (where the remainder of the water is added just prior to fermentation). If brewing all-grain batches, you must either add a mash tun to your equipment list or a kettle that is at least 8 gallons (30 L) if doing BIAB batches so it can fit the grain and water to mash in the kettle. In addition, once you get into all-grain brewing there are many other pieces of equipment that may not be required, but make the hobby easier, such as a grain mill.

3. Consistency. There are less variables to make mistakes when LME/DME manufacturers do the quality control for you.

4. Time. As mentioned, you get to skip the mashing and lautering steps, reducing the brew day length by two hours or so, depending on the all-grain method used.

5. Less equipment cost and less cleaning. Great for the beginner who may not be ready to dive into a new hobby with 100% certainty.

The cons of extract brewing:

1. Less flexibility in the recipe. There are limitations to what you can do with extract, and even when adding steeping grains or doing partial mashes, it is not the same level of flexibility that all-grain brewing allows.

2. The cost of extract is greater than grains. This is the pay-off for having the maltster do the work for you.

3. Less hands-on. One of the reasons many all-grain brewers say they prefer that method is because it feels more personalized. They are doing all of the work required to make that wort, and there is a sense of pride in that.

RECIPE IN ACTION

Let's put the information discussed up to this point into a recipe to help further illustrate the differences between extract and all-grain brewing. See the recipe on page 35 for a simple brown ale that I've brewed and enjoyed many times, with step by step instructions for each method.

CONCLUSION

If you are already doing extract brewing and making beer that you like, it may be a fun next step to jump into all-grain brewing, but it's certainly not necessary to make high-quality homebrew. If you are brand new to brewing then consider the pros and cons listed earlier and decide which approach better fits your desires for the hobby. As someone who quickly went from extract to all-grain brewing, I often recommend to people who believe they will really get into the hobby to jump right into it with all-grain and a setup that suits your needs. The flexibility to do any beer style and to access all available variables in the brewing process makes all-grain brewing more rewarding to me. However, if you're looking for a fun, more low-key hobby that won't consume the 4+ hours each brew day, then extract batches will likely be more convenient for you. The choice is yours, and either way you choose to make beer, the end result is going to be delicious.

Related Links:

We purposely simplified many parts of the brewing process in this article. If you want to learn more about some of the technical aspects that were touched on, check out these links that are all free to read online:

- BIAB is a great way to get into all-grain brewing. Learn more about this technique: https://byo.com/article/brew-in-a-bag-techniques/

- Lautering is the process by which the brewer separates the liquid sweet wort that will go on to the boil from the solid spent grain once the mash is complete: https://byo.com/article/lautering/

- New to the hobby? Check out our "New to Brew" page with all you need to know about ingredients, gear, techniques, and more to start homebrewing: https://byo.com/newbrew/

Beppy's Brown

(5 gallon/19 L, all-grain)
OG = 1.051 FG = 1.012
IBU = 40 SRM = 14 ABV = 5.1%

This simple brown ale recipe illustrates the differences between brewing all-grain batches and extract batches of beer with extract replacing one malt in the ingredients and different techniques to get your wort in the boil kettle.

INGREDIENTS

10.5 lbs. (4.8 kg) 2-row pale malt
4 oz. (113 g) Carafa® Special I malt
4 oz. (113 g) caramel malt (60 °L)
4 oz. (113 g) brown malt
4.5 AAU East Kent Golding hops (60 min.)
(1 oz./28 g at 4.5% alpha acids)
5 AAU Willamette hops (45 min.)
(1 oz./28 g at 5% alpha acids)
5 AAU Willamette hops (15 min.)
(1 oz./28 g at 5% alpha acids)
Whirlfloc tablet (10 min.)
Imperial Yeast A10 (Darkness), White Labs WLP005 (British Ale), or LalBrew Nottingham yeast
¾ cup corn sugar (if priming)

STEP BY STEP

Heat 3 gallons (11.5 L) of strike water up to 165 °F (74 °C). Stir in the crushed grains, making sure no dough balls remain. The goal is that the mash temperature stabilizes between 150–152 °F (66–67 °C), but don't worry too much as long as you are within 5 °F (2.5 °C) of this target. After 60 minutes, the mash is complete. You will want to sparge with about 5 gallons (19 L) of hot water at about 180 °F (82 °C). You should target about 6.5 gallons (24.6 L) of wort in the kettle at the end of sparging.

Boil the wort for 60 minutes, adding hops at times indicated and Whirlfloc at 10 minutes remaining. At the end of the boil give the wort a long stir to create a brisk whirlpool then let settle for 10 minutes. Cool to 68 °F (20 °C) and transfer to your fermenter. Aerate the wort (if you can) if using a liquid yeast strain.

Hold the temperature between 68–74 °F (20–23 °C) during fermentation. When fermentation is complete, rack the beer, prime and bottle condition, or keg and force carbonate.

(5 gallon/19 L, extract with grains)
OG = 1.051 FG = 1.012
IBU = 40 SRM = 14 ABV = 5.1%

INGREDIENTS

7 lbs. (3.2 kg) pale liquid malt extract
4 oz. (113 g) Carafa® Special I malt
4 oz. (113 g) caramel malt (60 °L)
4 oz. (113 g) brown malt
4.5 AAU East Kent Golding hops (60 min.)
(1 oz./28 g at 4.5% alpha acids)
5 AAU Willamette hops (45 min.)
(1 oz./28 g at 5% alpha acids)
5 AAU Willamette hops (15 min.)
(1 oz./28 g at 5% alpha acids)
Whirlfloc tablet (10 min.)
Imperial Yeast A10 (Darkness), White Labs WLP005 (British Ale), or LalBrew Nottingham yeast
¾ cup corn sugar (if priming)

STEP BY STEP

Heat 6 gallons (23 L) of water up to 150 °F (66 °C). Place crushed grains in a hop sock or mesh bag that allows wort to flow freely through the grains. Submerge in water and maintain this temperature for half an hour. Remove bag and then bring the wort to a boil. Remove kettle from heat and stir in the malt extract until fully dissolved. Return kettle to burner and boil wort and boil for 60 minutes, adding hops at times indicated and Whirfloc at 10 minutes remaining. At the end of the boil give the wort a long stir in a circular direction to create a brisk whirlpool then let settle for 10 minutes.

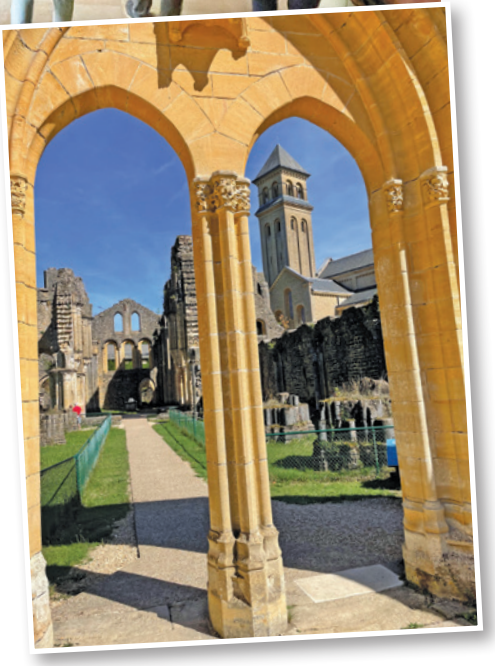
Cool to 68 °F (20 °C) and transfer to your fermenter. Aerate the wort (if you can) if using a liquid yeast strain. Top fermenter up to 5.25 gallons (20 L) with cold water. Hold the temperature between 68–74 °F (20–23 °C) during fermentation for two weeks. When fermentation is complete, rack the beer, prime and bottle condition, or keg and force carbonate.

DRINK LIKE A MONK

BYO's Belgium Brewery, Biking & Hiking Tour

Brew Your Own readers including Publisher Brad Ring recently spent a week exploring Belgium's breweries, beer cafes, and scenic countryside. With visits to five Trappist abbeys (Westmalle, Achel, Rochefort, Orval, and Chimay) and several more abbey breweries such as Grimbergen where Father Karel showed us their brand new brewery, the *BYO* tour explored the long-running relationship between the church and brewing in Belgium's storied beer culture. We also visited a broad spectrum of breweries from the tiny 26-gallon (100-L) nano brew system of the Microbrasserie Zythologist to the impressive brewing campus of Duvel Moortgat. No beer trip to Belgium is complete without a visit to a traditional sour beer producer and we all enjoyed sampling young gueuze right from the aging barrel at De Lambiek Fabriek. All along the way we had the chance to meet with friendly local brewers from Belgium's growing craft beer community and ask plenty of questions while trying their beers.

Each day we also took to the trails for scenic hikes and bike rides to earn those chalices of beer through the beautiful, rolling hills and farmlands of the French-speaking Wallonia region of Belgium.



From tripels to saisons, it was a special chance to enjoy classic beer styles at the source. Plus, all that beer had plenty of great Belgian food paired alongside (often using beer as a key cooking ingredient) giving plenty of fuel for hiking or biking to the next stop. It was a treat to have Orval's Vert patersbier served on draft at the abbey cafe (the one and only place it is served), spend the night on the brewery grounds at Het Anker's hotel, bike up to the neighborhood co-op brewery Brasserie de la Lesse to learn how locals banded together to run a brewery for their small town, talk with homebrewers turned pro brewers at Brasserie Minne and Het Nest, see the ultra-modern new brewery tucked inside the ancient wooden rafters at Val Dieu Abbey, and sit down to a special historical saison tasting at Brasserie de la Senne. And it was a week made all the more special by sharing it with fellow homebrewers passionate about beer and exploring the incredible towns, countryside, and culture of Belgium.

Our next *BYO* brewery trip with space available is in our home state of Vermont during the peak of fall foliage October 11–16, 2023. Details on this upcoming trip can be found at byo.com/trip. We hope you can join us on a future beer adventure. Cheers! BYO

Photo courtesy of Shutterstock.com

Kellerbier

Seeking clarity in Franconia's unfiltered lager

by Scott Burgess

Every Friday morning at 7 a.m. sharp, the delivery truck would arrive streetside beneath my bedroom window. Sometimes it was the whiff of diesel exhaust that would seep into my consciousness and alert me that it was delivery day. Other times it was the rattle of the bottles in their plastic crates being unloaded from the flatbed. Either way, I'd awaken and greet them, sometimes a bit groggy from the night before, and lead the delivery team through the courtyard to the cellar of the house where I was living at the time. There they'd drop the case of beer — 20 freshly filled, half-liter bottles — and pick up the empties. And I'd pay them the usual: Around $10 U.S. (tip included).

Horizontal fermenters inside the kellerbier cave of Schmausenkeller in Reundorf, Germany.

What was this weekly beer they'd bring? And what had I consumed the night (or, let's be honest, nights) before that led to the grogginess? In the simplest terms, it was the beer of choice in my adopted town of Bamberg, Germany (and, really, the rest of Franconia). The beer that you drink most everywhere, but especially at the bierkeller (the Fraconian term for a biergarten). Kellerbier.

But a single term — or even an official "style" designation — can't come close to capturing what kellerbier really means. And it means a lot — to the region, to tradition, and to me. What exactly is kellerbier then? If you trust the guidebooks and guidelines, it's "a young, unfiltered lager that's usually either amber or pale. It can have levels of what typically may be considered 'off' flavors, including, but not limited to, diacetyl, sulfur, and/or acetaldehyde." The paler stuff comes from southern Bavaria and the amber from Franconia.

OK. But what is kellerbier, really?

In all honesty, it's a beer that defies pat description. Or, even more so, prescription. I can't truly tell you "how to brew" the style. Because there isn't just one way to do it. Or two. Or 20. There are literally hundreds of unique, idiosyncratic examples to be found within about an hour's radius around Bamberg. All of them different. All of them delicious. But what I can do is tell you what I've learned about what makes a true kellerbier, having consumed literally hundreds of these various examples over the decades since I lived in Bamberg.

So, let's begin with the year in the scenario we opened with: 1999. I had originally gone on exchange from the University of South Carolina to Bamberg back in 1993. But after a year there, I did not want to leave. I just couldn't leave, and I didn't, for nearly a decade. Why? Because there was simply too much work left to do. You see, during my first year, when I wasn't studying (which was most of the time), I had managed to visit somewhere in the vicinity of 150 breweries and their various bierkellers within the aforementioned hour's radius of Bamberg. The problem was, there were almost 400 total in operation at the time within that same distance. And I was determined to visit more of them. All of them.

It's more than 20 years later now. Some things have changed since those heady early days. I think the price of a case of bottles, including delivery, has risen to around $15 U.S. Home delivery still exists from my Friday go-to, as well as from the hundreds of other breweries. I've been back in the interceding years almost a dozen times. In that time, I have now managed to sample around 300 of the remaining 350 or so unique breweries and bierkellers. And, still, there's so much work left to do.

A SHORT HISTORY OF KELLERBIER

A big reason for the proliferation of small breweries in the area in and around Bamberg known as Oberfranken, or Upper Franconia, is that all landowners were given brewing rights by the prince bishops who ruled there before the area's incorporation into the State of Bavaria. Many of these possessed the necessary land for growing raw materials, so the entrée into brewing was eased considerably. Most of these planter/brewers made their money from various sources — beer being just one of them. Why not open a brewery? In Bamberg at the time I lived there in the '90s there were 10 breweries. In 1910, there were 110. In the years preceding, even more. Literally down every alley and in every neighborhood. Another more obvious reason why the area is so heavily condensed with breweries is that the landscape and the soil is ideally suited for the growing of barley and hops. And while it's no longer the hop-producing center that, say, the Hallertau is, traditions still run deep.

But why kellerbier and not, say, helles (as with much of Bavaria)? Again, that may have something to do with geography. The sandstone hills that comprise the Franconian countryside provide more than a lot of beauty. They also serve a very real, and very important, purpose for the production of kellerbier. Buried beneath the hills (or, more specifically, cut into them), at a depth ideal for lagering beer at 43 °F (8 °C), are vaulted

cellars. "Keller" means "cellar" in German. And lining the walls of these kellers throughout the centuries — and to this day — are rows and rows of (traditionally wooden) kegs of kellerbier. These bierkellers are found scattered throughout the countryside as well as within the city limits of Bamberg and other towns. Many are owned by the breweries themselves. Some are owned by the locals for their personal storage. At any rate, traditionally, brewers would produce the beer at the in-town breweries and then lay it down young for lagering on the outskirts of the village in a bierkeller. And the locals who owned their own keller would go to pick up their own young beer to lay down for lagering. As we all know, it's sometimes difficult to resist tapping into a fresh keg before the beer is truly "ready." This is, and likely has always been, the case with the locals and their kellerbier. Moreover, town and village dwellers who didn't own their own keller could fetch fresh beer daily (diesel delivery trucks weren't a thing yet) from the breweries' bierkeller to take home for the evening's meal. Having worked up a thirst to get to the caves, they would often stop to have a few while there. Hence the tables and the shade trees. And the snacks that pair perfectly with these refreshing brews. The original biergartens in Franconia were all perched atop these cellars. And so the Franconians still call their biergartens "bierkellers."

It was as common a ritual as going to the butcher for your meat, the market for your produce, or the bakery for your daily bread. Indeed, kellerbier is the beer locals have for centuries considered their "liquid bread." Like the best German bread, it can vary in style and execution widely and wonderfully, from light to dark, yeasty to grainy. It fits no parameters and yet somehow manages to comprise all the parameters of what beer should be. It's almost always served super fresh. Poured from a gravity keg with a brass tap hammered into the bung and a "ventil" smacked into the top to allow some air in and improve the flow (and add just the faintest hint of oxidation in some cases) into a traditional ceramic mug. Set down in front of you at a rustic outdoor table, and often accompanied by plates of roasted, cured, or ground pork, it's been this way for centuries. And it continues to this day. Franconians are a proud, stubborn people that way.

HOW, AND WHERE, TO FIND THE BEST (AND MY FAVORITE) KELLERBIERS

As mentioned, to best understand kellerbier you'll need to visit the area. Because to truly experience kellerbier you have to drink it in its native habitat: The bierkeller. Yes, commercial examples are readily available. And more and more places are brewing kellerbier. But just trust me on this one. The fresh stuff from Franconia — served from a gravity keg at the bierkeller — is the definition of kellerbier, if there can be a definition at all. And it's a definition with hundreds of entries. Go and try, say, a few dozen. The place makes it easy.

By bike — my personal preferred mode of transport — you can easily reach around 150 bierkellers using Bamberg as your home base. You can rent a bike from one of the handful of shops. And simply set out. Any direction will do. Cycle through the beechwood forests surrounding Bamberg (which feed the area's rauchbier brewers with the clean-burning wood for making that specialty) and pop out to any village that may lie just beyond the lines of trees and you're likely to happen onto a gem of a bierkeller. Some directions are hillier than others. You can choose based on your desire to supplement your sojourn with a workout. The Steigerwald to the west is most arduous, but you'll be rewarded for your work at the Reundorfer Schmausenkeller (beers from Brauerei Müller), the Pettstadter Keller (Löwenbräu Buttenheim), or the lovely Witzgall beers in Schlammersdorf. The Hauptsmoorwald to the east (Griess Keller, St. Georgen-Bräu, Brauerei Honig, Brauerei Reh). North or south can take you on a flat path along the Rhine/Main/Danube canal (Brauerei Kraus, the Forchheimer Kellerwald, basically paradise for bierkellers and kellerbier, and the Kreuzberg kellers in Hallerndorf). Whichever direction you choose, just continue the loop alongside the waterways and/or back through the woods. You're guaranteed to hit at least a half-dozen breweries in a jaunt of a few hours. And they'll all be magical. Just ask the respective locals you'll meet.

As you cycle through the region, remember, let the locals and not your academic expectations be your guide. Kellerbier may be brown. Or gold. Or near black. As well as pale or amber like the guidelines say. Anyway, it can be kinda hard to tell when you're peering down into your ceramic mug (if you're anything like me, in pure amazement at how satisfying the stuff is). How wonderful to catch that whiff of SO_2 that sometimes hits you in the nose and makes you think of the fresh stream water that runs through the valleys throughout the region of sandstone hills and, at its most severe, jurassic rock formations. Streams that, as in the case of the lovely little Felsenkeller in Rossdorf am Forst, for example, run right alongside your biergarten table. Or that, say, at Brauerei Mager in Pottenstein, are home to the rainbow trout the brewery/restaurant will fish out of the Wiesent River and serve broiled with butter and potatoes to go along with your bright, hoppy half liter.

KELLERBIER IN BAMBERG

The kellerbier I would drink most when I wasn't consuming the bottles I'd have delivered was my local: Mahrs Bräu. It's also probably the most well-known example in the world. I lived at the time in an area of Bamberg known as the Wunderburg. It was, and remains, a working-class area. A bit of a walk from the touristy spots where the more famous taverns of Schlenkerla and Spezial are located. A stroll along the canal and a flight of stairs or a ramp up the riverbank will take you to the brewery, bierkeller, and super cozy tavern. If you're navigating, it's literally across the street from another brewery, Keesmann (with their own version known as Sternla). And, being a bit out of the way, both of those

are priced more for the local wallet/budget. A half-liter of fresh kellerbier straight from the gravity keg used to cost around $2 U.S. Now it costs closer to $3 U.S. But it's still just as fresh and just as delicious.

Even with a cellar full of delivered bottles, I would make the walk almost nightly with my 3-liter ceramic *Stützle* (roughly "growler") for the evening's beer. Three liters to go cost me $5 U.S. back then. These days it's a little more, but not much. Mahrs Kellerbier is more specifically known as Mahrs Ungespundetes. *Ungespundet* means unbunged. Which is to say the tanks aren't bunged or spunded. So the CO_2 produced during fermentation is largely lost and the resulting beer is very low in carbonation. At Brauerei Hönig – my Friday fill-up source – their unbunged kellerbier is simply called "lagerbier." In some places it may be called something even more cryptic like *"urtrunk"* (original drink, roughly). Again, don't pay too much attention to names. Focus on the next sip from your ceramic mug instead. Other Bamberg examples can be found at Spezial (Ungespundetes); Klosterbräu (Kellerbier); Greifenklau (Zwickel); Bürgerbräu Bamberg/Kaiserdom (Kellerbier).

BREWING YOUR OWN KELLERBIER

While I mentioned earlier that I can't possibly prescribe one way to brew kellerbier, I've learned enough to say the following of the "style" for those looking to brew it in its most traditional form. And it's not what you may be thinking. As mentioned, kellerbier can range in color (and, thus, grain bill) from the very dark to the very pale. That said, you're likely going to be working with some combination of Pilsner and darker Munich malt. If I had to give a classic ratio, I'd say 70% Pils and 30% Munich is a good starting point. But the ratio can be much higher or lower. So go with what you feel most comfortable with, I guess. The hops are noble varieties with Spalter and Perle perhaps being the common. Go with all lower alpha acid hops and do two charges — one at 60 minutes and another at 15, to anywhere between, say, 20–34 IBUs. Yeast should be the Weihenstephan classic lager strain; something that won't flocculate out completely before around 7–8 weeks. Kellerbier should be slightly cloudy. That's about it for ingredients. Now onto the important stuff.

Kellerbier is the everyday beer of choice throughout the Franconian region of Germany, traditionally served in ceramic mugs by the half-liter.

The most important things I've learned about making true kellerbier center on fermentation and serving method. First, make a yeast starter if using liquid yeast or use two packets of dry yeast. That should kick off fermentation quickly, even at low temperatures — 50–52 °F (10–11 °C) is a good place to start. Let temperatures free rise to around 58 °F (14 °C) during primary. They can go a bit higher even, so don't fret too much. Kellerbier is known for having some estery qualities, as well as a whiff of SO_2 on the nose. This young beer flavor is prized in the super-fresh stuff. To me, it is reminiscent of the organic smells coming off the creeks that sometimes flow through Franconia. It just screams freshness. Also, and this is key, keep the primary fermenter unspunded. The CO_2 should escape almost completely, leaving a very low amount of CO_2 in solution. True kellerbier comes in somewhere in the low 2.0 volumes of CO_2 range. It can go even lower than that in some cases. After primary, drop the temperature steadily over the course of another week or so to the 30s °F (1–3 °C). Hold at that temperature for one more week (so this is three weeks total before you consider serving).

For serving, if you're going to bottle condition, reduce the amount of priming sugar considerably. If you really want to get the full effect, though, you should consider filling 5-quart (5-L) party kegs instead of bottles. Bottled kellerbier is a bit of an oxymoron. True kellerbier always comes from the keg, by gravity.

So, yes, there are innumerable ways to brew kellerbier. And fewer ways to enjoy the true stuff. At Bierkeller Columbia we brew but one example of kellerbier. Our inspiration is our favorite: Mahrs Ungespundet. Find a clone recipe for it on page 43.

Bierkeller Columbia's Kellerbier clone

(5 gallons/19 L, all-grain)
OG = 1.054 FG = 1.013
IBU = 24 SRM = 6 ABV = 5.4%

As a lover of kellerbier from my decade of living in Bamberg, Germany, when it came time to create the flagship beer at Bierkeller Columbia (Columbia, South Carolina), I modeled it after my favorite: Mahrs Ungespundet. It is an unfiltered Franconian lager with a bready malt character that is balanced by soft carbonation and clean Perle hops.

INGREDIENTS

8 lbs. (3.6 kg) Weyermann Pilsner malt
3 lbs. (1.4 kg) Weyermann Munich II malt
4 oz. (113 g) Weyermann acidulated malt
5.6 AAU German Perle hops (60 min.)
(0.9 oz./25 g at 6.2% alpha acids)
2.1 AAU German Perle hops (15 min.)
(0.33 oz./9 g at 6.2% alpha acids)
½ tsp. yeast nutrients (10 min.)
White Labs WLP830 (German Lager), Wyeast 2124 (Bohemian Lager), or SafLager W-34/70 yeast
½ cup corn sugar (if priming)

STEP BY STEP

Mash in with 4.2 gallons (16 L) of strike water at 144 °F (62 °C) for 40 minutes. Target a mash pH between 5.2 and 5.6. Raise to 154 °F (68 °C) for 20 minutes. Raise mash temperature to mash out at 168 °F (76 °C), then recirculate and sparge with 170 °F (77 °C) water. Transfer to your brew kettle slowly, collecting 6.5 gallons (24.6 L).

Boil wort for 60 minutes, adding hops and yeast nutrient at times indicated. At the end of the boil conduct a whirlpool for 15 minutes, then cool to 48 °F (9 °C) and transfer to your fermenter. Pitch rate is 2 million cells/°Plato/mL (about 500 billion cells). Aerate wort well if using a liquid yeast strain.

Let temperature free rise to 56–58 °F (13–14 °C) over the first seven days and hold there for three days or until active fermentation has ceased. Over the course of several days, drop temperature to 32 °F (0 °C) and hold for one week. Keg and force carbonate or add priming sugar and bottle condition.

(5 gallons/19 L, extract only)
OG = 1.054 FG = 1.013
IBU = 24 SRM = 6 ABV = 5.4%

INGREDIENTS

4.5 lbs. (2 kg) Pilsen dried malt extract
1.5 lbs. (0.68 kg) Munich dried malt extract
1 tsp. lactic acid, 88%
5.6 AAU German Perle hops (60 min.)
(0.9 oz./25 g at 6.2% alpha acids)
2.1 AAU German Perle hops (15 min.)
(0.33 oz./9 g at 6.2% alpha acids)
½ tsp. yeast nutrients (10 min.)
White Labs WLP830 (German Lager), Wyeast 2124 (Bohemian Lager), or SafLager W-34/70 yeast
½ cup corn sugar (if priming)

STEP BY STEP

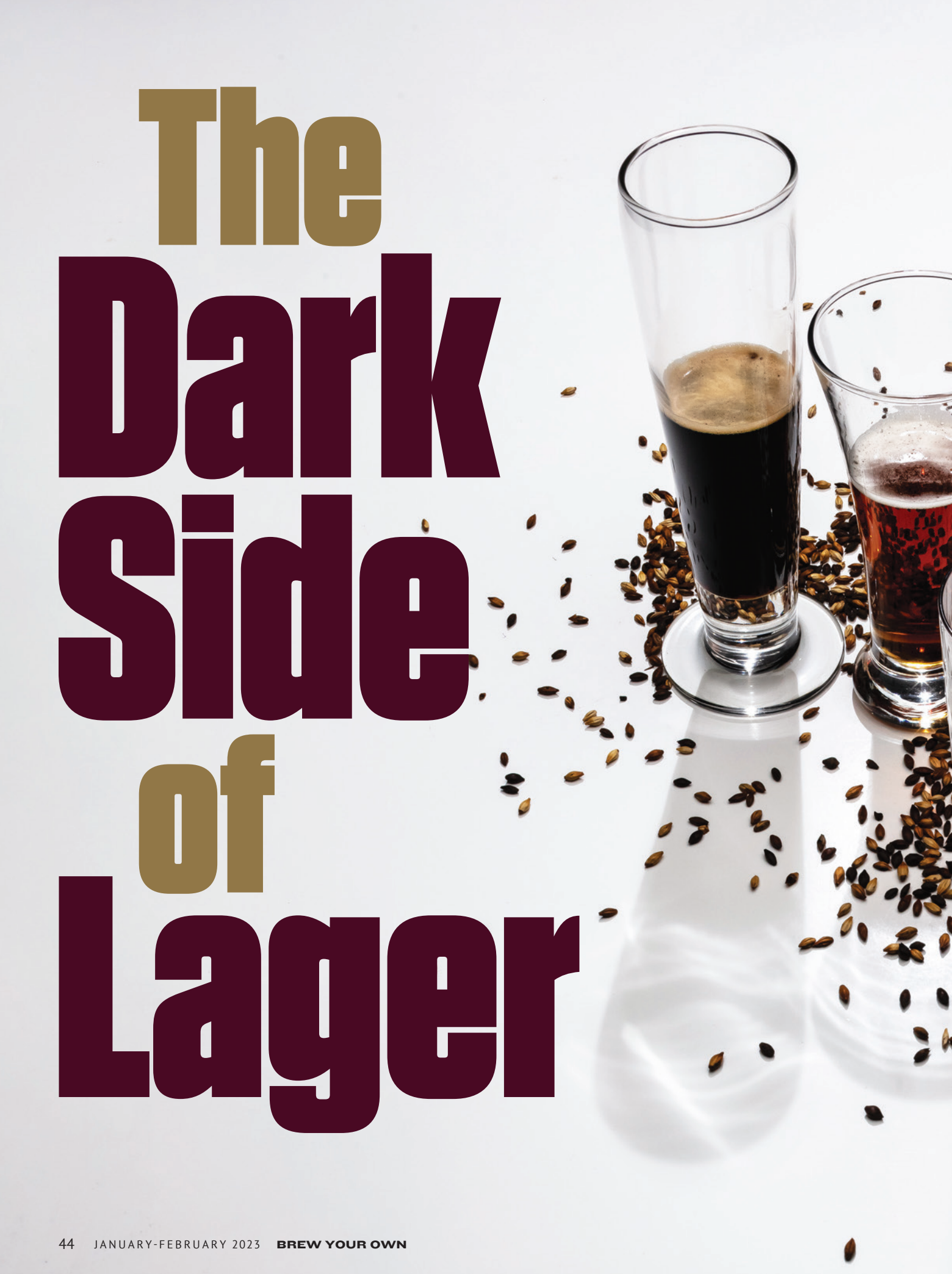
Starting with 5 gallons (19 L) of water in your brew kettle, heat to 180 °F (82 °C) then turn off the heat. Stir in the dried malt extract. Once completely dissolved, turn the heat back on and bring to a boil.

Boil wort for 60 minutes, adding hops and yeast nutrient at times indicated. At the end of the boil conduct a whirlpool for 15 minutes, then cool to 48 °F (9 °C) and transfer to your fermenter. Top up fermenter to 5.25 gallons (20 L). Pitch yeast at a rate of 2 million cells/°Plato/mL (about 500 billion cells). Aerate the wort well if using a liquid yeast strain.

Follow the remainder of the all-grain instructions. BYO

Photo by Alisha Ostermair

The Dark Side of Lager



Brewing classic dark lager styles

by Dan Russo

Dark Lagers are seeing a surge in modern American brewing culture but are very far from new. The various styles of dark lager have been around for hundreds of years and drinkers all over the world have enjoyed these delightful beers. The origins of dark lagers follow suit with other classic lager styles and can be attributed to originally being brewed in Germany or the Czech Republic. Germany's versions vary broadly in style and alcohol. They span from schwarzbier, to dunkel, bock, and doppelbock. The Czechs generally have one distinct style called tmavé pivo, and from the Baltic countries we have Baltic porter (which, even though it has porter in the name, is actually a lager). The influence of German brewing also spread to Mexico during the 1800s and heavily influenced early brewing culture in the country and created the negra-style of dark Mexican lager that is still enjoyed today.

All these beers styles have wonderful attributes and also present significant challenges to brew well. The ability to balance the dark roast character with the smoothness of a traditional lager requires a chef's kiss, so to speak. Paying close attention to malt profile, water chemistry, and how the beers are hopped will help to make a great version of any dark lager. My hope is to explain the styles with more significance and provide some helpful details on how to create a deliciously drinkable brew.

Photo by Charles A. Parker/Images Plus

DARK LAGER STYLES

Schwarzbier

Schwarzbiers can be as black as stout, but they generally tend to lean towards a dark brown character with ruby highlights. What was and still can be appealing to creating and drinking schwarzbier is the roast character. It has a tendency to mimic characteristics of stouts, while having the smooth drinkability of a lager. The roast character of the beer is the key, but it needs to be tame and any roast bitterness needs to be absent from the beer. All bitterness should be attributed to the hops (20–30 IBU) and the fermentation should be clean with a traditional German lager strain; your favorite one will work perfectly. They are traditionally brewed to 4.5–5% ABV. That said, I like to brew mine untraditionally to about 6% ABV for the winter. I find that little extra warming character really helps with the finish of a pint.

Munich-style dunkel

Dunkel's direct translation to English is dark. They are most often deep copper to dark brown in color and exhibit notes of caramel and bread crust from the extensive use of Munich malt in the style. Hints of chocolate generally tend to follow thanks to the use of dark malt, but does not hit the extensive roast profile that you tend to find in schwarzbier. With the heavy addition of Munich malt in the grain bill and a clean fermentation, you find yourself with a beer that can be beautifully paired with different types of food without overpowering any dish. Dunkels have a restrained bitterness and generally fall between 4.5–5.5% ABV.

Bocks and doppelbocks

Bocks and doppelbocks also hail from Germany, Einbeck to be specific. Though not all bocks are dark, a wonderful subset of the style brings a beautiful entry into the dark lager category. The name of the game here with both beers is malt sweetness. Driven by malt character, these beers are rich. Both were originally brewed by German monks to supplement food during Lenten fasts; so meant to provide needed calories. Most traditional bocks clock in at over 6% ABV while doppelbocks push the 8% ABV range and can go as high as 10%. Both are no joke, but balancing a high (by German lager standards) finishing gravity, while also creating a balanced, full-flavored and drinkable lager can be tough. When this balance is achieved, these are absolutely beautiful beers.

Baltic porter

Modeled after the classic porter recipes of Britain, the Baltic countries of Europe put their own spin on the style and began fermenting similar recipes with lager yeast. These beers are big, bold, and resemble classic imperial stout, with examples ranging from 6.5% ABV all the way up past 9%. The roast profile is profound, the malt character is complex and bold. The bitterness is low-to-medium, providing just enough balance to keep the beer from seeming cloying. The lager fermentation and extensive cold conditioning sends the beer to a beautifully smooth place. My favorite variations use a touch of wood smoke malt to really enhance the malt characteristics in the beer. Between the roast profile and alcohol content, but representative smooth profile of the beer, 4-6 months of lagering time before serving will truly benefit the style. Even longer can be better. I've known brewers (myself being one) that have won major awards with Baltic porter at two to three years old. Once that long maturation is achieved, something special will be enjoyed.

Tmavé pivo

Largely forgotten, until recently, Czech-style dark lager is stunning when created and brewed correctly. It's meant to be rich and flavorful, but as easy to drink as a Czech-style Pilsner. It has a low-to-moderate roast character with a slight malt sweetness. Incorporating an extensive malt bill helps to balance out all the flavors instead of relying on just a few malts to do the job. Hopping levels vary by example and a touch of diacetyl is also present in some. Trying to shoot for a beer at about 4.5% ABV will help hit all the marks and have you wanting to return for another. Tmavé pivo is one of my favorite styles that I have had the chance to create in the last couple of years and look forward to many more takes on the style.

Negra-style Mexican lager

This is another one of my favorite styles to make and drink. These beers have had such an impact on the world of brewing and continue to influence how we make dark lager. In the mid-1800s, German immigrants not only came to America and started a longstanding brewing culture, but also traveled to South and Central America. Many of those who landed in Mexico brought centuries-old brewing tradition to the culture that have had a longstanding impact on how we make beer. A cross between Vienna lager and dunkel lager, Mexican dark lager uses the addition of corn to help dry out the body, while contributing a pleasant sweetness, all while fermented with a traditional lager yeast. Dry, crisp, and full-bodied, it can be one of the tastiest dark lagers when created properly.

CREATING DARK LAGERS

While each dark lager style is unique in its own way, there are commonalities among ingredients and technique that should be looked at when brewing any dark lager. At Oakshire Brewing in Eugene, Oregon, where I lead brewing operations, we have brewed many examples of these beers. So I'll summarize the major considerations homebrewers should have when brewing a dark lager while sprinkling in my own experience and preferences when it comes to these styles.

Malt

The base of all your dark lagers should be Pilsner malt. American Pilsner malt will always work; but if available, German Pilsner malt provides the best representation of the style. I have come to the opinion that creating a classic style of beer deserves the classic ingredients that pay homage to the country of origin. However, maltsters all over the world are cre-

Photo courtesy of Shutterstock.com

Malt character shines in all traditional dark lager styles and complexity is most often achieved through a variety of roasted, Munich, and Pilsner malts.

ating great examples of traditional malts. Try what will work for you in your time and place, and with good technique you can create a fantastic beer with almost any malt available.

The hardest part of brewing dark lagers is the balance. Most dark beers, including lagers, use some sort of dark malt to achieve their color. Most, though not all, will also come with a roasted or chocolate-like characteristic associated with them in the beer. I have found the trick to be to use dehusked and de-bittered black malt. My personal favorite is Weyermann Carafa® Special malt. They are labeled as type 1, 2, and 3. Ranging between 300–500 °Lovibond, just a little will create the roasted malt impact that you are looking for in any of your dark lager beers. At Oakshire, we use Weyermann for our dark lagers to keep as true to style as we can, but you can certainly use Briess Blackprinz® or Midnight Wheat to have the same character; but if chasing traditional lager, German malt will always win out. My choice varies between Carafa® Special 2 and Special 3. I usually employ Special 3 as it has a more direct impact on the beer with less malt usage and allows the base beer to shine. There are also other malt products such as Weyermann Sinamar® that can be used to darken the color of your beer. Try them all out to find which one works best for your brewing.

Munich malt should be incorporated for most every dark lager. I'm a sucker for German dark Munich malt. Only a few Lovibond darker than traditional Munich, the longer kiln times add a beautiful caramel character to the base that helps to accent the desired malt character, especially to balance any roast malt added to the beer that you create.

Water

I'm lucky where I brew and with my source of water. I start at nearly zero on all ranges. I get to adjust as I see fit to recreate beer in a way and style that makes sense. That being said, I implore you to do research into your local water supply. You can find all the information from your local water department, often listed on their website, which makes water adjustments to match any profile possible. Beginning with reverse osmosis water is another great option.

When looking at dark lager in particular, the focus should be on adjusting your wort pH before fermentation. With the addition of dark malt, you are going to drive down the pH; sometimes lower than you would like. We use calcium carbonate to re-balance our wort pH during the mashing process. A little bit of mash salt can go a long way to helping create great lager beer!

Hops

Dark lagers are not generally extensively hopped. From tmavé pivo through Baltic porter, we are looking

for a harmonious balance of malt-to-hops. Most of the hopping is focused towards bittering. We want to balance the intense malt character with an even bitterness. Any additional IBUs come from late addition hops in the kettle and during the whirlpool, but tend to be very minimal. Certain hop varieties achieve this bitterness in a better fashion than others. Some bittering varieties will have an aggressive profile that even when added at a minimal level will come across as harsh and overbearing on the palate. Sometimes that works for a beer like IPA, but when you are looking for a soft profile in a lager of any sort, you want to make sure you are choosing the right hops. The classic hops used for lighter lagers are common with darker lagers as well. I have personally found that German-grown Herkules is perfect for most every lager that we make. It helps to fit the balance of the profile that we are looking to achieve. If German hops are not available, American-grown Nugget and Warrior have become our go-to substitutions and work well.

For finishing hops we almost exclusively use either Hallertau Tradition or Czech Saaz. For us it comes down to reliability of the product we are receiving. Similar to homebrewers, as a small brewery we don't have the ability to select a specific lot of German-grown hops to create our lagers. Our suppliers each year blend our German varietals to create the best representation of the style they can with that year's growing conditions. We've found that Tradition and Saaz repeatedly hit all the noble characteristics that we are chasing without being overbearing to the final beer and also give us the consistency that we are looking for. Again, the malt is king in these styles of beer and we want the hops to be a secondary contribution to the beer that brings everything together.

Fermentation

The only rule that I have for dark lager fermentation is that it is always cold and slow. I target between 50–52 °F (10–11 °C) for all of my dark lagers. I've found that a higher fermentation temperature can bring out some of the rougher attributes around the style. Getting the beer cold from the start allows the yeast to work through those rough profiles and balance them out. Don't rush fermentation — we're not out here making pale ale. This direction is simply the process that we have adhered to at Oakshire and best exemplifies what we feel are the best representations of dark lager styles. We also know that there are plenty of delicious versions of these beers that ferment at higher temperatures and for shorter amounts of times, so there is some leeway if you are unable or choose to ferment quicker at a higher temperature. A full week to week and a half of fermentation is beautiful and allows the yeast to clean up any diacetyl that may be lingering around. Once a final VDK (vicinal diketones) check is passed (i.e., you aren't tasting traits of diacetyl such as butter or butterscotch), start a strategic step crash. Take it down 4 °F (2 °C) every other day until you are at 34 °F (1 °C). From there it is all about time with the beer. Styles like dunkel, schwarzbier, negra, and tmavé pivo will be ready to go in another six to eight weeks.

Doppelbock and Baltic porter will benefit from many more months. Those two styles are meant to sit for an extended amount of time. You may feel the urge to get into your beer, but let them sit for a bit longer. The higher ABV of each style, along with the intensity of the malt character, can see some great benefits from extended aging. Once you send them to cold conditioning, check in with them every few weeks. It's really all about personal preference and will be up to you to decide when you feel they're ready. I've found doppelbock coming to fruition from our brewery in three to four months. Baltic porter for us is a minimum of six months. The higher roast malt profile, while driving in a smooth drinkability, starts to be seen on our end after that half year. That being said, at the end of the day it's all based on personal preference of taste.

With all these styles, a traditional German or Czech lager yeast strain will work beautifully. It really comes down to which is your favorite. We personally use the Czech Budvar strain from one of our preferred yeast suppliers. Professional brewers are all very opinionated on what lager strain to use; so, I would say do the same! Try a bunch out and decide which one does best for your style of brewing and tastes.

LET'S GET BREWING

Lager in general seems scary. People will tell you how difficult it is to create a lager the right way. The added layers in dark lager can have any person freaked out before brewing. There are a ton of variables that can lead a brewer to doubt their abilities in creating complex styles that make them seem out of reach to brew properly, especially in a homebrew setting. However, they should not be. Care and detail are paramount to making dark lager; just like any beer that you set out to create. The fun part with making dark lager is that there is a challenge, yet when created properly you have a beer that many people have not attempted, and many more people will want to drink when you are done.

In a world of crazy beer, the simplicity of something that seems tough can make your brewing mind be reimagined in ways that allow you to see further steps forward than you have ever seen. And if those steps forward happen over a pint that you created, and are able to change the view of how people see beer afterwards, then job well done! Now, fire up that kettle and get brewing your own dark lager.

Related Links:
Want to dig deeper into specific dark lager styles? Check out these previous "Style Profile" columns:

- Munich dunkel: https://byo.com/article/munich-dunkel-the-original-brown-lager-of-bavaria

- Baltic porter (Digital member exclusive): https://byo.com/article/baltic-porter-imperial-stouts-vagabond-cousin

- Schwarzbier (Digital member exclusive): https://byo.com/article/schwarzbier-germanys-darkest-beer

Oakshire Brewing Co.'s Doppelbock clone

(5 gallons/19 L, all-grain)
OG = 1.079 FG = 1.020
IBU = 16 SRM = 21 ABV = 7.8%

Doppelbock is one of our favorite brews to make each year. Ferment low and slow to ensure a very smooth and malt-forward beer that can withstand the high alcohol. Our trick is to first run off about a quarter of the wort and stop sparging. We then boil the highly concentrated wort for an hour to achieve the most out of the Maillard reactions of using a direct-fire kettle. We then finish our sparge and proceed with the rest of the recipe. After fermentation, the beer will remain in-tank undisturbed for about three months. We then transfer to our conditioning tank and carbonate. Shooting for a little higher on your carbonation will help offset some of the sweetness and make for a wonderful drinking experience for everyone around.

INGREDIENTS

4.25 lbs. (2 kg) German Pilsner malt
11 lbs. (5 kg) German dark Munich malt (9 °L)
1.2 lbs. (544 g) CaraFoam® malt
11 oz. (312 g) CaraMunich® Type II malt
3 oz. (85 g) Carafa® Special III malt
7.5 AAU Herkules hops (90 min.)
(0.5 oz./14 g at 15% alpha acids)
1 oz. (28 g) Saaz hops (0 min.)
Yeast nutrient (15 min.)
Whirlfloc (15 min.)
Wyeast 2000 (Budvar Lager), White Labs WLP802 (Czech Budejovice), Omega Yeast OYL-100 (Lager 1), or SafLager S-189 yeast
⅔ cup corn sugar (if priming)

STEP BY STEP

This is a single infusion mash, utilizing a grain-to-water ratio of 1.5 qts./lb. (3.1 L/kg). Add 1 tsp. calcium carbonate if using soft or reverse osmosis water. Target a mash temperature of 150 °F (66 °C) and hold for 60–90 minutes. Begin recirculation, then raise temperature to 168 °F (76 °C) for mash out and hold for 10 minutes. Begin sparging and, if possible, run the first 1.5 gallons (5.7 L) to a separate kettle and boil it down into a thin syrup. Continue to sparge, collecting another 7 gallons (26.5 L) in your kettle. Total boil time is two hours adding hops, yeast nutrients, and kettle fining per the ingredients list.

At the end of the boil, combine the two worts with the goal being that there is 5.5 gallons (21 L) of chilled wort in your fermenter. Chill to 50 °F (10 °C) and pitch a big starter or three packets of dried yeast. Repitching yeast from a smaller lager may be a great idea for a big lager like this. Also be sure to aerate/oxygenate the wort if repitching or using a liquid yeast strain. Ferment for 2–3 weeks at 52 °F (11 °C). Once signs of fermentation have ceased and final gravity has been achieved rack into a secondary vessel, such as a Corny keg, and lager at near-freezing temperatures for 2–3 months. Keg and force carbonate to 2.4 v/v or prime and bottle condition (consider adding a bottle conditioning yeast strain).

(5 gallons/19 L, extract with grains)
OG = 1.079 FG = 1.020
IBU = 16 SRM = 21 ABV = 7.8%

INGREDIENTS

2 lbs. (0.9 kg) Pilsen dried malt extract
6 lbs. (2.7 kg) Munich dried malt extract
1.2 lbs. (544 g) CaraFoam® malt
11 oz. (312 g) CaraMunich® Type II malt
3 oz. (85 g) Carafa® Special III malt
7.5 AAU Herkules hops (90 min.)
(0.5 oz./14 g at 15% alpha acids)
1 oz. (28 g) Saaz hops (0 min.)
Yeast nutrient (15 min.)
Whirlfloc (15 min.)
Wyeast 2000 (Budvar Lager), White Labs WLP802 (Czech Budejovice), Omega Yeast OYL-100 (Lager 1), or SafLager S-189 yeast
⅔ cup corn sugar (if priming)

STEP BY STEP

Begin with 5 gallons (19 L) of water in the brew kettle and submerge crushed grains placed in a muslin bag. Steep grains as the water heats up to about 170 °F (77 °C) then remove grains, allowing the liquid to drip back into the kettle. Turn off the heat and add half the dried malt extract and first hop addition then bring wort up to a boil. Boil for 60 minutes, adding the yeast nutrients, kettle fining, and remaining malt extract with 15 minutes remaining in the boil. Add the second hop addition after the heat is turned off.

Chill wort to 50 °F (10 °C) then transfer to your fermenter. The goal is to have 5.25 gallons (20 L) of wort. Pitch a big starter or three packets of dried yeast. Follow the remainder of the all-grain recipe.

Photo courtesy of Shutterstock.com

Oakshire Brewing Co.'s Tmavé Pivo clone

(5 gallons/19 L, all-grain)
OG = 1.048 FG = 1.013
IBU = 24 SRM = 28 ABV = 4.6%

Tmavé pivo is the overlying style of Czech dark lager. The beers are generally differentiated by their starting gravity and are named as such. Usually found in three variations, 8 degree (1.032), 10 degree (1.040), or 12 degree (1.048). Oakshire's is a 12 degree. We use an extensive malt bill to add depth to the final beer while eliminating as much of the roast character as possible. Supremely drinkable and one of our favorites to make!

INGREDIENTS

3.75 lbs. (1.7 kg) Bohemian Pilsner malt
4.4 lbs. (2 kg) German Vienna malt
6 oz. (170 g) CaraMunich® Type I malt (34 °L)
1.1 lbs. (500 g) CaraBohemian® malt (73 °L)
9 oz. (250 g) Carafa® Special II malt
4 oz. (110 g) melanoidin malt
3.8 AAU Herkules hops (75 min.)
(0.25 oz./7 g at 15% alpha acids)
4 AAU Saaz hops (20 min.) (1 oz./38 g at 4% alpha acids)
1 oz. (28 g) Saaz hops (5 min.)
Yeast nutrient (15 min.)
Whirlfloc (15 min.)
Wyeast 2000 (Budvar Lager), White Labs WLP802 (Czech Budejovice), Omega Yeast OYL-100 (Lager 1), or SafLager S-189 yeast
⅔ cup corn sugar (if priming)

STEP BY STEP

This is a single infusion mash, utilizing a grain-to-water ratio of 1.5 qts./lb. (3.1 L/kg). Add ½ tsp. of both calcium chloride and calcium sulfate. Target a mash temperature of 152 °F (67 °C) and hold for 60 minutes. Begin recirculation, then raise temperature to 168 °F (76 °C) for mash out and hold for 10 minutes. Begin sparging and continue until collecting 7 gallons (26.5 L) in your kettle. Total boil time is 75 minutes adding hops, yeast nutrients, and kettle fining per the ingredients list.

Chill to 48 °F (9 °C) and pitch a starter or two packets of dried yeast. Be sure to aerate/oxygenate the wort if repitching or using a liquid yeast strain. Ferment for two weeks at 50 °F (10 °C). Once signs of fermentation have ceased and final gravity has been achieved rack into a secondary vessel, such as a Corny keg, and lager at near-freezing temperatures for 6 weeks. Keg and force carbonate to 2.4 v/v or prime and bottle condition.

(5 gallons/19 L, extract with grains)
OG = 1.048 FG = 1.013
IBU = 24 SRM = 28 ABV = 4.6%

INGREDIENTS

3 lbs. (1.7 kg) Pilsen dried malt extract
1.6 lbs. (2 kg) Munich dried malt extract
6 oz. (170 g) CaraMunich® Type I malt (34 °L)
1.1 lbs. (500 g) CaraBohemian® malt (73 °L)
9 oz. (250 g) Carafa® Special II malt
3.8 AAU Herkules hops (75 min.)
(0.25 oz./7 g at 15% alpha acids)
4 AAU Saaz hops (20 min.) (1 oz./38 g at 4% alpha acids)
1 oz. (28 g) Saaz hops (5 min.)
Yeast nutrient (15 min.)
Whirlfloc (15 min.)
Wyeast 2000 (Budvar Lager), White Labs WLP802 (Czech Budejovice), Omega Yeast OYL-100 (Lager 1), or SafLager S-189 yeast
⅔ cup corn sugar (if priming)

STEP BY STEP

Begin with 5 gallons (19 L) in the brew kettle and submerge crushed grains placed in a muslin bag. Steep grains as the water heats up to about 170 °F (77 °C) then remove grains, allowing the liquid to drip back into the kettle. Turn off the heat and add half the dried malt extract and the first hop addition, then bring wort up to a boil. Boil for 60 minutes, adding the second hop addition with 20 minutes remaining and the yeast nutrients, kettle fining, and remaining malt extract with 15 minutes left in the boil. Add the final hop addition after the heat is turned off.

Chill wort to 48 °F (9 °C) then transfer to your fermenter. The goal is to have 5.25 gallons (20 L) of wort. Pitch a yeast starter or two packets of dried yeast. Be sure to aerate/oxygenate the wort if repitching or using a liquid yeast strain. Ferment for two weeks at 50 °F (10 °C).

Follow the remainder of the all-grain recipe instructions.

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Oakshire Brewing Co.'s Doggerland Baltic Porter clone

(5 gallons/19 L, all-grain)
OG = 1.083 FG = 1.020
IBU = 15 SRM = 50 ABV = 8.3%

This recipe snagged a silver medal for Oakshire at the 2018 World Beer Cup. The most impressive part was that it was brewed and packaged nearly two years before (2016) and held up so well and fit the style so perfectly that we just knew we needed to enter it in competition. We focus much of the malt bill on Carafa® Special III and add a hint of smoked malt to round out the malt character. We also use the addition of Belgian dark candi syrup to boost the gravity and add a pleasant dark fruit characteristic to match with the dark malt character. These beers are meant to condition for an extended time before being served. I would shoot for a minimum of four months, but you can easily let it go up to a year before serving.

INGREDIENTS

7.5 lbs. (3.4 kg) German Pilsner malt
7 lbs. (3.2 kg) German dark Munich malt (9 °L)
1.25 lbs. (570 g) Carafa® Special III malt
6 oz. (170 g) cherry wood-smoked malt
1.1 lbs. (500 g) Belgian dark candi syrup (30 min.)
3.8 AAU Herkules hops (75 min.)
(0.25 oz./7 g at 15% alpha acids)
1 oz. (28 g) Hallertau Tradition hops (0 min.)
Wyeast 2000 (Budvar Lager), White Labs WLP802 (Czech Budejovice), Omega Yeast OYL-100 (Lager 1), or SafLager S-189 yeast
⅔ cup corn sugar (if priming)

STEP BY STEP

This is a single infusion mash, utilizing a grain-to-water ratio of 1.5 qts./lb. (3.1 L/kg). Add ½ tsp. of both calcium chloride and calcium sulfate. Target a mash temperature of 150 °F (66 °C) and hold for 60–90 minutes. Begin recirculation, then raise temperature to 168 °F (76 °C) for mash out and hold for 10 minutes. Begin sparge, collecting 7.5 gallons (28.4 L) in the kettle. Total boil time is two hours, adding hops, yeast nutrients, candi syrup, and kettle fining per the ingredients list.

Chill to 48 °F (9 °C) and pitch a big starter or three packets of dried yeast. Repitching yeast from a smaller lager may be a great idea for a big lager like this. Also be sure to aerate/oxygenate the wort if repitching or using a liquid yeast strain. Ferment for three weeks at 50 °F (10 °C). Once signs of fermentation have ceased and final gravity has been achieved rack into a secondary vessel, such as a Corny keg, and lager at near-freezing temperatures for 4–6 months. Keg and force carbonate to 2.4 v/v or prime and bottle condition (consider adding a bottle conditioning yeast strain).

(5 gallons/19 L, extract with grains)
OG = 1.083 FG = 1.020
IBU = 15 SRM = 50 ABV = 8.3%

INGREDIENTS

4 lbs. (1.8 kg) Pilsen dried malt extract
4 lbs. (1.8 kg) Munich dried malt extract
1.25 lbs. (570 g) Carafa® Special III malt
6 oz. (170 g) cherry wood-smoked malt
1.1 lbs. (500 g) Belgian dark candi syrup (30 min.)
3.8 AAU Herkules hops (75 min.)
(0.25 oz./7 g at 15% alpha acids)
1 oz. (28 g) Hallertau Tradition hops (0 min.)
Wyeast 2000 (Budvar Lager), White Labs WLP802 (Czech Budejovice), Omega Yeast OYL-100 (Lager 1), or SafLager S-189 yeast
⅔ cup corn sugar (if priming)

STEP BY STEP

Begin with 5 gallons (19 L) in the brew kettle and submerge crushed grains placed in a muslin bag. Steep grains as the water heats up to about 170 °F (77 °C) then remove grains, allowing the liquid to drip back into the kettle. Turn off the heat and add half the dried malt extract and first hop addition then bring wort up to a boil. Boil for 60 minutes, adding the yeast nutrients, kettle fining, and remaining malt extract with 15 minutes remaining in the boil. Add second hop addition after the heat is turned off.

Chill to 48 °F (9 °C), top up fermenter with water to 5.25 gallons (20 L), then pitch a large starter or three packets of dried yeast. Repitching yeast from a smaller lager may be a great idea for a big lager like this. Also be sure to aerate/oxygenate the wort if repitching or using a liquid yeast strain. Ferment for three weeks at 50 °F (10 °C). Once signs of fermentation have ceased and final gravity has been achieved rack into a secondary vessel, such as a Corny keg, and lager at near-freezing temperatures for 4–6 months. Keg and force carbonate to 2.4 v/v or prime and bottle condition (consider adding a bottle conditioning yeast strain).

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Oakshire Brewing Co.'s Miel Mi Amor clone

(5 gallons/19 L, all-grain)
OG = 1.051 FG = 1.010
IBU = 24 SRM = 11 ABV = 5.5%

We brew our Mexican dark lager (Miel Mi Amore) each spring to celebrate the impending change of weather in Oregon. A mix between Vienna and dunkel lagers, we incorporate polenta (coarse ground cornmeal) to build a crisp body, while using Mexican coffee honey for a touch of sweetness and flavor, while helping the body dry out during fermentation. Any type of honey will work, although we like something with a little bit of flavor that adds to the complexity of the beer. A classic wildflower honey will work great too!

INGREDIENTS

3 lbs. (1.4 kg) German Pilsner malt
5.3 lbs. (2.4 kg) German Vienna malt
8 oz. (230 g) dark Munich malt (9 °L)
4 oz. (113 g) CaraAmber® malt (26 °L)
1.5 oz. (43 g) Carafa® Special III malt
7 oz. (200 g) polenta cornmeal
1 lb. (450 g) raw honey (15 min.)
3.8 AAU Herkules hops (75 min.)
(0.25 oz./7 g at 15% alpha acids)
5 AAU Saaz hops (30 min.) (1.25 oz./35 g at 4% alpha acids)
Yeast nutrient (15 min.)
Whirlfloc (15 min.)
Wyeast 2000 (Budvar Lager), White Labs WLP802 (Czech Budejovice), Omega Yeast OYL-100 (Lager 1), or SafLager S-189 yeast
⅔ cup corn sugar (if priming)

STEP BY STEP

This is a single infusion mash, utilizing a grain-to-water ratio of 1.5 qts./lb. (3.1 L/kg). Add ½ tsp. of both calcium chloride and calcium sulfate. Target a mash temperature of 150 °F (66 °C), adding the polenta to the top of the mash and hold for 60 minutes. Begin recirculation, then raise temperature to 168 °F (76 °C) for mash out and hold for 10 minutes. Begin sparge, collecting 7 gallons (26.5 L) in the kettle. Total boil time is 75 minutes, adding hops, yeast nutrients, honey, and kettle fining per the ingredients list.

Chill to 48 °F (9 °C) and pitch a starter or two packets of dried yeast. Be sure to aerate/oxygenate the wort if repitching or using a liquid yeast strain. Ferment for two weeks at 50 °F (11 °C).

Once signs of fermentation have ceased and final gravity has been achieved rack into a secondary vessel, such as a Corny keg, and lager at near-freezing temperatures for six weeks. Keg and force carbonate to 2.4 v/v or prime and bottle condition.

(5 gallons/19 L, partial mash)
OG = 1.051 FG = 1.010
IBU = 24 SRM = 11 ABV = 5.5%

INGREDIENTS

3 lbs. (1.4 kg) Pilsen dried malt extract
1.5 lbs. (0.68 kg) Munich dried malt extract
8 oz. (230 g) dark Munich malt (9 °L)
4 oz. (113 g) CaraAmber® malt (26 °L)
1.5 oz. (43 g) Carafa® Special III malt
7 oz. (200 g) polenta cornmeal
1 lb. (450 g) raw wildflower honey (15 min.)
3.8 AAU Herkules hops (75 min.)
(0.25 oz./7 g at 15% alpha acids
5 AAU Saaz hops (30 min.) (1.25 oz./35 g at 4% alpha acids)
Yeast nutrient (15 min.)
Whirlfloc (15 min.)
Wyeast 2000 (Budvar Lager), White Labs WLP802 (Czech Budejovice), Omega Yeast OYL-100 (Lager 1), or SafLager S-189 yeast
⅔ cup corn sugar (if priming)

STEP BY STEP

Heat 3 qts. (3 L) of water to 165 °F (74 °C). Add the Munich malt and polenta cornmeal to a fine grain bag. Submerge in the water and hold between 145–155 °F (63–68 °C) for 45 minutes. Add the remaining grains to the bag and steep for an additional 15 minutes. Remove the grains and wash with 1 gallon (4 L) hot water. Top up the brew kettle to 5 gallons (19 L) and bring wort to a boil. Total boil time is 60 minutes, adding hops, yeast nutrients, honey, and kettle fining per the ingredients list.

Chill to 48 °F (9 °C), top up fermenter with water to 5.25 gallons (20 L), then pitch a starter or two packets of dried yeast. Be sure to aerate/oxygenate the wort if repitching or using a liquid yeast strain. Ferment for two weeks at 50 °F (11 °C). Once signs of fermentation have ceased and final gravity has been achieved rack into a secondary vessel, such as a Corny keg, and lager at near-freezing temperatures for six weeks. Keg and force carbonate to 2.4 v/v or prime and bottle condition. BYO

Photo courtesy of Shutterstock.com

BY DREW BEECHUM & DENNY CONN

THE SANITATION DEPARTMENT

Keeping spoilage at bay

If cleaning is the act of eliminating soils, sanitation is the act of "eliminating" spoilage organisms (e.g., unwanted yeasts, *Brettanomyces, Lactobacillus* – anything other than our desired microbes – usually a single strain of *Saccharomyces c.*). For non-mixed culture brewing practices, we treat otherwise useful creatures as "weeds" — a.k.a., plants growing perchance where we don't want them.

That second eliminating is in quotes for a reason. In an ideal world, we'd eliminate every last trace of spoilage mechanisms. We would suffer no *Brettanomyces, Lactobacillus, Pediococcus,* etc. to live. But that would be sterilization and true sterilization is impractical and generally out of reach for almost all brewing operations. Sterilization is good and achievable for lab work and the surgical suite, but for general brewing purposes, we can work with the less perfect and less demanding world of sanitation.

Side Note: One place homebrewers can practice "sterilization" is pressure canning starter wort. Drew's a big fan of prepping gallons of wort into jars and running them through a pressure cooker at 15 psi for 15 minutes. The end result is growth media that's as clean of bacteria and fungi as possible in a home setup.

The simplest thing you can do in terms of sanitation is nothing. Clean your fermenters well, pitch a massive quantity of fresh, happy, healthy yeast and stand back. "If it worked for our ancestors for millennia, then it'll work for me." You might be tempted to just add plenty of yeast and hope for the best, but please don't roll the dice when there is no need to risk bad beer. We know about microbes and molecular structures — things our brewing ancestors didn't.

SANITIZING VIA HEAT

Heat kills a lot of things. Boiling is, in fact, our primary sanitizer of wort (a.k.a., the reason we don't use things like metabisulfite like wine and cider makers). Steam can be used to sanitize appropriate materials.

To be clear — heat should not be used to sanitize your hoses, glass carboys, plastic buckets or your washers. In a lab, there's a whole slew of things that can be heat sanitized in an autoclave (a fancy version of a pressure cooker — and exactly what Drew was talking about with his starters). In Drew's whole brewing career, the most effective thing to be boil sanitized were metal Sanke kegs being used as fermenters. Remove any and all pressure retaining devices, add a bit of reverse osmosis (RO)/distilled/deionized water, heat the keg and cap the opening with foil – instant sanitized keg ready for wort.

As a safety reminder: Steam is very, very dangerous. Steam under pressure is basically a bomb. Note in the keg example, Drew's friends cover the keg opening with foil to avoid any pressure buildup or vacuum (on the cool down). Do not mess with steam unless you know what you're doing. Also, follow our rule of no drinking while brewing!

In general, don't use steam – use the stuff we're about to talk about! Now that we've gotten through the tactics we don't recommend, but if we hadn't included would have been asked about.

BETTER BREWING THROUGH CHEMISTRY

By far and away the easiest way to sanitize at home is through the judicious use of chemicals. Judicious in terms of dosage, action, and treatment. Just like with cleaning — too much of a compound is no more effective than the right amount. When we covered cleaning, we looked at items that dissolved chemical bonds and proteins. In sanitation, we're typically

Before you even think about the idea of sanitation, you must embrace the drudgery of cleaning.

Photo by Charles A. Parker/Images Plus

A clean and sanitized carboy should appear spotless to the naked eye.

looking at ways to kill bacteria by breaking cell walls. Violent, yes, but have you tasted an infected beer?

Of the ones we've used on the regular and going from cheapest to most expensive:

BLEACH — SODIUM HYPOCHLORITE

It's cheap, you can buy it at the local supermarket or corner bodega. It's supremely effective. What's not to love? Turns out that human palates are sensitive to chlorine flavors and aromas and bleach packs a punch. Used on its own at the rate of 1–2 oz. per gallon of water (8–16 mL per L), it will sanitize in as little as one minute of contact with the surface. After that, you have to rinse and let air dry. The rinse should be done with boiled water lest you add bacteria back to your newly microbe barren landscape.

So why pay $$ for other compounds? Consistency of efficacy (is your bleach old and less effective?), lower risk of flavor impact, and chlorine is corrosive to stainless steel with prolonged exposure.

That's what happens with bleach on its own. We haven't played with a method recommended by Five Star Chemical's Charlie Talley that promises to make bleach into a cheap and affordable no-rinse sanitizer: Into 5 gallons (19 L) of water mix 1 oz. (30 mL) of bleach and 1 oz. (30 mL) of white vinegar for a no-rinse, cheap sanitizer (don't use on stainless steel).

Warning – follow safe chemical practice and mix the bleach and vinegar into the water. Don't mix the bleach and vinegar together first and then add it to the water.

The theory is that using bleach in a lower pH medium makes the chlorine more effective and thus allows you to use a lower overall concentration. The quicker action and the lower concentration pushes below the level of concern in terms of taste and lingering impacts.

IODOPHOR

When you were a kid, your mom may have reached for a stinging bottle of iodine to clean a scraped knee — the pain meant it was working. Iodophor is a combination of iodine, a surfactant for easier mixing and an acid (usually phosphoric). Note that iodine is in the same chemical family as other potent sanitizers like chlorine and fluorine.

Iodophor works quickly (~60 seconds) and when mixed at the proper concentration of 12.5 ppm (typically ½ oz. per 5 gallons/15 mL per 19 L of water) is rinse-free. It's cheap as chips and is broadly effective. There are some concerns about how well it works against biofilms, but you cleaned the heck out of your surfaces, right? Ergo, that should not be a concern.

Unlike bleach, you won't find iodophor in the grocery store but it is available through many homebrew stores. Also, iodophor is used across multiple food handling industries, so make sure the stuff you use is suitable for brewing.

You may have heard that iodophor stains and when you see the yellowish solution floating in front of you, it's easy to believe it. But with proper dilution levels and appropriate contact times, the staining and potential odor inclusion from iodophor is minimal. Particularly with iodophor, higher doses aren't beneficial! And as long as the solution is yellow or a test strip gives the thumbs up — iodophor remains effective.

ACID SANITIZER

Acid-based sanitizers use food-grade and homebrewer-safe acids to kill our unwanted microbes. They're safe for hands and for beer with virtually no chance of "accidentally" contaminating the beer with off-flavors at any reasonable level of overdoing the concentration.

The biggest name in this game, as far as homebrewers are concerned, is Five Star Chemicals with their Star San. Easy to use and with lightning quick contact times, Star San also adds surfactants and a foaming agent to create bubbles that help ensure contact and complete wetting of the surface. (If the surface doesn't get wet for a sufficient period of time, you're not knocking out the bad guys.) The foaming properties are so dramatic and homebrewers worried enough that a motto has ensued – "Don't Fear the Foam!"

But if you use a system with a pump, the foam can actually get in the way. Big foam snakes are cool and all, but pumps usually prefer to move liquid around. If you want the acid-based goodness without the foam, Five Star has a product, Saniclean, which is effectively Star San without the foaming agent. It requires slightly more contact time and the onus is now on you to ensure you've gotten everywhere wet enough for long enough to ensure microbe murder.

Both Five Star products will remain effective as long as the pH remains below 3. When mixed with distilled or RO water, that can be quite a while and allow you to really extend the timespan of efficacy for your sanitizer solution.

OTHERS

There are scads of different products at the homebrew level that your local homebrew shop might carry, but these are the ones we've played with. In the wine world metabisulfites are the primary sanitizing agent. At the professional level there are other compounds like Quats (Quaternary Ammonium) and PAA (Peroxyacetic Acid) that are regularly used. We haven't seen much of these at the homebrew level as, like caustic in the cleaning discussion, they require more care when used.

One other thing we didn't mention – each of these compounds has different strengths and weaknesses. Acid-based sanitizers, for instance, are less effective against mold where iodophor tends to be weaker where biofilms are involved. But for our general use case of "sanitize this surface I've thoroughly cleaned" — they all do the trick.

MECHANICAL AIDS AND PROCESS

Just like when we talked cleaning, there are ways to make your sanitizing life better. We've addressed concentration previously. Hot temperatures (which do a cleaner good) are generally a no-no with sanitizers as the compounds are generally meant to be used cold at the homebrew level. But agitation is again your friend! If you have a submersible pump or a keg/carboy cleaner — you can easily create a device that ensures your fluids are moving and getting all over those surfaces.

If you're frugally minded and want to use the minimum product needed, homebrewers can fill a spray bottle with a sanitizing solution and use it to soak surfaces. For Drew, he'll do this for things like spigots, valves, hose connections at the last moment, but he still prefers soaking a complete vessel. BYO

BY AUDRA GAIZIUNAS

KEY PERFORMANCE INDICATORS

Managing through clear eyes and KPIs

It's a common scenario for a nanobrewery: One has a slew of numbers and data assembled in financial statements but isn't exactly sure how to assemble them in a meaningful manner fitting their particular business model. To those who lack financial degrees and accounting backgrounds, it may often feel like closing one's eyes before throwing a dart, hoping for the best while following instinct versus pragmatism. Additionally, owners often face making decisions quickly, without knowing where to start or how to prioritize their available resources, both in terms of time and money. In such a capital-intensive industry, it's imperative we follow the path that brings the greatest return while conserving or boosting cash.

Cash is the key to our survival, especially with all the price increases we've faced in our industry over the past 12 months. We must know where to focus our time and efforts, the math behind each focal point, and the methodology to confidently make decisions to bring us the greatest amount of return. We must construct customized benchmarks and vet our own business models to ensure we're operating at a sustainable level, while investing profits where we need them most without running out of cash over the long-term. It's a balancing act, for sure, but it's one we can certainly master if we know where to start.

Everyone should start with the balance sheet and we need to remember the basic accounting equation: Assets = Liabilities + Equity (ALE, how fitting). On one side we can see what the nanobrewery owns, while the other side shows how what we own was financed: Either through debt (loans) or through equity (paid-in capital). We can extract so much powerful information from this statement, but especially important for a rapidly growing nano we must calculate the following:

Working capital: Your current assets less your current liabilities.

This number should always remain positive and demonstrates what you have on hand to invest in your everyday operations. Take action to increase this number. If you're a startup, be sure you're in a positive position with three months of expected cash outflows on hand before you open those doors. Your working capital is the lifeline to your business and its importance can't be emphasized enough. Too many breweries have failed due to their lack of focus on working capital.

Other key ratios to track that involve numbers from your balance sheet include:

Current Ratio (Current assets/current liabilities): Target 1.3 and higher.

Quick Ratio (Current assets less inventory and prepaids/current liabilities): Target 1.0 and higher.

Inventory Turnover (Cost of goods sold for the year/average inventory for the year): Higher numbers indicate increased efficiency. Lower numbers may indicate too much cash investment in inventory without high enough return.

Days' Sales in Inventory (365 days in the year/inventory turnover for the year): The goal is to decrease this number over time by brewing as close to just-in-time demand as possible.

Debt-to-Equity (Total liabilities/total stockholders' equity): This number indicates your brewery's degree of leverage. It is not uncommon for a startup to show higher figures such as 20:1 in the very early stages, but the goal should be to get to 1:1 or less than 1:1. As that number decreases over time, this indicates that the nanobrewery's profits are funding a greater portion of the brew-

Cash is the key to our survival, especially with all the price increases we've faced in our industry over the past 12 months.

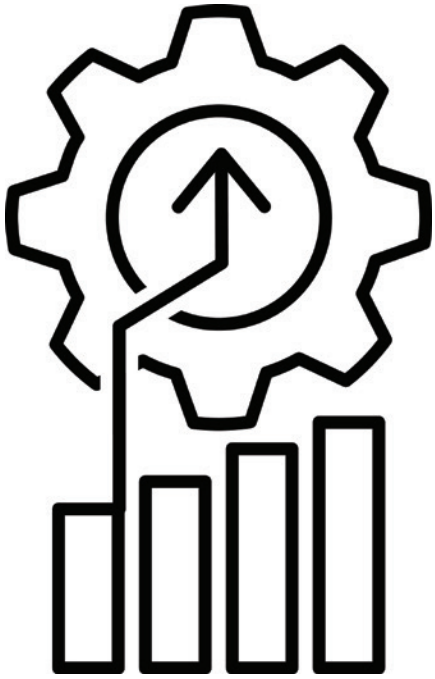


Photo courtesy of Shutterstock.comn

ery's assets. As debt holds steady in the numerator, or falls through debt payments being made, the equity in the denominator rises as the brewery continues to add profit to its retained earnings. Most banks use this calculation to investigate debt service coverage and cash flow when a brewery is evaluating expansion. So if your nano is looking for its next, larger home, be sure to get this leverage ratio under control.

Turning our attention to the income statement, a best practice is designing or revising your chart of accounts to utilize divisional accounting. Think about how many distinct business lines you may have where you can measure revenue against cost of goods sold; where different profit margins should be segregated in order to analyze the health of that particular arm of the business. For example, one nano may have three lines of business: The brewery, taproom, and a kitchen. Therefore, you would want to design the chart of accounts to reflect those three lines of business and align them with the brewery's defined success metrics. Once your chart of accounts reflects your specific business model, calculate the following ratios, then track their change over time:

Gross Margin: Gross profit/sales net of discounts, refunds, comps., etc.

Net Income %: Net income/sales net of discounts, refunds, comps., etc.

Return on Equity: Net income after tax/average stockholders' equity over the course of a year.

Generally speaking, the higher each of those three results is, the healthier the operation. As every business model is different, a standard % or dollar amount can't be specifically set across all. There is no one-size-fits-all magic number or % to hit. A sustainable gross margin for one may be treacherous for another. The goal, however, remains the same, regardless of business model: Take specific actions to increase each of those numbers over time and additional capital will become available to invest back into the brewery.

Finally, looking at the cash flow statement, understanding free cash flow is key as it is used by banks and investors in assessing the quality of a brewery's earnings. Free cash flow is calculated as cash provided by operating activities less capital expenditures. It represents the cash a brewery generates after cash outflows to support operations and maintain its capital assets. Unlike net income, free cash flow is a measure of profitability that excludes non-cash expenses of the income statement and includes spending on equipment and assets, as well as changes in working capital.

The amount of cash flow from operating activities should always exceed net income. If the opposite were true, this could be an indication of possible overinvestment of cash in inventory or overly aggressive short-term debt repayment, when the cash could have been utilized much more effectively elsewhere. In other words, a negative result could be an indication of a mishandling of operations and an early warning beacon.

Understanding the **debt-service-coverage ratio,** calculated as EBITDA (earnings before interest, taxes, depreciation, and amortization) divided by total debt service (principal plus interest of debt owed over the upcoming 12 months), is also crucial. It is a measure of the cash flow available to pay current debt obligations. A 0.85 debt service coverage ratio (otherwise known as DSCR) means the brewery can pay only 85% of its annual debt obligations. Most banks working with breweries seeking to open or expand in 2023 will look for a 1.2 DSCR to approve new loans.

The key takeaway here is to focus on those activities that generate the fastest cash inflows. From the sales, general, and administrative perspective, multiple actions may be taken. For starters, understand your prime costs, the sum of all labor and cost of goods sold, as they're controllable, and take actions to ensure they don't skyrocket over time as a percentage of total revenue. Try to limit occupancy costs to 12–14% of total revenue and renegotiate lease-to-sales targets if at all possible.

At the end of day, working capital is the cheapest and fastest source of cash to invest back into our brewery, as it is interest-free and bears no conditions. Therefore, managing it should be our priority. Some best practices to managing working capital include:

- Managing our inventory levels by calculating inventory turnover and days' sales in inventory regularly
- Streamlining and centralizing ordering whenever possible
- Reviewing pricing and contracts regularly
- Optimizing stock levels based on forecasted demand
- Practicing just-in-time management by knowing your optimal reorder points and optimal order quantities
- Paying vendors on time to strengthen our negotiation stance and obtain better terms and pricing
- Improving receivables collection and vetting debtors before doing business with them

So now that we've looked at some key financial ratios using our financial statements, let's move on to building a dashboard that includes key performance indicators, or KPIs, so that we can view our brewery in a single source, flash report. But before we do so, let's take a small step back to talk about KPIs specifically. By definition, KPIs are simply a set of quantifiable measures that a brewery uses to gauge its performance in terms of meeting strategic and operational goals over a specified time period. Sounds simple enough, but any brewery owner who's ever attempted to nail down their KPIs can tell you that determining which factors are really driving your brewery isn't always straightforward. I've witnessed several breweries spending months tracking metrics that turn out to have little or no impact on actual results because they didn't take the time to define their success metrics first. Focus on expressing those success metrics with your team, then aligning KPIs with those success metrics to drive accountability and buy-in by all involved. We're such a capital-intensive industry that we need to focus on how effectively and efficiently our assets are utilized to produce a return on our investment. Because of the pandemic and often unforeseen circumstances, we should be focused on generating positive cash flow from our operations. We need to know how quickly we can turn sales into cash and how long our cash is invested in inventory.

We've covered many of those classified as financial KPIs above, but KPIs can also be operational to offer us insights on our safety, quality, and productivity.

Some of the more common production-oriented KPIs I see

utilized within our industry include the following:

- **Total production yield by batch** (our brewhouse efficiency)
- **Product loss percentage through production and packaging** (tracked separately to gauge efficiency)
- **Capacity utilization** (a measure of efficiency and planning for additional fermentation options)
- **Barrels produced per employee** (to understand overhead)
- **Barrels produced per production employee** (to understand labor productivity)
- **Production labor dollars per barrel brewed** (to construct an income statement on a per barrel basis for setting pricing)
- **Dumped/dated beer in barrels** (to address quality concerns)
- **Raw materials per barrel produced** (to be able to construct an income statement on a per barrel basis for pricing)

A tool to assist with the raw materials per barrel produced calculation and how it comes into play with our pricing, can be found at: www.byo.com/article/key-performance-indicators

Turning to sales KPIs, I often see the following being included as part of the nano's dashboard:

- **Total sales in barrels**
- **Net revenue per case equivalent by beer style**
- **Net revenue per case equivalent by sales channel** (if the nano self distributes outside the taproom)
- **Net revenue per employee and by package type** (to assist with staffing the taproom and with possible variable compensation planning)
- **Depletions to retailers** (if self distributing)
- **On-premise mix by style and package type**
- **Off-premise mix by style and package type**
- **Taproom: Average guest tab**
- **Taproom: Average pints poured per hour** (to assist with staffing levels)
- **Taproom: Sales volume by day and hour** (to assist with staffing levels)

Once we've aligned our KPIs with our strategic goals and define the current value and the target we are striving towards, the next step is to define the data collection steps and the platform to be utilized for tracking and communication. Some use a spreadsheet in a Google shared drive while others prefer the visual appeal of inexpensive online platforms one can access on their phone or tablet. From that point forth, set an update frequency most fitting to your nano's operating hours. I most often see KPIs being reviewed as a combination of weekly and monthly as either part of a standup or a weekly leadership team meeting.

The important reminder is to be consistent, hold people accountable to meeting those KPIs via their explicit rights and roles, analyze expected versus actual results as a team, and take action. Hold your team and yourself accountable to meeting those targets. Sometimes it's tough to stay positive when goals are audacious, hairy, and long-term. Your team will feel empowered to make a difference when they see the needle move, so breaking down the more ambitious, larger goals into its key drivers will give them the opportunity to achieve each in stages. Focus on those baby steps and celebrate together to keep morale high. Good luck!

BY GREG PATERSON

E-INK FAUCET HANDLES

Crafting a novel pull

. . . I had a great idea: An e-ink screen faucet handle. No wires, no batteries, and preferably an easy method to flash a new image.

Photos by Greg Paterson

What's the first thing you do when you arrive at a new-to-you bar or pub? You look at the tap handles to see what kind of beers they're pouring. You can find them in every bar, pub, and grill around the world. They first evolved in the 1930s when bars would often advertise one type of beer and pour a cheaper version. Laws were introduced to combat this, and required labeling of the beers actually being poured. This requirement evolved into a chance for brewers to market their beers with mascots, logos, and flashy designs to catch the eye of their would-be-customers (lowlander-beer.com, 2022).

There's nothing quite like an ornate tap handle. In the United Kingdom you'll find brass beer engines often with simple designs nothing about the brand of beer. In Germany, you'll find classically stylized wood taps with ornate logos, some even light up. In America you will find tap handles shaped like fish, geese, pin-up girls, swords, surfboards, telephones, canoes, or trophies. The list is endless, and it's a great place for creative minds to experiment. Despite all the variety, there's still something missing from the list: Alterable digital screens.

I have been brewing for over 20 years now, and kegging for nine of those years. When it comes to dispensing I've used the default black handles, chalkboard tap handles, and recently installed a tapitgood.com Raspberry pi screen on my cold room (see "Building a Cold Room" January-February 2022 issue of *BYO*). While pondering new modes of tap handle labeling, I had a great idea: An e-ink screen faucet handle. No wires, no batteries, and preferably an easy method to flash a new image when new beers came online. Here's how I designed and produced the first prototype.

Most e-ink screens pair with an arduino, Raspberry pi, or just a USB interface and require special coding and a power source for the screen device (the "hat"). I didn't want to make these tap handles with a USB connection or require anything complicated for programming. In short, my search has caused me to have a small collection of screens that were complicated to program or I couldn't get to work at all. After a long search, I finally found Waveshare's passive e-ink screens. They use near-field communication (NFC) and don't require a power source. You load up an image in their app on your phone and hold the two devices in close contact. Voila! Modern magic. Note: As with most e-ink screens they are black & white.

I designed my tap handle using CAD software. Here are links to the drawings and a 3-D model:

Waveshare assive E-ink screen: https://bit.ly/BYO-e-ink
Drawing package: http://bit.ly/BYO-e-ink-tap1
CAD model: http://bit.ly/BYO-e-ink-tap2
Video demonstration of NFC image loading: https://bit.ly/BYO-e-ink-video

Tools and Materials

- (1) Waveshare 2.7-in. e-ink screen
- (2) aluminum blocks approximately 3 in. x 4 in. (8 cm x 10 cm)
- (1) aluminum rod ¾-in. diameter x 2-in. length (2-cm x 5-cm)
- (4) flat head socket cap screws M4x0.7 18-mm long
- (1) socket head cap screw M4x0.7 12-mm long
- (1) steel dowel pin 4-mm x 12-mm long
- Mill access and anodizing finish (not pictured) optional
- ⅜ in.-16 UNC tap

STEP BY STEP

1. RENDERING OF CAD MODEL

Having access to a 3-axis Bantam Mill at my workplace, I took the opportunity to produce my first prototype out of aluminum. You could readily replicate this design with wood, steel, stainless steel, brass, or 3-D print it out of any number of materials. See links above the Tools and Materials list on page 58 for drawings and 3-D models.

Starting with my aluminum bars, I cut them slightly longer than needed, approximately 110 mm (4.3 in.). I programmed the milling process using CAD software. I use Autodesk Inventor CAM since I have access to it at my work, but there are numerous free and paid alternatives to make G-code files for mills. I secured the parts in the mill, probed its location, installed the appropriate tools as needed and began the milling process. Starting with the perimeter shape, and the chamfered perimeter edge. The cover and base are similar enough, and only the cover requires front and back milling. The cover also requires a cutaway for the screen hole and additional chamfer.

2. INITIAL MILLING STEP

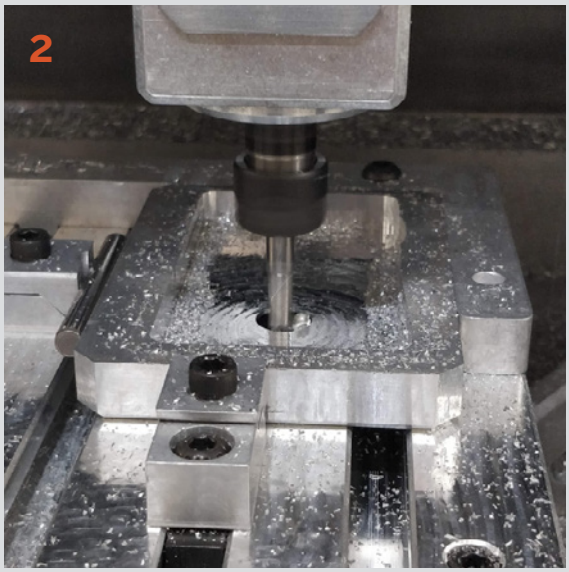
The backside of the cover requires a deep cutaway for the screen electronics, which if programmed correctly will open the screen hole from the previous step. While in this orientation I also programmed in the threaded M4 holes. These could be readily cut by hand, if needed.

3. CREATING THE STEM

For the stem, I started with a 1-in. (2.5-cm) aluminum rod blank and wanted to form it into a sharpened pencil-look and match the taper of the threaded tap handle adapter that comes with your taps. Each face of the octagonal edges was flat-milled, and some degree of precision was required so after some trial and error of eyeballing it, and 3D printing a V-shaped nest – I ended up milling a V-shaped nest to orient and secure the round/octagonal shapes. Slight variation in the rotation or level resulted in non-parallel lines. I milled longer lengths of this rod with the intent of making multiple of these digital tap handles at once. Milling the sharpened-pencil shape also turned out to be a bit of a challenge, taking a few creative programming changes to get right by milling it vertically with a bull-nosed bit.

1

2



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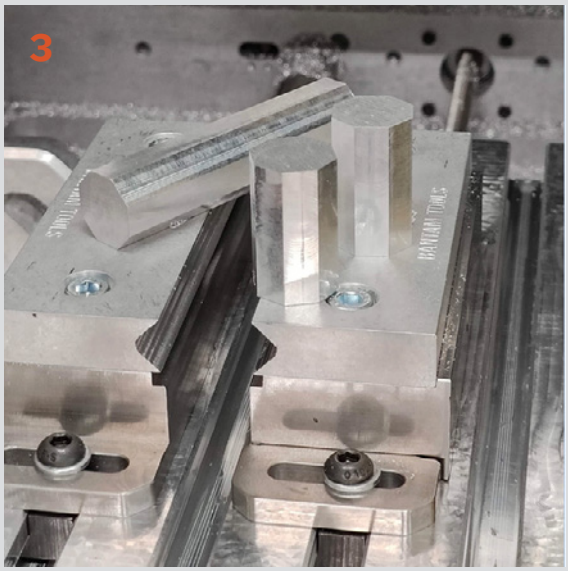
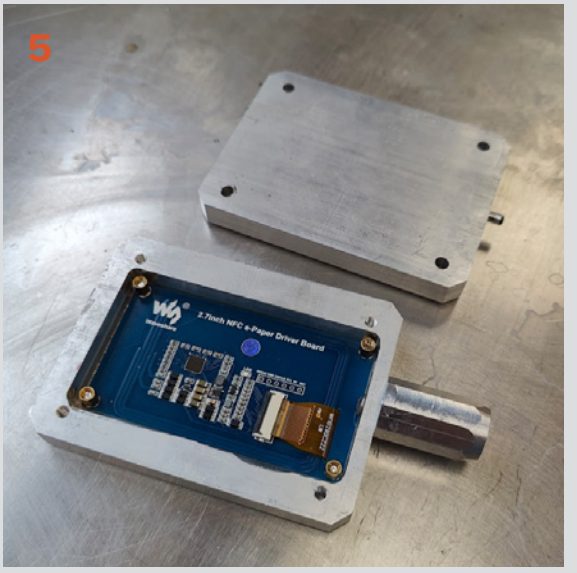


4. TAPPING THE STEM

Using a printer-scaled template, I manually marked, drilled the cover, base, and tapped the stem. Care must be taken to ensure the holes line up for assembly. The clearance hole for the screw will have a small amount of play, but the dowel does not. If these holes have the wrong spacing you'll be left with a gap between the mating faces. The thread of common American tap handles is UNC ⅜ in.-16. For shallow tapped holes, you need to use taper, plug, and bottoming taps in that order.

5. PUTTING THE PIECES TOGETHER

I assembled the cover to the stem with a socket head cap screw. I installed the screen with a small piece of expanding foam on the backside to press it against the inside surface of the cover. Tape or putty would also work for this. The back must be slid onto the dowel pin on the stem. If the spacing isn't right, you can adjust the cover slightly. Once you get it right, you should mark the location with a sharpie. With the base in place, the four flat head screws complete the assembly. You can avoid the dowel or widen the hole tolerance if needed. Without it, however, an inebriated pull on the tap handle could potentially break the small screw holding the cover on.



6. E-INK DISPLAY

Thread your fancy new wireless tap handle onto the nearest beer tap. Using your smartphone and manually installed app you use NFC to flash an image or text of your choosing onto your e-ink screen. Everyone is going to be so impressed with you while enjoying your beers.

After this prototype build, I still have some work to do. The screens are passive, so even when the screen is in contact with your phone it doesn't always flash a new image correctly. The aluminum cage I've put it in might be making this worse. A dedicated NFC repeater might help, but it's a challenge to be certain I find one that can repeat image data instead of just alpha-numeric data. The last step to finish up this project is to send my milled aluminum pieces to be clear anodized. Total cost of this (aside from the mill, design time, and machining) was less than $40. The anodizing will really make for a nice finish, but I'm going to have to make a few more to make the $100 batch fee worth the cost. BYO

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BY OBAKENG MALOPE

BEER IS ART

Crafting the next generation of brewers

I founded the Beer is Art movement to teach the youth (over 21 years of age) of South Africa about the beer craft. These are unfortunate times for many young adults in our country as many are sitting at home unemployed. For example, in 2021, ⅔ of our population between the ages 15 and 24 were unemployed. Our goal is to teach that beer is not simply something to get drunk off; that it can be an entrepreneurial opportunity. The focus of the campaign is to teach about beer and food pairing, the brewing process, beer podcasting, starting your own beer brand, etc.

The Beer is Art campaign relates beer brewing to art like the drawings that were left on the caves by the Khoisan (a tribe of the region). The Khoisan drew paintings on cave walls to tell stories of how they were living and events so that the next generation could read the stories to get to know who they were and understand their roots. Beer similarly tells a story, the beer that we make now is not necessarily the beer that future generations will be making, say in 200 years. The people who will be living in those times will be using the beer that we are making at this point in time as a historical reference. They will learn about the aromas that we prefer and the tastes that we sought. They will read the stories that we have left for them and learn what kind of people we were … our likes and dislikes that are influencing the beer we drink.

Our belief is that beer has gotten a bad reputation in many communities, especially amongst poor neighborhoods were it can often be abused. What Beer is Art has aimed to do is go to those same communities and empower the next generation through what beer can offer.

The youth don't have funds to pay for this education, so the plan of Beer is Art is to sustain this campaign and spread it to many communities throughout the country through beer documentaries and reality shows. See, I am also a filmmaker and a brewer here in South Africa. I participated in Eugenia Brown's "Road to 100" and was selected as one of 100 women of color to receive funding for a Cicerone® certification program by Black Beer Chick USA. It was here that I was introduced to brewing. After, I furthered my education by volunteering at local breweries.

So far Beer is Art has been able to team up with many businesses and groups. Several breweries from India as well as India's first and only beer podcast, Cheers Chatty by Chatty Girija, have come on board to partner with us. The breweries will teach the students how to brew Indian beer using Indian herbs and spices while Cheers Chatty will teach about beer podcasting.

The Indian brewers use local ingredients and unconventional ingredients. One popular beer uses anantmool/Indian sarsaparilla. It's woody and aromatic when steeped in hot water and gives a unique creamy texture and mild sweetness. The base beer is a stout brewed with both anantmool and organic cocoa powder. Another beer is brewed utilizing bajra grain and gondhoraj lime. The goal is to inspire the students who live in more rural villages to go pick wild berries and other herbs to infuse in their beer. Others can use the ingredients from local markets that resonate with them.

A brewery in Belgium offered help to our cause as well. Beerstorming, a brew-on-premise concept brewery located in Saint Gilles on the south side of Brussels, has pledged to teach the youth recipe development. What got our attention about Beerstorming is that you exchange your ideas, opinions, and desires about new recipes with them and, with their help and equipment, make it happen. Follow us on Instagram at @beer.is.art.movement. BYO

What Beer is Art has aimed to do is go to those same communities and empower the next generation through what beer can offer.

Photo courtesy of Obakeng Malope

The author enjoying a locally brewed pint of craft beer.

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