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DECEMBER 2021, VOL.27, NO.8

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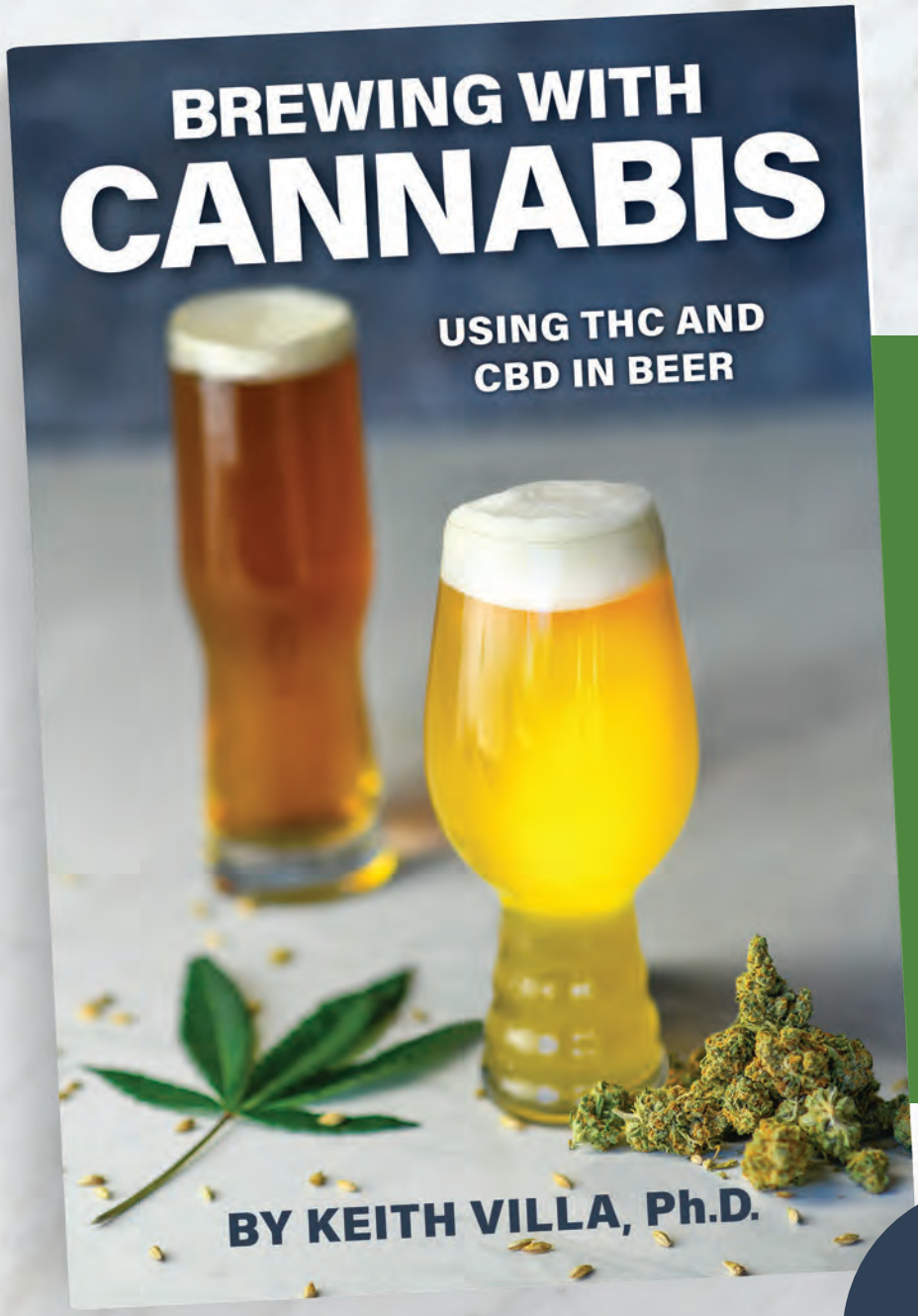

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NEW RELEASE

Keith Villa, Ph.D., is brewmaster and co-founder of Colorado-based CERIA Brewing Company, a trailblazer in the rapidly growing market of non-alcoholic, cannabis-infused beers. After earning his Ph.D. in brewing from the University of Brussels in Belgium, Keith began his 23-year career as founder and head brewmaster at Blue Moon Brewing Company, an operating unit of MillerCoors. Since then, this beer doctor has gone on to brew several award-winning beers and continues to set new standards and push the boundaries of flavor, styles, and ingredients. Keith also is co-founder and head brewer of family business Donavon Brewing Company based in Arvada, Colorado.

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contents

DECEMBER 2021, VOL. 27 NO.8

features

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HI, I'M THE NEW G40 MEET ME ON PAGE 5

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HI, I'M THE NEW S40 MEET ME ON PAGE 7

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RECIPE INDEX

RECIPE STANDARDIZATION

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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.

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Cover Photo:
Sean Quilty/Artisanal Brewing Ventures

Q What brew-related gear do you hope Santa brings you this holiday season?

I would love to have a dedicated nitro draft set-up. I love Irish dry stouts and plenty of other styles served on nitro, but in my thirty years of homebrewing I have never had a way to pour one of my own beers on nitro and watch all those bubbles dance and settle in the glass before taking my first sip.

I hope Santa brings me a Tilt Hydrometer! I'd love it if I got two, one green and the other yellow, but not sure if Santa thinks I've been that nice.

All I want for Christmas is someone to write more brewing books as I already have them all! Would love to see a book covering the new twists in the beer brewing world . . . but understand that by the time it gets published, it would probably already be dated.

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The Science of Step Mashing

Step mashing may not be a necessary technique for most styles and grains, but there are times it can be beneficial. Make sure you understand the basic premise of why brewers step mash as well as several mash programs that brewers can employ. https://byo.com/article/the-science-of-step-mashing/

MEMBERS ONLY

Winter Warmers

Looking for a taste of the season? Winter warmers are just that; with the bite to take away the cold, these rich beers often have spices and flavors reminiscent of the holiday season. Here are five winter warmer clone recipes to brew for when the weather gets cold. https://byo.com/article/winter-warmers/

Adding Extract To Make Big Beers

To make a really big beer, a reader ponders adding malt extract to their strike water instead of adding it to the boil to help with the fermentability of the extract. Mr. Wizard weighs the pros and cons of this method. https://byo.com/mr-wizard/adding-extract-to-make-big-beers/

MEMBERS ONLY

2 Beers From 1 Batch

Basically, take the work of making one beer and turn it into two. There are a couple of options for doing this — some require a little more time and effort, and one is no more difficult than making a single 5-gallon (19-L) batch. https://byo.com/article/2-beers-from-1-batch/

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FORCED CARBONATION

I've been reading about forced carbonation and when looking at carbonation priming charts I can see what temperature and pressure to set a keg at to reach 2.4 volumes CO_2. Assuming that's my aim, what do I actually do after that? Do I uncouple the CO_2 ball-lock or leave it attached, as surely if I leave it attached it would continue to increase the 2.4 figure, right?

Carl Wyatt • *via email*

Despite what your gut may tell you, go ahead and leave the CO_2 line attached. It usually takes about two weeks for a beer to reach that equilibrium of about 2.4 volumes of CO_2, meaning the pressure of CO_2 dissolved in the beer equals the pressure in the headspace. As you pour off the beer from the bottom of the keg, CO_2 gas will be replaced in the headspace and the equilibrium remains. If you disconnect the CO_2 line, then the loss of pressure in the headspace will mean that gas will come out from the beer and slowly you will lose carbonation in the beer. In other words — keep the pressure on!

SWEET SCHWARZBIERS

I stumbled across a beer style that I have never heard about. It's called schwarzer abt ("black abbot"). I found it when I was searching about the history of the Reinheitsgebot. It is a beer that came afoul of the German Purity Laws during the 1990s when East Germany was re-integrated into West Germany and had to get a name change because it could not be called a beer anymore. I am curious as what it is and what the difference is between it and a schwarzbier (which I love!). An internet search was fruitless and the *BYO* recipe archives are silent on this one. I was wondering if you could enlighten me and possibly provide a recipe?

Kevin Brock • *via email*

For this question, we reached out to our "Style Profile" columnist Gordon Strong, who is always there to provide clarity when it comes to beer styles throughout history. Here's what he had to say: "It's not really a style. It's just a sweetened schwarzbier from the former East Germany. Schwarzer Abt is a beer brewed by Klosterbrauerei Neuzelle, which is on the current Polish border, near the Oder River.

"Schwarzbier in general was popular in that east-central region of

contributors

Denny Conn began homebrewing in 1998. His recipes have been brewed by several commercial breweries in both the United States and Europe, and he consults for several breweries. **Drew Beechum** began homebrewing in the spring of 1999 as an escape from his day job as an engineer and has been obsessing over the hobby ever since. Since the mid-90s the friends have been writing articles and books on homebrewing, including *Experimental Homebrewing*, *HomeBrew All-Stars*, *and Simple Homebrewing*. They also host the bi-weekly podcast "Experimental Brewing" and operate the blog https://www.experimentalbrew.com. The pair have been writing *BYO*'s "Techniques" column since 2019.

In addition to exploring ways to package and carbonate beer in this issue's "Techniques" column on page 73, the duo also sets out to debunk some of the most common homebrewing myths on page 38.

Dave Clark lives in Phoenix, Arizona and is a connoisseur of all things homebrew and craft beer. A former professional brewer with Hoppin' Frog Brewery of Akron, Ohio, Dave is a member of the Beer Judge Certification Program, currently ranked Master, as well as a Certified Cicerone. He has worked in virtually all facets of the beer world from production, to sales, to marketing. Dave is a full-time musician, performing throughout the state of Arizona and beyond. He is also a part-time journalist, writing primarily about craft beer and music. Dave is the author of *Phoenix Beer: A History Rising to New Peaks*. He has written *BYO*'s "Replicator" column since the start of 2021.

In addition to singing the "Song of the Open Road" with Bell's Brewery for "Replicator" on page 16, Dave also tells the story of Victory Brewing Co. on page 54.

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

On page 68, Stephen combines his professional life and homebrewing hobby to teach homebrewers how to improve recipes through marginal gains.

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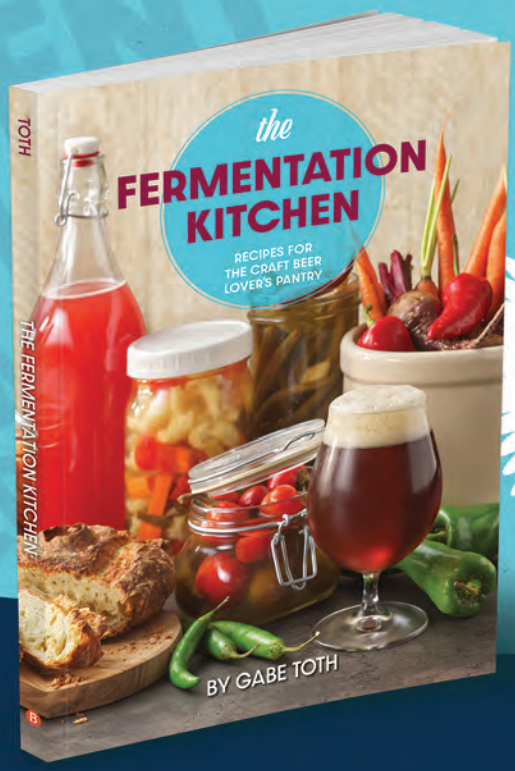

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MAIL

Germany historically, and breweries behind the Iron Curtain were not bound by the Reinheitsgebot. So they had no problem adding sugars to their beers, including schwarzbier. The European Union ruled the Reinheitsgebot anti-competitive prior to German Reunification, so it didn't have any legal force at that time. The current beer law in Germany allows sugars for coloring and flavoring, which was in response to the need to allow the former East German beers.

"Schwarzbier became popularized after German Reunification, mostly after Bitburger purchased Köstritzer, reformulated the beer, and started exporting and promoting the beer. This is where the style diverged, and is the basis for the modern schwarzbier style.

"In Michael Jackson's pre-Unification writings, he mentions schwarzbier in passing during his discussion of East German beers. He characterized it as a minor style, lower in alcohol, very sweet, and suitable only for blending with other beers in bars. Kind of like some London brown ales are used, in a way.

"I don't have a specific clone recipe for this beer, but I would make a Köstritzer-type schwarzbier like I provided in the July-August 2020 "Style Profile," then sweeten it post-fermentation with either invert sugar #2 or #3, or if you can't find that, an amber-to-dark Belgian candi syrup (like D-45 or D-90). Sweeten it to taste trying to match the level of sweetness you perceive in the commercial beer.

"If you enter this into a competition using BJCP Guidelines, I would pick 31B Alternative Sugar Beer, specifying Schwarzbier as the base style, and whatever type of sugar you used as the specialty ingredient."

VIN BLANC IPA

Today I brewed the Vin Blanc IPA recipe (all-grain) from the January-February 2019 issue. I'm just looking for some clarification on the wine part of the recipe. Am I correct that, when ready to rack to a secondary fermenter, you are to decant the gin from the oak, then add the wine to the oak, and add both the oak AND the wine to the secondary fermenter along with the beer? If so, do I add the whole bottle of wine?

John Brackbill • *via email*

You are correct that after a one-week soak in gin you'll want to decant off the gin (maybe try to repurpose it for something else) then add the wine and soak for about two days. I get the sense the author only intended homebrewers use enough wine to cover the chips, but one bottle (750 mL) in a 5-gallon (19-L) batch is definitely not excessive. I think that level, with its thiols, will go nicely with the hops. We would opt for a New Zealand Sauvignon Blanc over one from California, as the New Zealand-grown grapes are known more for their tropical fruit character while California-grown grapes are generally more floral in character. A Sancerre Sauvignon Blanc (from the Left Bank of France's Loire Valley) would be another good option. BYO

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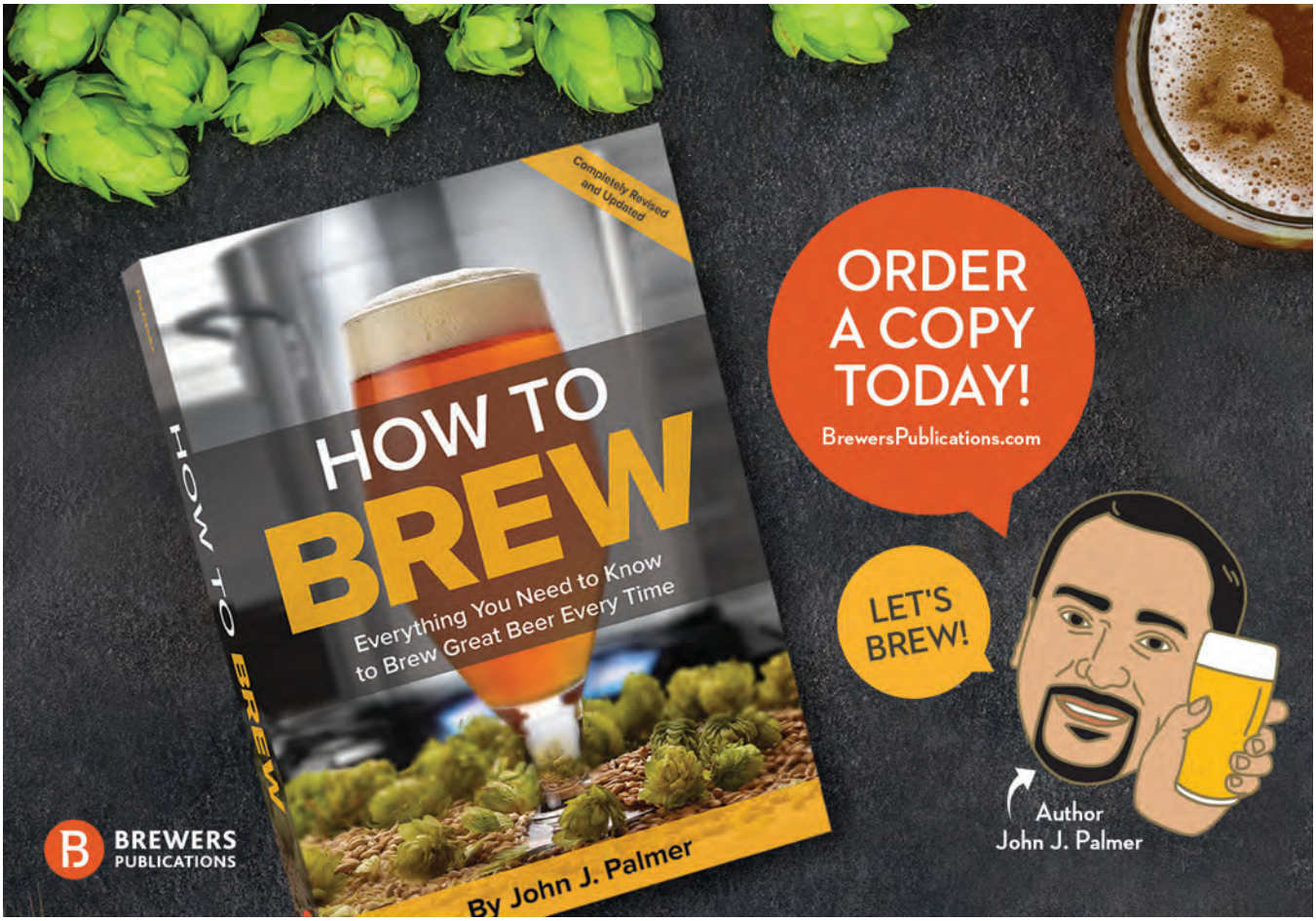

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BEGINNER'S BLOCK

BY DAVE GREEN

EASY LAGERS

Most of us grew up with them, many may have disavowed them for a while . . . but fans of beer know that lagers come in many colors and strengths and that they are often considered the apex of brewing. Lagers will put on display a brewer's skills in both the brewhouse and the cellar as the recipes are often simple, but the techniques to brew them require a delicate touch and planning.

In this piece the goal is to show you that even with basic equipment and some sound processes brewing a solid lager is not out of reach for even beginner brewers. Special attention to a few details as well as patience should yield a lager to be proud of. But before we get into that, know that the term "lager" has come to have two connotations in modern brewing. So the first section will be focused on clearing up that confusion.

YEAST OR CONDITIONING?

The term lager, when used in reference to brewing, goes back to beer brewed in the central European regions of Bohemia and Bavaria. In these regions some beers were allowed a slow and cool-temperature aging process performed in underground cellars. These beers were referred to as lagers since the Germanic word means "to store." Prior to the 1500s, brewers in these regions would have primarily been using *Saccharomyces cerevisiae* yeast for their lagers. But a freak event occurred early in the 1500s where *S. cerevisiae* mated with a New World yeast species called *S. eubaynus,* which came from the cold-temperate region of Patagonia in South America. The cross created a new hybrid species: *Saccharomyces pastorianus*. This new yeast began to spread through the highlands of central Europe through the century and brewers found it performed quite well even fermenting in these cool, cavernous locations. So while the lagering process can actually be performed on beers fermented with any type of yeast, the term later became synonymous with any beer fermented with this "new," clean-fermenting species of yeast.

LAGERS: THE YEAST

One of the main hurdles to brewing beer with *Saccharomyces pastorianus* is the fact that many of its strains are well known to create off-flavors if fermentation temperature gets too warm. Many of the strains are best fermented between 50–56 °F (10–13 °C) and require brewers to either have a dedicated temperature-controlled space or an expensive glycol unit for chilling the fermenter. But not all *S. pastorianus* strains are like this. There are several, notably California common and Weihenstephaner W-34/70, which can produce clean beers even when fermented up near room temperature (low-to mid-60s °F or high teens °C). If your living arrangement does not offer a cool basement or space for a dedicated fermentation chamber, then a swamp cooler is one alternative to keep fermentation temperatures below ambient room temperature. But there are many inexpensive, MacGyver techniques homebrewers have used to keep their lagers cool during active fermentation. A quick web search can yield some interesting results. Also be sure to pitch double the amount of yeast you would for your ales . . . so for example, two sachets of yeast instead of one for that Pilsner.

LAGERS: THE PROCESS

In order to clarify the terms, many brewers now call the lagering process either cold-conditioning or simply conditioning. As a homebrewer the simplest way to lager beers is in a refrigerator or freezer that has an external temperature-controller. These temperature controllers can be found at many homebrew supply stores. The lagering process can be performed in a wide range of temperatures, but is generally done in the 30–50 °F (-1–10 °C) range. The beer should be completely finished with primary fermentation, moved off the yeast before lagering starts, and should be in a vessel that is either filled right up to the very top (if using a carboy) or in a sealed and CO_2-purged container (like a Corny keg).

The time frame for lagering can be as short as one week and as long as 6 months or more for bigger beers. Just note that the warmer the lagering temperatures, the less time a brewer should condition the beer as excessive aging in warmer temperatures can be detrimental, especially to more delicately flavored beers like a helles. Meticulous brewers will slowly ramp down the temperature over the course of a week or more to get the beer down to lagering temperatures. If you don't have this luxury, just be sure air is not sucked back into the vessel. Finally, it is important to note that the beer should be clean going into the lagering process. Lager yeast fermented cold may have trouble cleaning up an off-flavor called diacetyl. A brief warm up prior to lagering called a diacetyl rest, is common to assure cleanliness. Lagering is simply a time for settling and mellowing of flavors.

FINAL NOTE

Another key to producing a quality lager is to reduce oxidation during transfers. One of the best ways to do this is to obtain a carbon dioxide tank and regulator to purge any receiving vessel to minimize oxygen pick-up. When post-fermentation beer gets even minute amounts of oxygen absorbed, both the fresh malt and hop character quickly fade. Focus your attention on these details and you should find yourself sipping a lager to be proud of.

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WHAT'S NEW

GRAINFATHER S40 & G40

The Grainfather has come out with two new mid-sized all-in-one countertop brewing systems, both with a 12-gallon (40-L) pre-boil maximum capacity. The G40 (seen here) grain bill maxes out at 26 lbs. (12 kg) while the S40 can go up to 22 lbs. (10 kg) of grain. You can brew a high-ABV recipe on these systems simply by brewing a smaller volume. The G40 allows brewers to manage a brew remotely with the smart controller that has built-in wireless connectivity. Both systems connect to the Grainfather app. Another difference is the G40 comes with 3,300W of power while the S40 has 2,300W, while both run on 230V. To learn more, visit https://shop.grainfather.com/us/shop/brewing.html

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ANCIENT BEER AND CHEESE PAIRING

While this story may not send anyone scrambling in search of an ancient recipe or down the path towards a new strain of yeast used in beer of old . . . scientists found in Austrian salt mines 2,700-year-old human feces with clear evidence of beer and cheese consumption by its creator. A new subject to us, paleofeces is the study of ancient, preserved feces. Researchers, using DNA sequencing technology, were able to pinpoint two specialized microorganisms in the preserved remains: *Saccharomyces cerevisiae,* beer yeast, and *Penicillium roqueforti,* fungi used to create blue cheese. While we know that beer and other fermented food products would have been known to the people of the day, just how widespread their availability was during the Iron Age becomes a little more clear. The fact that folks in that time utilized the same organisms our modern techniques use is fairly intriguing. To read more or find out how to possibly become a paleofeceologist, visit: https://www.cell.com/current-biology/fulltext/S0960-9822(21)01271-9

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BYO REPLICATOR

BY DAVE CLARK

DEAR REPLICATOR, I really like winter warmers and the absolute best, in my opinion, I've ever had is Bell's V, Song of the Open Road, from their *Leaves of Grass* Series. Since that was a special release from a special series of beers, my guess is that they'll not brew it again. Would you be so kind as to try to get the recipe so I can brew it myself?

Steve Russell
Denton, Texas

SONG OF THE OPEN ROAD, I BY WALT WHITMAN

Afoot and light-hearted I take to the open road,
Healthy, free, the world before me,
The long brown path before me leading wherever I choose.

Henceforth I ask not good-fortune, I myself am good-fortune,
Henceforth I whimper no more, postpone no more, need nothing,
Done with indoor complaints, libraries, querulous criticisms,
Strong and content I travel the open road.

The earth, that is sufficient,
I do not want the constellations any nearer,
I know they are very well where they are,
I know they suffice for those who belong to them.

(Still here I carry my old delicious burdens,
I carry them, men and women, I carry them with me wherever I go,
I swear it is impossible for me to get rid of them,
I am fill'd with them, and I will fill them in return.)

Larry Bell has always been known as an innovator and a creator. A leading voice of the craft beer movement, Bell is passionate about many things, including classic literature that has inspired him over the years. Larry channeled his passion for literature, specifically the work of Walt Whitman and created a series of beers each named after poems found in Whitman's classic 1855 work, *The Leaves of Grass*.

There were seven beers in the *Leaves of Grass* Series, each having its own unique place. The first beer of the series was released on May 1, 2019 on what would have been Walt Whitman's 200th birthday. A different beer was released every two months, tying into the seasonality at the time, just as Whitman often brought seasonality to his poetry. The first beer of the series was a unique take on an IPA with European malts and hops. Next was a fruited sour. The third release was a black India pale lager, the fourth was a smoked porter.

The fifth beer was a traditional, non-spiced winter warmer known as Song of the Open Road. Released in January 2020, this malt-driven "old school" winter warmer was intended to be enjoyed during the cold Great Lakes' winters. Created around the finest base, kilned, and roasted malts available, the beer was designed to drive the best and most robust flavors possible. At 8.5% ABV, Song of the Open Road was the strongest release of the entire series.

Most things at Bell's Brewery involve a team effort and this series was no different. Bell's Innovation Manager Andy Farrell, with twenty-plus years experience at the Michigan-based brewery, took the lead on the project and had a major hand in developing each of the seven beers for the series.

"One of the things we do well as a brewery is malt," said Farrell. "We are very comfortable brewing classic craft styles. Putting together a great malt profile was very important with hops being mainly for balance. Our goal was a full-bodied, malt-driven ale that delivers flavors and aromas of brown bread, toffee, and pleasant alcohol warming."

BREWING SONG OF THE OPEN ROAD

Using a medium-thick mash, the 45-minute mash contains an array of specialty malts including dark Munich, melanoidin, amber, brown, and other specialty grains that help deliver the deep and complex flavor profile.

Bell's does not employ a traditional 60-minute bittering hop addition for Song of the Open Road. The entire boil is just 54 minutes and the first hop addition is added at the 42-minute mark. The flavor addition appears with 27 minutes to go. There are no whirlpool or dry hops in this malt-dominant winter warmer. Crystal is the only type of hops used in this beer. According to Farrell, "It's a versatile hop, and can be used in many styles. In this case, it offered really great, clean background notes that I thought worked really well."

The *Leaves of Grass* Series was not the first series of beers produced by Bell's Brewery. The *Planets* Series came before and according to Farrell, you truly never know what might be next.

"Larry has such a creative mind," said Farrell. "You never know what he's going to come up with. This was the second series he's created. It's been a great challenge both times — and super enjoyable — to think of a group of beers as a whole then to try and differentiate them individually. The key is to create interest in all of them, while still being able to tie them all together to one main theme."

Song of the Open Road will pour a nice shade of brown with garnet notes. The hearty ale is best served in a snifter glass and will pair well with rich desserts, a fine cigar or, of course, the literary works of Walt Whitman. Serve your beer at 45–55 °F (7–13 °C) and enjoy it as a sipper.

BELL'S BREWERY'S SONG OF THE OPEN ROAD CLONE

(5 gallons/19 L, all-grain)
OG = 1.084 FG = 1.020
IBU = 35 SRM = 24 ABV = 8.5%

INGREDIENTS

12.17 lbs. (5.52 kg) Maris Otter pale ale malt
3.45 lbs. (1.57 kg) dark Munich malt (30 °L)
0.91 lb. (0.41 kg) dark crystal malt (120 °L)
0.56 lb. (0.25 kg) melanoidin malt
0.56 lb. (0.25 kg) roasted amber malt (43 °L)
7.8 AAU Crystal hops (42 min.) (2.4 oz./68 g at 3.25% alpha acids)
3.25 AAU Crystal hops (27 min.) (1 oz./28 g at 3.25% alpha acids)
White Labs WLP001 (California Ale), Wyeast 1056 (American Ale), SafAle US-05, or equivalent yeast
¾ cup corn sugar (if priming)

STEP BY STEP

In a medium-thick mash, achieve a mash temperature of 150 °F (66 °C). Mash for 40 minutes or until fully converted. Mash out at 170 °F (77 °C) then recirculate until clear. After collecting wort, boil for a total of 54 minutes, adding the hops at 42 and 27 minutes, respectively. If you care to, add yeast nutrient and a Whirlfloc tablet with 10 minutes to go in the boil for yeast health and beer clarity. Whirlpool and let the break and hops settle for 20 minutes at the end of boil for easy transfer.

Chill rapidly to 70 °F (21 °C). Pitch yeast and oxygenate thoroughly. Ferment at 72 °F (22 °C). Being a fairly large beer with a lot of sugars to ferment, give it no less than two weeks for primary and secondary fermentation. A few days longer will not hurt. Keg the beer and carbonate to 2.5 volumes or bottle condition.

BELL'S BREWERY'S SONG OF THE OPEN ROAD CLONE

(5 gallons/19 L, partial mash)
OG = 1.084 FG = 1.020
IBU = 35 SRM = 24 ABV = 8.5%

INGREDIENTS

6.6 lbs. (3 kg) Maris Otter liquid malt extract
2.5 lbs. (1.13 kg) Maris Otter pale ale malt
3.45 lbs. (1.57 kg) dark Munich malt (30 °L)
0.91 lb. (0.41 kg) dark crystal malt (120 °L)
0.56 lb. (0.25 kg) melanoidin malt
0.56 lb. (0.25 kg) roasted amber malt (43 °L)
7.8 AAU Crystal hops (42 min.) (2.4 oz./68 g at 3.25% alpha acids)
3.25 AAU Crystal hops (27 min.) (1 oz./28 g at 3.25% alpha acids)
White Labs WLP001 (California Ale), Wyeast 1056 (American Ale), SafAle US-05, or equivalent yeast
¾ cup corn sugar (if priming)

STEP BY STEP

This recipe has a combination of grains that can be steeped (crystal 120) and others that need to be mashed (amber, melanoidin, and Munich). Since the crystal 120 is the only steepable grain and imparts no roastiness that might contribute additional unwanted bitterness, you can include it when you mash the others. With grains in a large muslin bag, mash in 3 gallons (11.4 L) of water at 150 °F (66 °C). Mash for 40 minutes or until converted. Upon completion of the mash, remove grains, letting the wort drip.

Raise temperature to a boil and slowly add half of your malt extract. Boil for a total of 54 minutes, adding the hops at 42 and 27 minutes, respectively. If you care to, add yeast nutrient and a Whirlfloc tablet with 10 minutes to go in the boil for yeast health and beer clarity. With 5 minutes remaining, add the remaining LME. Separately, pre-boil and chill about 2.5 gallons (9.46 L) of water so you can top up your fermenter to 5 gallons (19 L) after the boil.

Chill rapidly to 70 °F (21 °C). Pitch yeast and oxygenate thoroughly. Ferment at 72 °F (22 °C). Being a fairly large beer with a lot of sugars to ferment, give it no less than two weeks for primary and secondary fermentation. A few days longer will not hurt. Keg the beer and carbonate to 2.5 volumes or bottle condition.

TIPS FOR SUCCESS:

The large quantity of specialty malts in the grain bill will inherently lead to a less fermentable wort. Bell's mash profile is aggressive at this duration of time and at that temperature, yielding a well-attenuated beer with good drinkability. Feel free to mash longer to ensure full conversion.

While there are no oats in this recipe, Farrell believes that an addition of flaked oats could potentially enhance the beer. "I would say you can add 5–15% oats if you wanted to soften it up and create your own character of the beer," said Farrell. "The beer was silky to begin with, but oats would enhance that character even more." BYO

BY DAWSON RASPUZZI

TWEAKING RECIPES

And brewing one-offs

Even if you've brewed a great beer, there is likely still room for improvement according to these pros, who are never satisfied enough to close the book on recipe development.

I am a big believer in the evolution of a beer. With almost every original recipe of a new beer we create, we have a good idea of what the final product will taste like, based on past experience. That being said, I have a hard time accepting or thinking that a beer is ever "perfect" or in its finalized form. There is always something that can be tweaked or improved upon in subsequent batches (e.g. water profile, bitterness, mouthfeel, flavor, aroma, carbonation, etc.). We are always striving to make the next batch better than the last. We don't have any static or untouchable beer recipes.

The first thing I teach my brewing staff is to enjoy what they have made (assuming there are no glaring flaws or assertive off-flavors). We all got into brewing in the first place because it was fun! When we release a new batch of every beer, I encourage the brewing staff to pour a full pint and let themselves thoroughly enjoy it. After all, they worked hard to get it from grain to glass. Once they have enjoyed the fruits of their labor, the real work can start. With each subsequent taste or pint, I want them to critique the hell out of it so we can start to make the next batch better. At that point, we ask ourselves an endless series of questions — did we hit the profiles (water, grist, hop flavor, hop aroma, special ingredients, etc.) we were shooting for? Did the changes we made to the previous batch make the beer better, worse, or have no distinguishable effect? Etc.

A good example of how our recipes have progressed over the years is in our West Coast IPAs and DIPAs. We have definitely skewed the calculated IBUs of our hoppy beers lower than they used to be. A lot of our hop-forward beers used to sit in the 80–100+ calculated IBU range, but now fall in a range closer to 50–70 IBUs (much lower for our hazy offerings). The perceived bitterness of our beers has not changed much, but our focus on how we utilize bitterness has changed.

We rotate through our recipes on a weekly, monthly, sometimes yearly basis, depending on the recipe. I guess I would say that the majority of our recipes are "semi-core." They will likely come back around at some time, in some fashion in the future. But our customers can expect that we will make tweaks to the original recipe to try to make it better than last time.

In addition to smaller tweaks to these recipes, we have the opportunity to brew a significant amount of one-offs. We sell the majority of our beer through our taproom and that allows us the financial freedom to constantly experiment with new products. These are a way we can keep the job exciting and fun for our entire staff. At Riip, we do the majority of our experimentation with new hops and hop products. The most important part is knowing how to create a clean base in order to be able to evaluate the final product.

If you want to do some one-offs at home, my advice is to experiment as much as possible, but do it with purpose. Dial in a few base recipes (e.g. a West Coast IPA, pale ale, imperial stout, and an American lager) before you start to play with it. If your base beer is no good, how can you expect to compare tweaks batch-to-batch? Choose one or two variables to play with at a time so you can note the differences, good or bad. If you are going to go off the deep end with new malts, yeast, and adjuncts all at once you won't have anything to compare or relate your experiment to. That said, I am all for creating something brand new, out of left field, just be prepared if it doesn't work.

I have a hard time accepting or thinking that a beer is ever "perfect" or in its finalized form.

Ian McCall is the Head Brewer at Riip Beer Co. in Huntington Beach, California. He has been in the beer industry for over 15 years.

Ryan Marcom is the Head Brewer at Westbrook Brewing Company in Mount Pleasant, South Carolina. He is also the Co-Owner and Head Brewer of Free Reign Brewing, which utilizes Westbrook's pilot system to produce small batches for the Charleston, South Carolina area.

Sometimes you nail a new recipe on the first go and sometimes it takes 3 or 4 attempts. However, even when you brew up a great beer on the first go, I tend to think there is always room for minor adjustments here and there. If you don't make adjustments and brew multiple iterations, how will you really know if you brewed the absolute best version you could have? One example is with our Belgian-style witbier, White Thai. It's one of our staple beers and one of our best sellers as well. It was brewed for years with a combination of malted wheat and flaked oats, amongst other grains. One day we decided to nix the oats, dial down the malted wheat, and add in some flaked wheat. We really thought this gave us a better version of White Thai and we've brewed it this way ever since.

Over the past couple of years we have really started to amp up our small-batch, one-offs as we look at ways to improve beers (and have fun). We invested in a 5-BBL pilot system for the sole purpose of being able to brew experimental small batches. Trying out new malts, different hop combinations, different yeast strains, or maybe even the same yeast but fermenting at a lower or higher temperature to see the different flavor profiles that yeast will produce. And then obviously with the pastry stout and smoothie sour craze nowadays, the possibilities are endless with all the different adjunct combinations you can try.

A one-off that we recently brewed on our pilot system was a banana milkshake IPA. In this case we brewed our normal milkshake IPA grain bill but the beer was fermented with a different yeast strain than we normally use. This yeast strain, when used to ferment at slightly higher temperatures, produces very pronounced banana flavors. So although the yeast was the only different thing about this beer, it provided a whole new flavor profile from what we would normally see in one of our milkshake IPAs. I think it turned out great!

Ultimately, the only way to get better is to build up your experience; and the only way to do that is to brew as much as you can and get a feel for what you like and what you don't. Beer is constantly evolving so there will always be new things to try.

Jon Kielty is the Head Brewer and Production Manager for Big aLICe Brewing with three locations in New York State. Jon and his team were named the 2020 Small Craft Brewer of the Year and Small Craft Brewery of the Year at the Great American Beer Festival.

On average it probably takes 2-4 times brewing a recipe before I'm really pleased with where it's at. Even still, there are times when I'll make a minor adjustment on a beer that we've been brewing for years because I see something I didn't see before that could be improved.

Start small when tweaking a recipe. When you take the time and energy to put together a recipe that you're happy with, usually the only tweaks that will need to be made are the small ones. For us it's usually a touch more or less of a malt or hop, a few degrees difference in mash or fermentation temperature, or slightly changing our water profile.

I love doing one-offs and we do quite a few of them. As a New York State Farm Brewery we put a heavy focus on brewing with locally sourced ingredients, so brewing one-offs is a great way for us to experiment with a lot of these different local malts and hops to see what we like, what we want to use more of, and how we can use these ingredients in other ways. It also adds to the taproom experience here as customers are always coming in to try new beers from us.

While a good amount of one-off brews have remained just that, many of them have become beers that we re-brew and bring back into our rotation because of the positive reception they get in our taprooms. Many of my favorite beers that we brew started off as what we anticipated would be just a one-off.

Beer is a great storyteller. One of the things that has made our brewery so special is that we're willing to take risks and experiment with different ingredients in an effort to create bold and flavorful agriculturally focused beers. I'd encourage homebrewers to experiment more with locally grown grain, hops, fruits, etc. wherever they are. There are some great locally grown ingredients all around us that can produce great beers with a great story.

BY ASHTON LEWIS

FLAKED VERSUS ROLLED GRAINS

Also: Gelatinization, identifying an infection, and draft cleaning

Q I KEEP SEEING THE FORUMS SUGGESTING A DIFFERENCE BETWEEN "FLAKED GRAINS" AND "ROLLED GRAINS." FROM WHAT I CAN GLEAN SEARCHING ONLINE, I'M FINDING SOME SOURCES REFER TO THE DIFFERENCE AS SEMANTICS, AND OTHERS SEEM TO SUGGEST THERE IS A REAL DIFFERENCE BETWEEN THESE LABELS. I'M WONDERING IF THERE'S A FUNCTIONAL BREWING DIFFERENCE BETWEEN THESE OR IF THEY WOULD NEED TO BE USED DIFFERENTLY IN MY BREWERY. AS A FOLLOW-UP QUESTION, I'VE GOTTEN INTO A FEW DEBATES BETWEEN MILLING FLAKED PRODUCTS VERSUS NOT. IS THERE ANY ADVANTAGE IN YOUR OPINION TO MILLING THESE GRAINS?

TONY DELMEDICO
ST. PAUL, MINNESOTA

These steam-rolled grains usually have a longer shelf life compared to raw-rolled grains because of enzyme denaturation and the grain starches are also gelatinized in the process.

Photo courtesy of Shutterstock.com

Rolled or flaked oats have become a popular adjunct in many fuller-bodied beer styles.

A Thanks for the great question, Tony! An interesting topic to dive into for sure because there are some real differences among adjunct grains that are invisible to the eye. For starters, the terms "flaked" and "rolled" are indeed used interchangeably. It seems that some writers have learned that repetitive words make for odd-looking sentences and use the term "rolling" as the process of producing "flaked" grains. Here is an example from the interwebs: "To create rolled oats, whole grain groats are first steamed, then rolled flat into flakes." And here is a headline from a website about using a handheld grain flaker titled "Make Rolled Oats & Flaked Grains." In this case, one piece of equipment called a grain flaker (attaches to a KitchenAid® stand mixer) functions in a single manner to produce "rolled oats" and "flaked grains" . . . or is that "flaked oats" and "rolled grains"? Suffice to say, the flat things that make for a healthy bowl of oatmeal are known as rolled and/or flaked oats.

Semantics aside, there are very real differences in how grains are treated prior to being squished into flat bits. For the sake of clarity, I will use the terms "rolling" and "rolled" for the remainder of this answer to describe the rolling process and the resultant rolled grain. There are essentially four different preparation methods before the pre-rolled grain meets the roller. The first is to simply clean or screen grains to remove dust, rocks, etc. before rolling. This method works well enough, but the rolled grains can literally look a bit rough around the edges and are not terribly shelf stable because rolling exposes the inside of the grain to oxygen. This is an important issue with oats because oats contain lipids (fats) that turn rancid over time. Other grains, like barley, wheat, and rye, contain much less lipids and are not known for being prone to rancidity. Rolled, unprocessed grains are most common among home rollers of grain.

When raw grains are wetted prior to rolling, the resultant rolled grain is more uniform in appearance and is easier to produce. The most common way to moisten raw grains in a commercial production plant is with steam. Steaming the raw grain has two key advantages from a brewing

perspective: 1) Steaming heats and hydrates starch granules and 2) Steam heating denatures enzymes. Immediately following the steam step, the grains are rolled and then cooled. These steam-rolled grains usually have a longer shelf life compared to raw-rolled grains because of enzyme denaturation and the grain starches are also gelatinized in the process.

As a quick aside, none of these methods were developed to help brewers with brewing or to make the preparation of that morning bowl of oatmeal faster to get onto the table. The science of grain rolling and the nuanced differences in the rolled products all came out of research conducted to optimize feed utilization for beef production. For a really interesting review of the history of this topic, search "History of Feed Processing, John K. Matsushima" and check out his review from the 2006 Cattle Grain Processing Symposium.

In the pursuit of more complete gelatinization, scientists continued to pursue refinements to steaming and rolling. This is why there are so many different thicknesses of rolled grains. In about 1970, the process of micronization was developed. So-called micronized grains are heated using a dry, indirect heating source to cause the starch granules to swell and burst. Popcorn is a common example of this basic process, except with micronization infrared energy is used as the heat source.

The term micronization is not a common term outside of the animal feed world and the same process is more commonly known as torrefication. The products of the process are known as "micronized," "torrefied," and "puffed." Name aside, a real difference between micronization and steaming is more complete gelatinization of the starch. This distinction is key in animal nutrition, especially with horses (non-ruminant herbivores), because it significantly affects nutrient uptake and feed utilization, a.k.a. feed cost.

Micronized/torrefied grains can be rolled just like steam-cooked grains. Examples of these products include torrefied wheat (not rolled) and flaked torrefied wheat, oats, rye, barley, rice, and maize (corn).

Toasting is yet another pre-rolling preparation technique. While toasting uses the same sort of process of micronization, the term "toasted" is not used to describe how animal feed stuffs are made and published data quantifying differences among other rolled grains is not readily available. Most toasted and rolled adjuncts are indeed very similar to "flaked torrefied [micronized] grains" but there are whole toasted grain products that do not have a puffed appearance; these toasted grains are more akin to lightly roasted grains. Up until now, things have been fairly clear. Unfortunately, "toasted" does not have a single definition universally used by all processors. For any commercial brewer reading this, the best way to understand what you are dealing with is to request a Hazard Analysis Critical Control Points (HACCP) process flow diagram from your supplier to understand the method(s) being used in the production of your raw materials.

And finally, let's touch on milling. The advantage of milling rolled grains is increased extract yield. Digging

WHAT IS GELATINIZATION?

Starch granules are microscopic spheres containing crystalline, tightly packed starch molecules. Nature's form of a packet of energy stuffed into a ball. Within these granules is a mixture of amylose (straight-chained) and amylopectin (branched) starch molecules. The ratio of these starches varies between and within cereals bred and grown for starch. For example, "normal" maize/corn, contains about 75% amylopectin and 25% amylose, waxy maize is about 99% amylopectin, and high amylose maize starch is about 75% amylose and 25% amylopectin. When starch granules are viewed under a polarized light microscope, they have a distinctive appearance often called a Maltese Cross due to birefringence of polarized light (think Pink Floyd's *Dark Side of the Moon* album cover).

When starch granules are hydrated and heated, they swell and eventually burst. From a practical sense, this can be felt when stirring a starch solution over a heat source. Upon gelatinization, the solution thickens, becomes more voluminous, before the viscosity drops when the granules burst. And if you happen to be visualizing this using a polarized light microscope, birefringence is lost and the Maltese Cross disappears. Very cool stuff. This is important to brewers because hydrolytic enzymes from malt can now break down these large molecules into fermentable sugars. It's as simple as saying no gelatinization, no beer!

One crazy thing about gelatinized starch is that it stales by a process known as retrogradation. When starch retrogrades, it re-crystallizes. This is the primary path of how bread stales. Speaking of stale and moldy bread, those problems seem to have dropped off the radar over the last fifteen years or so. How is that? Well, exogenous alpha and beta amylases are now commonly used by commercial bakeries to alter the starch structure before baking, thereby preventing starch retrogradation. And organic acids, like acetic (vinegar), propionic, isovaleric, and butyric (all naturally found in cheeses) do a great job of inhibiting mold growth. This one-two combo has all but eliminated fuzzy loaves of hard bread.

Although most rolled grains tend to look similar, don't assume they are all the same. The pre-rolling method has a significant effect on gelatinization rate. This means that some rolled grains can be chucked into an infusion mash where they will dissolve and easily release gelatinized starch into the mash. Other rolled grains are gelatinized to varying degrees and either require cooking or greatly benefit from cooking prior to use. A process known as cereal mashing is one way to gelatinize grains. But that is a whole other topic to cover another day.

around in spent grains after the kettle is full is a really great way to see how things went in the mash. Whole malt kernels, easier to spot in spent grains than in milled grist, obviously did not yield their extract and represent loss. Likewise, large bits of rolled grains have largely gone unchanged by the mash. A great visualization is to squeeze one of these rolled bits onto a spoon and drop in a bit of iodine. A jet-black result confirms the presence of starch and indicates that goodies are present in the spent grains. Many brewers don't want to mill rolled grains for fear of sticking the mash. That's a legitimate concern, but so is adding an ingredient that ends up being discarded after the process.

Hopefully this clears things up a bit on the topic of steamed, puffed, micronized, toasted, and torrefied, rolled or flaked, grain flakes.

Q IS IT POSSIBLE THAT YOU CAN HELP ME IDENTIFY THIS INFECTION (SEE PICTURE BELOW)?

ROGER JACOBS
HAMILTON, SCOTLAND

A Identifying beer spoilage by visual observation can be a challenge, but the photo of your brew does look suspect. If I were to wager a bet, my money would be on *Acetobacter* for the win. Whatever is on the surface of your beer, it's definitely not normal brewing yeast. Another common surface organism are *Brettanomyces* yeast species, but *Brett* pellicles usually have a different texture and appear more continuously across the surface once developed.

My guess about the identity of this does not really help you with your quest. You, however, should be able to do a bit of sleuthing with your nose. *Acetobacter* converts ethanol into acetic acid (vinegar) and its presence is often highlighted by elevated levels of ethyl acetate aromas, such as solvent, nail polish, and pear drops, as well as rope formation. *Acetobacter* are not the sort of spoilers that fall under the stealthy category of contaminants! *Brettanomyces* yeast, on the other hand, produce a different range of aromas from pleasant tropical fruit notes, to leather-like, barnyard aromas, to intense phenolics that are sometimes described as baby diaper. I call this the rosy, the funky, and the fugly.

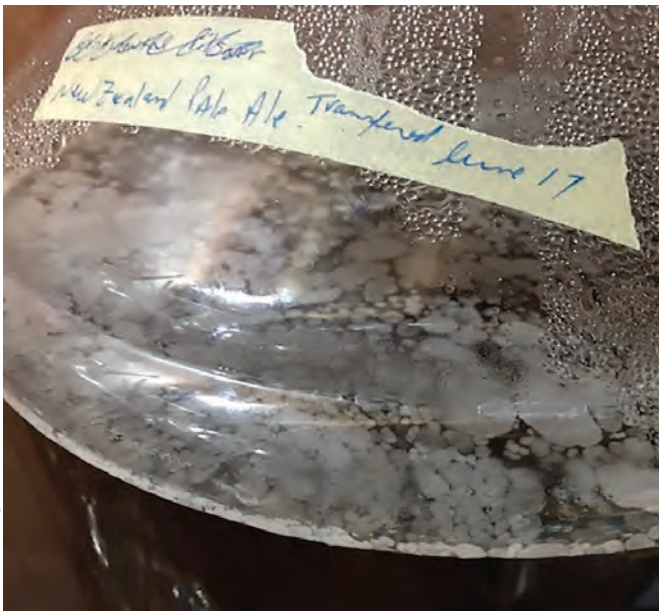

Photo by Roger Jacobs

The practical rule with this sort of brewing challenge is to use sensory to make a swift go or no-go assessment of the beer. Although it helps to have some prior experience in confidently rejecting a batch of contaminated beer, a bad batch of beer is usually hard to miss. If it smells really bad, tastes really bad, looks funky, and persists in this condition for a couple of weeks, it's probably not going to get any better. In other words — dump it, clean it, and refill it to move on to better times ahead.

Commercial breweries are more analytical about contamination because understanding the root cause is important to stop the problem from spreading through the brewery. Classic microbiological methods are still common in brewing labs. These methods include the use of different types of growth media, colony morphology, anaerobic/aerobic environments, staining, and microscopic observation to identify the spoiling microorganisms. Many breweries, including a surprisingly large number of breweries producing fewer than a couple thousand barrels per year, use PCR (polymerase chain reaction) technology to detect and quantify beer spoilers.

Whether a brewer knows what has spoiled a batch of beer, it is always important to come up with some ideas on how the spoilage occurred so that future problems may be avoided. For the sake of discussion, assume that the photo of your problem brew does indeed show *Acetobacter*. This bug requires oxygen at the surface to effectively do its magic of converting ethanol into vinegar, and in combining ethanol and vinegar to produce ethyl acetate. A great way to deal with *Acetobacter* is to exclude air from the headspace of carboys and barrels. Try not to age beer in a primary vessel with lots of headspace for too long. Oxygen will find its way in over time.

Another great question to ask is how the bug found its way into your beer. Was it because of poor sanitation, a faulty piece of equipment that could not be properly cleaned, or was it from an ingredient addition after the boil? Microbiological problems can be difficult to definitively identify, yet they always remind brewers that organisms are everywhere in our world and some find beer a fairly hospitable environment.

Q TWO YEARS AGO, I BOUGHT MY FIRST TWO CORNY KEGS AND HAVE BEEN SERVING SOME OF MY BEER ON DRAFT (STILL BOTTLE SOME). FOR A WHILE I WAS JUST USING PICNIC TAPS AS THEY WERE CHEAP AND EASY, BUT I JUST BOUGHT TWO STAINLESS FAUCETS AND WILL BE RUNNING THEM THROUGH THE FRIDGE DOOR. WITH THE PICNIC TAPS, CLEANING WAS EASY AS I JUST UNSCREWED THE TOP PIECE ON BOTH THE TAP AND THE QUICK CONNECT AND SOAKED IN CLEANER SOLUTION FOLLOWED BY A QUICK SANITIZER RINSE. I WOULD DO THIS JUST BEFORE PUTTING EVERY NEW BEER ON TAP. WHAT'S YOUR RECOMMENDED PROCEDURE FOR CLEANING LINES AND FAUCETS? DO YOU RECOMMEND REPLACING THE TUBING OVER TIME?

FRANK PETRIGNANI
BRAMPTON, ONTARIO

A Clean draft lines and faucets are key to any properly maintained draft beer system. The good news for the homebrewer is that our draft lines tend to be relatively short and contain little volume. For example, 6 feet (1.8 m) of 3⁄16-inch inside diameter line, a typical length in a balanced system designed for normally carbonated beer, contains about 1 ounce (30 mL) of beer. The usual cleaning period in bars is bi-weekly, so even if a keg is on tap for 8 weeks, bi-weekly cleaning at home will consume only 3 ounces (90 mL) of beer.

The most common and simplest method used to clean draft lines in a bar is to use a keg-cleaning bottle to push rinse water and line cleaner through beer lines using gas pressure. This same basic setup can also be purchased with a hand pump. These work great for cleaning multiple short lines in quick succession. It's typical to fill the bottle with warm water and flush beer from the lines being cleaned. After rinsing, the bottle is then filled with a cleaner and the lines are flushed with cleaner. When multiple lines are cleaned in succession, the cleaner sits in the lines for as long as it takes to flush all lines. Good practice allows adequate soak time between steps to ensure enough time for cleaning. This time varies by cleaner type and what sort of beer has been in the line; 5–10 minutes is generally adequate. Primary cleaning is sometimes followed by a rinse with a secondary cleaner, usually an acid, or just a thorough rinse with water. This general method cleans the keg coupler/tap, beer line, shank that goes through the cooler/refrigerator wall, and the main contact surfaces of the beer faucet. Not all faucets are cleaned by simply flushing and should be routinely disassembled and cleaned.

Although the method described above is handy for use in bars, it is not the easiest thing to apply at home because keg-cleaning bottles are designed for commercial keg couplers. A spare Corny keg can be used at home, but one of these gems is probably not just sitting around. And if one is the method is probably more trouble than it's worth.

> **"... 6 feet (1.8 m) of 3⁄16-inch inside diameter line, a typical length in a balanced system designed for normally carbonated beer, contains about 1 ounce (30 mL) of beer."**

My suggestion for those using Corny kegs is to set up one side of the line with a swivel fitting to allow easy removal from the outlet coupler on your keg. On the other end use a 3⁄16-inch barbed fitting x beer nut coupler to connect your line to the shank that goes through the refrigerator door. When it comes time to clean your line(s), simply disconnect the beer coupler for your keg, unscrew the male beer nut from the beer shank. Next, unscrew the flat nut that connects the shank to the refrigerator door and pull this out from the front of your refrigerator. You can now easily rinse your Corny fitting, beer line, shank, and faucet, clean with an appropriate detergent (soaking in a mild alkaline cleaner like PBW works well), rinse, and reassemble.

You asked about tubing life; well-maintained beer tubing will last for years. The signs that tubing needs to be replaced include visible cracks, soils that do not appear to remove with normal cleaning (assuming tube is clear), difficulty pouring beer, and excessive age. Because homebrew draft lines are typically short and limited in number, replacing is not expensive. Consider noting the installation date of new draft lines and replacing every two years or so. Whatever time is spent cleaning and maintaining draft lines pales in comparison to the time required for bottling. Here's to draft homebrew! BYO

Photo courtesy of Draftnauts.com

Not properly maintaining a regular cleaning and sanitation of your beer lines and faucets can have unsightly consequences.

BY GORDON STRONG

IMPERIAL STOUT

Back in black

Historically, it was a strong English beer that was exported to the Russian Empire, but today it is a popular craft beer style in the U.S. and elsewhere in the world.

IMPERIAL STOUT
BY THE NUMBERS

OG:	1.075–1.115
FG:	1.018–1.030
SRM:	30–40+
IBU:	50–90
ABV:	8–12%

Photo by Charles A. Parker/Images Plus

When the weather starts turning cool, I immediately think of brewing and drinking big, rich beers. Sure, winter warmers, old ales, and barleywines will do the job, but when I want to turn it up to 11, my focus turns to that Darth Vader of beer styles, imperial stout. Historically, it was a strong English beer that was exported to the Russian Empire, but today it is a popular craft beer style in the U.S. and elsewhere in the world. It often serves as the base style for barrel-aged beers and beers with special ingredients.

The traditional English and modern American takes on the style often leads people to think that the style has two main variants. Indeed, the Brewers Association recognizes those substyles during Great American Beer Festival judging, just like barleywine and IPA are separated. However, the Beer Judge Certification Program (BJCP) treats it as a single style representing the continuum between these variants since there are many examples that freely mix English and American ingredients and techniques. Rather than create a third hybrid style, it was easier to acknowledge the historical division and then explain the full range of the style.

The BJCP classifies imperial stout as style 20C, in the American Porter and Stout judging category, along with American porter and American stout. This grouping was somewhat controversial since many rightly point to the historical English roots of the style. However, I choose to group it here because style categories are intended for judging purposes, and imperial stout actually judges well against those other two styles. In the 2008 and prior guidelines, Russian imperial stout was grouped with all other stouts, which led to lower-gravity styles being neglected. Ordinary bitter isn't judged alongside English barleywine, is it? The same logic applies here.

HISTORY

Stout in general evolved from porter, an English beer style since the early 1700s. Originally called stout porter meaning a stronger porter, it subsequently split into several styles. Irish stouts split from English stouts and became influential and popular, due in no small part to the efforts of Guinness. But what is known today as imperial stout has its roots in the double brown stouts (or extra stout porters) of London.

The Anchor Brewery in the Southwark district of London on the south bank of the River Thames is often named as one of the first popular exporters of the beer style. They are known to have exported it to the Russian Empire and other countries on the Baltic Sea as early as 1781. Catherine the Great was empress of Russia from 1762 to 1796, and she and her court were said to enjoy the high strength beer. Thrales owned the Anchor Brewery until it was purchased by Courage in 1795.

Barclay Perkins and other London porter brewers such as Reid, Whitbread, and Truman also produced and exported the beer. Barclay Perkins much later merged with Courage in 1955. They were known for producing the Courage Imperial Russian Stout, which was the last surviving English example, produced until 1993 before being resurrected by Wells & Young's in 2011. Bass was known for their P2 Imperial Stout, a fairly limited production not as well known as their P1 Barleywine.

Some businessmen bottled and exported beers from England, much like modern distributors. Albert Le Coq, a Prussian of French origin, is associ-

ated with this trade, as his company exported Barclay Perkins (later Reid) Imperial Extra Double Stout during the 1800s before buying a brewery in modern Estonia in 1912 to supply the Russian market. Michael Jackson mentioned this beer, which led to its reintroduction in 2000 after years of decline during the Soviet era. Interruption of trade during the 1800s, especially in the Napoleonic era, helped lead to the development of modern Baltic porter, a spin-off of these early imperial stouts.

The microbrew boom in the U.S. led to early brewers making versions of this style that Michael Jackson described. Grant's (opened in 1982, now Yakima) was one of the first. Rogue and Great Lakes were mentioned as early producers, although neither currently makes the style. Bell's Expedition Stout (first made in 1989) and North Coast Old Rasputin (first made in 1995) are perhaps the best-known U.S. examples still made today. Samuel Smith's in England began making the beer in the 1980s for the U.S. market in response to this demand. Much later, Fuller's also introduced a limited-edition example.

Today, many U.S. examples are barrel-aged or involve specialty ingredients. One such example I enjoy is Cigar City Hunahpu's Imperial Stout with cinnamon, vanilla, cacao nibs, and chili peppers. During my travels, I often see examples in South America and elsewhere, showing the global reach of modern craft beer. I have had wonderful examples in Brazil that were aged in Amburana wood.

SENSORY PROFILE

Imperial stout is properly known as the richest and strongest of the stouts. So much that *imperial* has become a modern adjective for other beer styles meaning big, not its historical meaning of *brewed for emperors*. The overall balance can vary, but it has intense flavors — always with a strongly roasted emphasis — is very strong and always dark. Like all stouts the color is black, typically very dark and opaque. The head will generally be well-formed and have a brownish color. The 8% and higher alcohol level

IMPERIAL STOUT

(5 gallons/19 L, all-grain)
OG = 1.100 FG = 1.026
IBU = 61 SRM = 111
ABV = 10.8%

INGREDIENTS

13.25 lbs. (6 kg) Golden Promise pale ale malt
1.75 lbs. (794 g) U.K. brown malt
0.5 lb. (227 g) flaked oats
2 lbs. (907 g) U.K. roasted barley
1.25 lbs. (567 g) U.K. chocolate malt
0.75 lb. (340 g) U.K. black malt
2 lbs. (907 g) Belgian extra dark candi syrup (180 °L) (15 min.)
21 AAU Centennial hops (60 min.) (2 oz./57 g at 10.5% alpha acids)
13 AAU Chinook hops (15 min.) (1 oz./28 g at 13% alpha acids)
1 oz. (28 g) U.K. Golding hops (5 min.)
Wyeast 1028 (London Ale), White Labs WLP013 (London Ale), LalBrew Nottingham, or SafAle S-04 yeast
¾ cup corn sugar (if priming)

STEP BY STEP

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

This recipe uses an infusion mash. Use enough water to have a moderately thick mash (1.5 qts./lb. or 3.1 L/kg). Mash in the pale and brown malts and the oats at 151 °F (65 °C) and hold for 60 minutes. Add the three dark grains, stir, begin recirculating, raise the mash temperature to 169 °F (76 °C), and recirculate for 15 minutes.

Sparge slowly and collect 6.5 gallons (24.5 L) of wort.

Boil the wort for 90 minutes, adding hops at the times indicated in the recipe. Add the candi syrup when 15 minutes remain in the boil.

Chill the wort to 64 °F (18 °C), pitch the yeast, and ferment until complete, allowing the temperature to rise as high as 70 °F (21 °C).

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

IMPERIAL STOUT

(5 gallons/19 L, extract with grains)
OG = 1.100 FG = 1.026
IBU = 61 SRM = 100
ABV = 10.8%

INGREDIENTS

10.1 lbs. (4.6 kg) light liquid malt extract
2 lbs. (907 g) U.K. roasted barley
1.25 lbs. (567 g) U.K. chocolate malt
0.75 lb. (340 g) U.K. black malt
2 lbs. (907 g) Belgian extra dark candi syrup (180 °L) (15 min.)
21 AAU Centennial hops (60 min.) (2 oz./57 g at 10.5% alpha acids)
13 AAU Chinook hops (15 min.) (1 oz./28 g at 13% alpha acids)
1 oz. (28 g) U.K. Golding hops (5 min.)
Wyeast 1028 (London Ale), White Labs WLP013 (London Ale), LalBrew Nottingham, or SafAle S-04 yeast
¾ cup corn sugar (if priming)

STEP BY STEP

Use 6.5 gallons (24.5 L) of water in the brew kettle; heat to 158 °F (70 °C).

Turn off the heat. Add the three crushed dark grains in a mesh bag and steep for 30 minutes. Remove and rinse grains gently.

Add the malt extract and stir thoroughly to dissolve completely. Turn the heat back on and bring to a boil.

Boil the wort for 60 minutes, adding hops at the times indicated. Add the candi syrup when 15 minutes remain in the boil.

Chill the wort to 64 °F (18 °C), pitch the yeast, and ferment until complete, allowing the temperature to rise as high as 70 °F (21 °C).

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

TIPS FOR SUCCESS:

Aging this beer for six months or more at cellar temperatures will allow the flavors to meld. If you plan to bulk age in a carboy, just make sure the beer is filled up above the curve of the neck and keep the airlock topped with sufficient liquid.

should be noticeable, but not burning, and the body is typically quite full with a chewy, velvety texture.

The roasted quality expresses itself in different ways, such as coffee, dark chocolate, cocoa, black licorice, or even tar. There may be caramel, dried dark fruit, or biscuity notes present. Hop flavors may or may not be present, and can be of almost any variety that adds to the complexity. There may be a bit of alcohol flavor sneaking in, but it should not be prominent. These qualities are apparent in both the flavor and the aroma. The intensity level and balance between these components are subject to brewer interpretation and can vary quite a bit as long as they all blend coherently.

Americanized versions can use a neutral base malt or something bready and biscuity like Maris Otter. Those wanting added maltiness often find a way to sneak in Munich, Vienna, or other character base malts, sometimes accenting with biscuit, Victory®, or similar malts that give British flavors akin to amber and brown malts. Dark malts and grains are normally at least two of roasted barley, chocolate malt, and black malt. Crystal malts skew to the higher Lovibond colors, 60 and higher, up to 160, maybe with some Special B for raisiny notes. Starchy adjuncts are often flaked oats or barley for body, maybe with some wheat malt for head retention. Flavors of crystal and dark malts can vary quite a bit between maltsters, so you may want to compare flavors before making your final selection.

> **I tend to think about the dark flavors first, and the finishing gravity and bitterness next to determine the overall balance.**

The balance of sweetness and bitterness can vary with the overall bitterness ranging from moderate and balanced to quite aggressive. The finish can seem fairly dry to moderately sweet, but shouldn't be syrupy or cloying. Age often affects this balance with flavors mellowing and body diminishing over time. The strong flavors should last into the aftertaste, along with a warming impression.

The overall impression may seem "English" or "American" or somewhere in between. English versions tend to be more estery and often have a more tarry flavor, while American examples can favor more of a late hop character and clean fermentation profile. Both acceptable, as are those that blend any of these components.

BREWING INGREDIENTS AND METHODS

It's hard to describe how to make an imperial stout without sounding like anything goes. I think the fermentables can be divided into four groups: Base malts, dark malts and grains, crystals and sugars, and adjuncts. My recipes often include something from each group, but I have seen recipes as simple as three ingredients (pale malt, roasted barley, chocolate malt). On the other end of the spectrum, I've seen recipes with more than a dozen ingredients in the grist. Both have won significant medals, so whatever approach is taken, it's the flavor that matters.

Historical English versions often use some combination of pale malt, amber malt, brown malt, black malt, and dark brewing sugars (well, depending on the year — remember black malt wasn't invented until 1817). The pale malts were often pale ale malt but could be the more dextrinous mild or stout malts. Sugars were usually dark invert sugars (#2 through #4), not white table sugar, and provided many of the flavors that modern brewers get from dark crystal malts. Roasted barley, chocolate malt, and crystal malts were not common English ingredients in this style historically, although it's not uncommon for them to show up in modern incarnations.

Looking at all the recipes I've used over the last 25 years, I see base malts in the range of 70–80% of the grist, adjuncts between 0–5%, crystal and sugars in the 0–15% range, and dark grains at 10–20%. The balance and composition of these are your choice. I tend to think about the dark flavors first, and the finishing gravity and bitterness next to determine the overall balance. Remember that sweetness masks many flavors so keep that in mind if your finish gravity is on the high side. I prefer mashing at lower conversion temperatures (151 °F/65 °C or lower) to encourage attenuation, knowing that any crystal malts and starchy adjuncts will provide the body and sweetness, but many people will mash higher (154–158 °F/68–70 °C) if they do not use these in the grist.

The hop character can vary greatly with the bitterness level being your first choice. IBUs are typically between 50 and 90, although there are some commercial outliers on either end. If I'm making an English style, I tend towards the low side, while American versions can go higher. Remember that if you are intending to age the beer, you might want to overshoot the hop character so it ages into balance. That was often my strategy when I was actively competing. Some late hops work in the style, and can be low to high. English or American varieties are classic, and many of my recipes use Chinook, Centennial, and Golding for piney, citrusy, and floral notes. The beer may or may not be dry hopped; it can certainly take it.

Neutral American or fruity English yeasts are common, as long as they can handle the alcohol levels (often 10% or more) without leaving the beer cloying or generating too many higher alcohol byproducts. I tend to prefer attenuative strains while using the grist to drive the body and sweetness of the beer, not lower residual extract. But I also know people who have successfully used yeast stains that are described as favoring malty beers, and some have used Scottish or Irish strains. Some pitch lager yeast when the

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beers will go through extended secondary aging. Fermentation temperatures are in the normal range for whatever yeast is selected; don't try to use higher temperature fermentations as these often stress the yeast. Use larger pitch rates appropriate for higher gravity beers; I typically double the yeast of a normal-strength beer or repitch from a standard-strength beer.

HOMEBREW EXAMPLE

I'm presenting an English-inspired version with some American hopping. The base malt is Golden Promise, but any English pale ale malt can be substituted. Maris Otter isn't necessary since the other flavors will be quite strong. A good English brown malt like from Crisp or Fawcett will add some of that porter-like flavor. Oats will help provide some body, while the mash temperature remains at a moderate level to encourage attenuation. My friend Joe Formanek sometimes decocts his base malts; if this process appeals to you, now is a good time to use it.

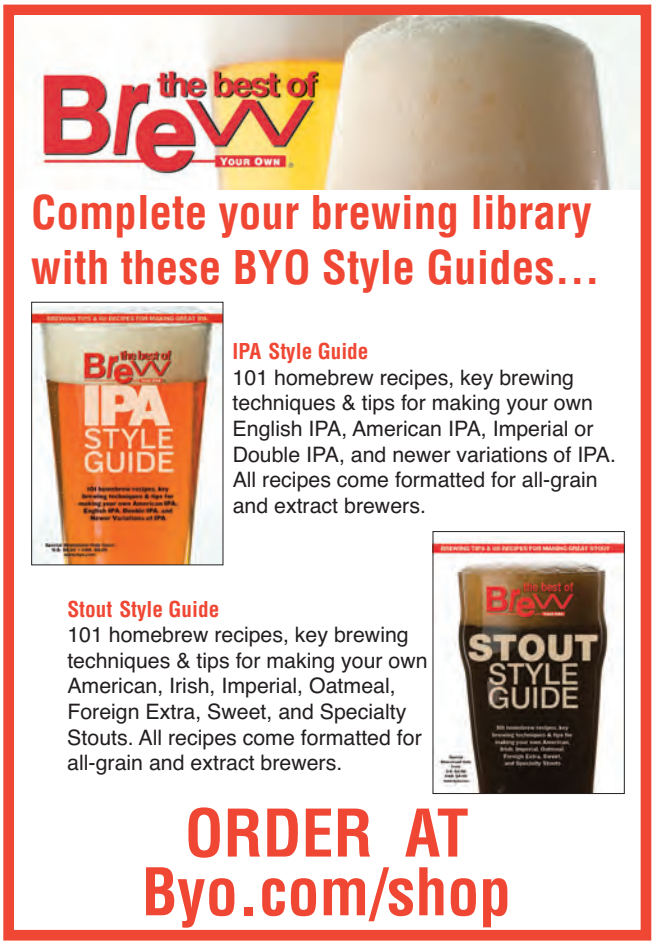
I'll use all three of the typical dark grains, including roasted barley as the highest percentage with chocolate and black malt. I like using English maltsters here as well. Instead of a collection of crystal malts, I'll use invert #4 or the closest equivalent I'm likely to find, a Belgian candi syrup of 180L color. These will give the fruity and dark sugar flavors without having to use four or five different crystal malts.

The mash method is my typical approach, including lower levels of minerals and adding the dark grains during the vorlauf. This step is pretty important, since it helps the mash pH be in a predictable range and reduces the harshness extracted from the dark grains. Just be sure to recirculate for the full time, and conduct a slow sparge as well. A short steep won't cut it; that recirculation and sparge time is when the color and flavor is rinsed from the dark grains.

I'll use three additions of hops — traditional bittering, flavor, and aroma additions: Centennial for bitterness, Chinook for flavor, and Golding for aroma. I have used first wort hopping before with non-traditional styles; it worked with Chinook. I have also moved the aroma addition to dry hops previously. I mention these only as options.

I like a dry English yeast in this style and Wyeast 1028 (London Ale) fits the bill. Any other attenuative English strain could serve a similar purpose including dry yeast like LalBrew Nottingham or SafAle S-04. Making a starter with a large smack pack or repitching from a prior batch is what will give you enough yeast (or use two large packs or an extra sachet), and I'd always oxygenate this beer when reusing yeast or pitching a starter to encourage a quick start to fermentation.

With this level of alcohol and dark grains, I'd cellar it for at least six months before serving. It will age well for years if your sanitation and packaging game is solid. So brew one now for next winter's enjoyment. BYO



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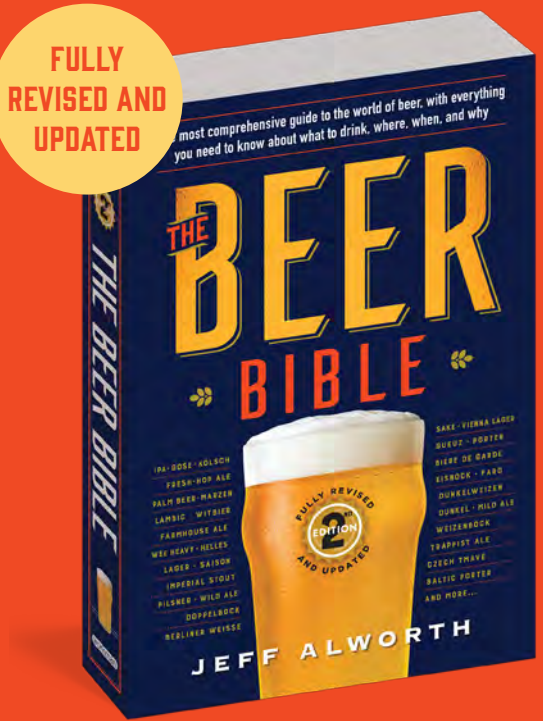

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11:00 AM – 12:00 PM	Post-Pandemic Taproom Trends	Optimizing Brewery Layout for Workflow & Space	Top 5 Legal Mistakes to Avoid as a New Brewery
12:00 – 12:30 PM	Q&A WITH NANO VENDORS		
12:30 – 1:30 PM	Hazy Brewing Case Studies	Planning a Brewery Quality Control Program	Brewery Metrics & Key Performance Indicators
1:30 – 2:15 PM	NANO CRAFT BREWING TRENDS PANEL		
2:15 – 3:15 PM	Breaking Down the Numbers on Taproom-Focused Breweries	Finding & Keeping Staff	Evaluating your Malt
3:15 – 3:45 PM	Q&A WITH NANO VENDORS		
3:45 – 4:45 PM	Relaunching Taproom Events Panel	Taproom Draught System Troubleshooting & Maintenance	Nano Tank: Pitches to Expert Panel
4:45 – 5:15 PM	Q&A WITH NANO VENDORS		

NanoCon Online Day #2 • Saturday, December 4, 2021

11:00 AM – 12:00 PM	Enzymes, Nutrition & Brewing Process Aids	5 Steps to Taproom Success from Day One	Financing a Brewery Expansion
12:00 – 12:30 PM	Q&A WITH NANO VENDORS		
12:30 – 1:30 PM	Keys to a Better Nano Business Plan	Turning Social Posts into Sales	Hard Seltzer Production for Nanos
1:30 – 2:15 PM	NANO BUSINESS TRENDS PANEL		
2:15 – 3:15 PM	Intellectual Property Strategies for Breweries	Starting Up a Sensory Panel	Brewery Branding 101
3:15 – 3:45 PM	Q&A WITH NANO VENDORS		
3:45 – 4:45 PM	Equipment Planning for Expansion	Planning your Taproom Draught System	Membership Programs to Boost Loyalty & Revenue
4:45 – 5:15 PM	Q&A WITH NANO VENDORS		

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MYTH BUSTING

by Denny Conn & Drew Beechum

Clearing the confusion on foggy information

It was the best of times, it was the worst of times, it was the age of wisdom, it was the age of foolishness . . .

Charles Dickens may have thought he was describing the French Revolution, but his expression of a near universal sentiment equally captures the flood of homebrewing information available today. We have unprecedented access to brewing (and homebrewing) information and ingredients — a wonderful thing. Simultaneously, we have an overload of information (wait a minute, this sounds even more universal!). As anyone who has ever tried to hit every booth at Homebrew Con Club Night can tell you, it's possible to have too much of a good thing!

Figuring out what we need to absorb is a problem in the relentless noise. Much of it isn't applicable to what we do, is questionable, or is simply wrong. We've spent a lot of our brewing "career" trying to figure out what's true, what isn't, and most importantly, what matters to homebrewers. (We're going to keep hammering this point — there's a massive difference between what we do at home, what we can get away with, and what matters to us homebrewers compared to what a professional brewer needs to do to maximize quality, repeatability, and profits).

Myths come to us from all different directions. Humanity is awash in stories that we tell ourselves to explain and amuse.

The most common source is — well — other homebrewers. Brewing is, after all, a very "hands-on" craft with some teachers being taciturn, doling out drips and drabs of wisdom, and others garrulous to a fault, loosing torrents of facts and tales. The "facts" come from various sources, often half-remembered or missing some detail.

The second most common source appears to be homebrewing literature. Someone will write something they've learned in a new book. That makes it "fact," and it gets repeated down the line. The repetition gives it even more credence: "Everybody knows that's true! It was in a book!" Maybe the misinformation appears because someone misunderstands an underlying principle. Or they attribute a particular effect to the wrong cause. Or it could be because no one has ever tested the concept to determine its validity or applicability to homebrewers.

Some myths start with commercial brewers

Photo by Charles A. Parker/Images Plus

Decoction mashing is done by removing a portion of the mash and boiling it before returning it to the mash tun — clearly exceeding 170 °F (77 °C).

whose concerns and processes are quite different than those of most homebrewers. Others simply come down to a difference of opinion. And then there are myths that are directly contradicted by common brewing practices, but for some reason, people don't connect them.

Here is our list of the top six myths and misunderstandings that are common in the homebrew world.

SPARGE TEMPERATURE

Since the rise of the sparge, it has been taken as fact that using water over 170° F (77° C) will extract harsh tannins from the grain, causing mouth-puckering astringency in your beer. No one wants that! This still frequently appears on forums and in books. But it seems to overlook one little brewing technique: The decoction mash.

Decoction mashing has been around for centuries and is still used by many award-winning homebrewers today. Decoction mashing is done by removing a portion of the mash and boiling it before returning it to the mash tun. The last time we checked, boiling temperature (212 °F/100 °C at sea level) is hotter than 170° F (77° C)! So, why does this technique make award-winning beer instead of a harsh, astringent mess? Because of pH.

The magic number appears to be a pH of 6 or above. If you keep your pH well below that (ideal mashing pH range is 5.1–5.6), the temperature of your sparge water really won't matter. For the last 15 years Denny has been using sparge water in the 185–190° F (85–88° C) range and has no issues with tannin extraction. That's because the pH of his mash stays well below 6. Sometimes it just works out that way, sometimes he needs to add a bit of lactic acid to achieve a suitable pH. Whether that exact method works for you will depend on your water.

Another common myth lies on the other end of the temperature spectrum. There is a belief that you must sparge with hot water. Some homebrewers we've spoken with assume that hotter water loosens the sugar in the grain more, making it less viscous so it removes more sugar and increases efficiency. Unfortunately, physics doesn't work like that. There's a thing called the "limit of solubility," which determines how much sugar can be dissolved in a liquid at a given temperature. While there are certain benefits to sparging with warm water (like runoff rate), it actually does little to help with extract efficiency.

Unless the specific gravity (SG) of your wort is over 1.300, there is minimal, if any, advantage for homebrewers to use hotter water to dissolve the sugars. Kai Troster has done experiments showing that even using cool (60° F/16° C) water to sparge will not adversely affect effi-

ciency or beer quality.[1] Ray Found of Brülosphy did an Exbeeriment that resulted in a minimal difference (at least in homebrewing terms) in original gravity and alcohol when sparging at cool vs. standard temperatures.[2] Denny has also tested this repeatedly using room-temperature water with no apparent effect on efficiency.

But let's get real here. Aside from the curiosity of demonstrating that hot sparge water doesn't matter, or as an emergency technique when for some reason you can't heat the water, we don't see a real advantage to using cool sparge water. You have to heat the wort to a boil anyway, and hotter water will get you there more quickly.

HOT-SIDE AERATION (HSA)

Three of the most controversial words in homebrewing! Hot-side aeration is one of those things that originated in the commercial brewing world (for good reason) and got passed on to homebrewers. Twenty years ago, we were taught to carefully avoid aerating wort when it was above 85 °F (29 °C) to avoid accelerating oxidation and staling (i.e. wet cardboard, metallic, and, strangely, caramel flavors in your beer). The only time oxygen was supposedly not harmful was when the wort was chilled and ready for yeast. So homebrewers were careful to the point of paranoia. "Thou shall not splash the wort!"

But a funny thing happened — almost no one noticed an impact on their homebrew. Larger commercial brewers were, and still are, usually careful to avoid oxygen in the brewing process as much as possible, although there are notable exceptions. But at the homebrew level it just didn't seem to make a noticeable impact on the resulting beers.

Luminaries like Dr. Charlie Bamforth said that HSA was not a problem. Eventually he and Randy Mosher, among others, reached the conclusion that it could be a problem, but at the homebrew level it was unlikely to rear its head and there were far more important things to worry about. A Brülosophy Exbeeriment found no

Photo by Charles A. Parker/Images Plus

Hot-side aeration, in the authors' opinions, has minimal if any impact on the resulting beer. That said, it is easy enough to avoid that you shouldn't actively try to introduce oxygen into hot wort. Using tubing to transfer mash runoff into the kettle is easy enough and probably a good practice.

difference between beers that had minimal hot-side oxygen exposure and ones that had been heavily aerated on purpose.[3]

So, what's the takeaway here? Our point of view is that hot-side aeration is easy enough to avoid that you should try to not do it. That can be as simple as not pouring hot wort or using a piece of tubing when you collect mash runoff in the kettle. We all know that oxygen is the enemy of beer, so why not try to avoid it anywhere you can? But at the same time, don't freak out about it.

Side note — the new hotness is LoDO (low dissolved oxygen) brewing — which picks up a number of techniques from large commercial, particularly German, brewers. Proponents of the technique point to improved malt character amongst other flavor impacts. While there's nothing wrong about the techniques themselves, again at the homebrew level, we haven't found an advantage to employing these tactics for our preferred beer styles. But, like all things homebrewing, if you feel the urge to try it, go right ahead.

Remember, homebrewers have one big advantage over commercial brewers — we can keep our beer cold for its lifetime. Warm storage of beer speeds up staling. If you can keep things cold, you're gold.

FLY SPARGING VS. BATCH SPARGING EFFICIENCY

You will frequently hear people say that fly sparging yields better extraction efficiency than batch sparging. That's true . . . in a perfect world! We don't know about where you live, but this is not a perfect world we're brewing in.

If you had a perfectly designed fly sparging system, and you executed your sparge perfectly, you may achieve greater extraction by fly sparging. But those ifs are the problem. In reality, batch sparging will yield at least as high, if not higher, efficiency than fly sparging. When you batch sparge, variables like lauter tun design and sparge technique are removed from the process. In the real world, efficiency in excess of 80 to 85 percent is possible with batch sparging — pretty much the same as fly sparging. The decision of which to use should be based on your preferences and equipment choices, not efficiency concerns.

Commercial breweries and equipment manufacturers spend tons of time creating well-balanced and understood systems and even they get it wonky!

And besides, haven't we seen people go even farther these days? After all, what is brew-in-a-bag (BIAB) except a very flexible limited batch/no sparge setup? (See also all the new "all-in-one" electric homebrewing systems like Grainfather, Brewzilla, Foundry, and all of the other fun, shiny pieces of equipment that were just featured in the October 2021 issue of *BYO*.) Of all the practices adapted from commercial brewing, we think fly sparging, while fun, adds needless complication on our scale.

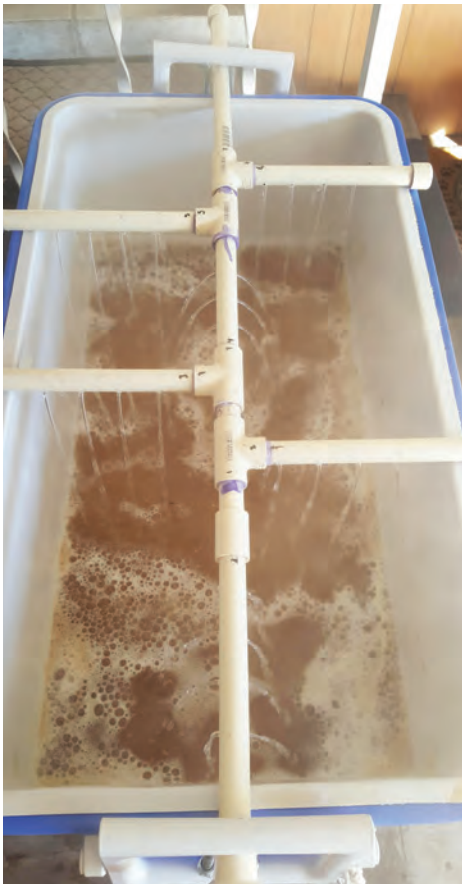

Photo by Ashton Lewis

Photo by Denny Conn

Fly sparging (left) and batch sparging (right) have been shown to have similar extraction efficiencies on the homebrew scale. Make the decision based on your preferences and equipment choices, not efficiency concerns.

OLIVE OIL IN PLACE OF AERATION

Homebrewers love a good shortcut and if it's cheaper, that's a bonus! In 2008, Grady Hull, the Assistant Brewmaster at New Belgium Brewing at the time, published a peer-reviewed paper titled "Olive Oil Addition to Yeast as an Alternative to Wort Aeration".[4] In a nutshell, the idea is that yeast cells use oxygen to synthesize ergosterols, which keep cell walls flexible and ease the budding process for yeast cell growth. The thinking with olive oil is that you "cut out the middleman." You add the oil, which the yeast cells can uptake to do the same thing and avoid the potential damage (for New Belgium) and expense (for homebrewers) of oxygen.

Homebrewers being homebrewers, they jumped on this technique as an easy, inexpensive alternative to aerating wort. Unfortunately, most missed what Grady was really doing: He was adding the oil to yeast in a yeast brink prior to pitching, not propagation in the fermenter. They also didn't account for the infinitesimally small amount of olive oil needed (the average dose was about 20 mg/L yeast). Most homebrewers who tried it reported things like "well, it didn't hurt." Neither does doing the Chicken Dance around your wort!

At Experimental Brewing, we decided to test the effectiveness of using olive oil in place of aeration (as this is what many homebrewers gobbed onto when the paper hit blogs and homebrew chat spaces). For our experiment, four different brewers each split a batch of beer using olive oil "aeration" on one half and doing no aeration at all on the other half. The idea was to see the most dramatic difference possible. If olive oil "aeration" worked, we should see a marked difference between that and doing absolutely no aeration at all. The four brewers arranged blind triangle tastings with a total of 47 tasters. The results? Most tasters found no difference whatsoever in beer flavor. The brewers reported no differences in fermentation performance. The takeaway was that using olive oil for aeration was equivalent to doing no aeration at all. You can see the results for yourself at www.experimentalbrew.com/experiments/olive-oil-vs-no-aeration.

Take our advice: Save your olive oil for salads!

To dig deeper, this makes sense — Grady had the yeast cells in long-term agitated contact with the oil addition in non-fermentation conditions. The yeast had plenty of time to uptake the sterols. In a batch of wort, the cells have barely any time to absorb the oil before fermentation kicks off. Oxygen, on the other hand, can be quickly assimilated by yeast.

FERMENTATION TEMPERATURE

When you buy a package of yeast or look at a yeast company's website, you see a list of recommended temperature ranges for each yeast strain. What a lot of homebrewers don't realize is that those are only broad

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Fermentis by Lesaffre

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Photo by Danny Clark

Beginning fermentation slightly under the yeast manufacturer's recommended temperature range and increasing the temperature after a couple of days has benefits. While sticking within the recommended range may be the safest way for new homebrewers to ferment, it's not the only way to ferment.

recommended guidelines, not hard-and-fast rules (and when we say broad, we mean broad). Manufacturers often recommend temperatures higher than those that experienced homebrewers prefer in an attempt to help newer brewers prevent bacterial contamination by ensuring rapid yeast growth.

Yeast fermentation temperature has a large impact on beer flavor. The warmer you ferment, generally, the more impact it has. Esters (aka fruity tones) tend to increase at warmer temperatures. If you get too warm, the dreaded fusel alcohols can become a problem.

Many experienced homebrewers prefer to begin fermentation at temperatures lower than manufacturer recommendations. (For instance, Drew almost always starts his ales, including saisons, at 63 °F (17 °C) for 1–2 days.) Most esters and fusels are formed during the first 72 to 96 hours of fermentation. After that, you can safely raise the temperature to make the yeast more active and ensure complete fermentation.

Another myth floating around is to always start fermentation of Belgian styles at higher than normal temperatures. While some Belgian breweries do that, it is far more common for them to follow the fermentation schedule previously described; starting cool and finishing warmer.

Our general recommendation would be to start your fermentation at, or a bit below, the lowest temperature recommended for the yeast. The exothermic reaction from fermentation will raise the temperature a bit, and after three or four days you can safely let the fermentation temperature rise. If you find you're not getting enough yeast character like that, then start a bit warmer the next time. Part of this comes down to what flavors you want the yeast to contribute to your finished beer.

Along the same lines, the conventional wisdom is that lagers take a long time, sometimes months, at a low fermentation temperature. But there's an old lager fermentation method, also used by commercial brewers, that has begun making itself known in the homebrew world—fast lagers. Using this method, you can have a lager in your glass in as little as two weeks after brewing it. Mike "Tasty" McDole was one of the first homebrewers to rediscover this method and begin talking about it. Since then, many of us have started using this method. The basic idea is to start your fermentation at 55 °F (13 °C). When the gravity drops 50 percent of the way to its expected terminal value, raise the temperature to 58 °F (14 °C). When it gets 75% of the way there, raise the temperature to 62 °F (17 °C). And then when it reaches 90%, raise to 66 °F (19 °C) and hold until the beer reaches your expected final gravity. You can have your delicious lager in two weeks rather than two months!

Denny wrote in more detail about this technique in a January-February 2017 *BYO* story (available to digital members at https://byo.com/article/fast-lagers/), and we also went into

more depth in our book *Homebrew All-Stars* (shameless plug).

LIQUID VS. DRY YEAST

This is another thing that has changed a lot over the last 20 years, but for some reason the old saw persists that liquid yeast is always better than dry yeast. The "always" in there should be a red flag! Years back, production techniques for dry yeasts were less sophisticated than they are today, and packets might have been lifeless or contaminated by the time homebrewers purchased and used them. These days, we're happy to say things are much better, and there are some great dry yeasts out there. You can make your selection based on flavor, performance, and your preferred methods rather than simply whether the yeast is dry or liquid. In addition to the quality, dry yeasts will also save you money and they have the added benefit of better viability and shelf life compared to liquid strains — meaning you should always keep some on hand for when you need yeast in a pinch.

A couple of our favorite lager yeasts are dry (Fermentis SafLager W-34/70 and S-189). Our recommendation: Try a few dry strains and see what you think of them before coming to a judgment based on outdated information. We think you'll be pleasantly surprised.

So, there you have it: Our partial list of "homebrew myths." There are certainly more, and you may have run across a few yourself. But the most important thing to remember, as always, is to try things for yourself and make up your own mind. BYO

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Photo by Charles A. Parker/Images Plus

DOUBLING UP

Brewing two beers in the time of one

by James Roth

My entrance into the joys of homebrewing began at an office Christmas party in 1991, when a colleague brought two six-packs of his homebrew to the party. My first thought was, "Oh dear, I'm gonna have to try this slop and be polite." One taste and I said, "This has real flavor! How do you make this stuff?" His supplier, and my first, was an elderly gentleman who used one room of his house to sell beer supplies. My first beer was an old ale made from a kit that had 3 pounds (1.35 kg) of hopped liquid malt extract, a packet of dry yeast, and instructions to add 6 cups of corn sugar and water. I thought it was wonderful at the time, but my brewing has come a long way since that humble beginning.

Even as I've gotten more experience and my understanding and technique has improved, one thing that that hasn't increased is available time. That limitation was a motivator for me to develop a technique (or maybe it is more of a planned-out schedule) that allows me to brew two delicious beers in one session with little more time than it takes to brew one beer. Other significant benefits are that it has less impact on the environment and cuts many of the "chores" required in our hobby in half. I'm here to explain the process so others who find time constraints hindering their supply of homebrew can follow suit.

My process takes a little over two hours and yields two 5-gallon (19-L) batches of different style beers from liquid and/or dried malt extract and steeping grains. This time estimate does not include the time it takes to set up the equipment beforehand or chill the wort and pitch the yeast, nor clean and put away the equipment afterwards. How long these activities take depends on your equipment, how you chill the wort, etc. I can say, based on my own experience with single-batch

Photo by James Roth

The two kettles on the larger front burners are for steeping grains for both recipes and the smaller back burners heat saucepans for boiling hops for both recipes.

brew days, that these activities take only about 10% more time for two batches than for one, whereas two batches on two separate brew days takes 100% more time — so there are significant time savings to be had there as well.

SO, HOW'S IT DONE?

My step-by-step process for a typical brew day goes like this:

1. Gather all the equipment and ingredients. I often do this the day before if it's convenient. This takes about the same amount of time whether I am brewing one beer or two. Most of the equipment is the same either way. I do have two 8.5-gallon (32-L) brew kettles and two propane burners in the garage, so it takes an extra two minutes to set up the second one. That and gathering ingredients for the second beer are really the only differences in time to set things up.

(Note: The propane burners and large brew pots are great to have but my technique can be adjusted for 3-gallon/11.5-L pots on the stove and doing a partial boil before topping off in the fermenter.)

2. Fill two 2- or 3-quart saucepans about half full of water to boil the hops in. Fill two larger pots with the amount of water the recipe calls for to steep the grains (assuming the recipes call for them). On most stoves, the saucepans fit on the small burners in the back and the larger pans on the front burners.

(Note: Boiling hops in water is somewhat controversial but it has knowledgeable advocates. It might be better for an all-grain beer to boil the hops with the wort, but I, like many others, have not found any difference in the results using extract and specialty grains.)

3. Turn on all of the burners. While the water is heating, weigh the hops and put them into hop bags. Also, weigh and grind the specialty grains and put them into grain bags. While doing this, monitor the heat in the pots for the grains and turn their burners off when the water gets to the heat the recipe calls for, around 150–170 °F (66–77 °C).

4. The water for the hops usually boils before the grain water gets to the right temperature. When it does, put the hop bags into the water and set a timer for 60 minutes (assuming the recipe calls for a 60-minute hop addition). When the water returns to a boil, set the cover ajar and reduce the heat so it doesn't boil over. You'll want a full rolling boil but not so strong that steam condensing from the cover drips onto the burner. That can be really difficult to scrub off. If the recipe calls for additional hop additions, add them to the water when you would normally add them to your wort.

(Note: You might consider doing what I do — increase the amount of hops by 10% and decrease the boil to 45 minutes to save a little electricity. Hop utilization charts indicate that this yields about the same number of IBUs.).

5. When the water for the steeping grains is at the right temperature, remove the pots from the front burner and put the grain bags into the water. Set timers for the grains or watch the clock. I am usually still milling the grains for a while after I've started the hops. This works out well because the grains typically only take a 30-minute steep vs. the longer boil time for the hops, so no time is lost.

6. With the front burners now free, use one to boil a quart or two (1–2 L) of water. You will find the water gets low in the hop pots, so add boiling water from this pot as needed to keep the level up.

7. When the boil and steep are done, put a large strainer over each of the two brew kettles. Put the hop bags into the appropriate strainer and press all the liquid out of them with your brew spoon or paddle to be sure you collect all of the precious hop juice. Discard the spent hops.

8. Put the grain bags into the appropriate strainers and rinse the grains. Now you have liquid with the flavor and aroma you want from the hops and specialty grains in each kettle.

9. If you have large enough kettles, fill them with enough water to have 5 gallons (19 L) after you've added the extract. If you only have 3-gallon (11.5-L) brew pots adjust accordingly.

10. Heat the worts to around 195–200 °F (90–93 °C). Sanitize your fermenters while it heats. When the temperature is reached, turn the burners off, stir in the extract and any other ingredients, and let it sit for 15 minutes

to pasteurize.

Note: I have found that with 5 gallons (19 L) of wort, adding either liquid or dried malt extract lowers the temperature by 13–17 °F (7–9 °C). If the temperature is less than 180 °F (82 °C), heat it up to ≥180 °F/80 °C and hold for 15 minutes to essentially kill all spoilage organisms that may be present.

11. Chill, oxygenate the worts if pitching a liquid yeast, transfer to your fermenters, and pitch the yeast.

12. Clean and store your equipment. You will have two brew kettles, four stovetop pots, and maybe additional bowls, etc. you use to weigh the ingredients. This will take longer than with a single batch of beer, but you'll use the same chiller and can reuse some of the miscellaneous bowls, utensils, etc., so it's not twice the time.

Every brewing technique has pros and cons. This one definitely does. Here are some of them that I have experienced over two decades of using this method.

PROS

• **Time savings.** As I said before, the time from weighing hops and crushing grains through when the wort is ready to chill is about two hours. This is the same whether you're brewing one or two batches. This is because there is enough time while you're waiting for the water to heat on the stove and then in the brew pots to do the additional weighing, measuring, etc. for both batches.

• **Better for the environment.** Boiling hops in 1–1.5 quarts/liters of water uses less energy than boiling hops in three or six gallons (11.5 or 23 L) of thick wort. You can reduce the energy use a little more by adding 10% more hops and reducing the boil to 45 minutes.

• **Less chance of a boil over.** It is still possible to have one if you don't monitor the temperature of the wort you're heating to 195–200 °F (91–93 °C). But it's much easier to catch it between 195–212 °F (91–100 °C) than it is just when it hits boiling and the foam is rising rapidly in the brewpot.

• **Getting two batches of delicious beer from a single brew day.** No need to elaborate on this benefit.

• **The ability to keep multiple batches of beer in stock** so you can enjoy different brews that you crafted whenever you want. I always have about a dozen batches in stock so I can choose the beer I want to have with dinner and then a different pre-dinner beer. My current stock includes:

• American IPA (recipe on page 50)
• New England IPA
• Brown ale
• Robust porter
• Imperial stout (clone of Goose Island's Bourbon County Brand Stout, recipe from November 2015 *BYO*)
• Belgian dubbel (recipe on page 50)
• Belgian strong pale ale (clone of Duvel)
• Belgian quadruple (clone of Rochefort 10)
• Belgian quadruple (clone of Westvleteren 12)
• Lambic
• Flanders red ale
• Gose
• Hefeweizen

As you can see, there's really no limit to the styles you can brew with this technique.

CONS

• **More stressful brew day.** This is by far the biggest potential negative to my brewing method. During the boil you might be weighing or measuring various additions (e.g., additional hops, yeast nutrient, Irish moss), each of which has to be added at a certain time. It's easy to get the timing wrong or put an addition into the wrong kettle if you are not well organized.

Even after the boil, mistakes can be made. I once chilled a pale ale and forgot to replace the filled carboy with an empty carboy to chill the porter I was brewing at the same time. I got a quart or two of porter into the pale ale before I noticed. (It was actually quite tasty in its own way — you could almost say I created a new style.) Another time, I added the malt and yeast for a brown ale to the hops and specialty grains for a pale ale and vice versa. Both were drinkable but not at all what I wanted. Still, in 20+ years of brewing about 20 batches a year, almost always two batches at a time, that's not too much harm. The main downside is the stress involved.

There are a couple of things you can do to minimize the likelihood of getting things mixed up. I put the ingredients for each beer into its own box on separate counters and when I prepare ingredients to add to the boils I put those ingredients next to the respective recipes. And I note the time I start each boil on its recipe and add the times when I should add any other ingredient to the boil. Not drinking until the brew day is complete helps.

• **More equipment expense.** You'll need two brew pots. That's not much

Photo by James Roth

The wort in the brew kettles only needs to get hot enough to pasteurize the malt extract and other ingredient additions added after specialty grains and hops are already boiled on the stovetop.

BELGIAN DUBBEL

(5 gallons/19 L, extract with grains)
OG = 1.080 FG = 1.018
IBU = 30 SRM = 25 ABV = 8.3%

INGREDIENTS

7.7 lbs. (3.5 kg) light dried malt extract
5.6 oz. (160 g) caramel malt (40 °L)
4 oz. (113 g) aromatic malt
8 oz. (227 g) Simpson's DRC malt
1 lb. (0.45 kg) D-180 candi syrup
10 AAU Sterling hops (45 min.) (1.3 oz./37 g at 7.5% alpha acids)
Wyeast 1214 (Belgian Abbey Yeast), White Labs WLP500 (Monastery Ale), or LalBrew Abbaye yeast
¾ cup corn sugar (if priming)

STEP BY STEP

Make a 1.8-quart (1.7-L) yeast starter prior to brew day if you're using liquid yeast.

Add hops to a muslin bag and boil hops in 2–3 quarts of water for 45 minutes. At the same time, heat 1 gallon (4 L) of water to 160 °F (71 °C), then steep the grains for 30 minutes at this temperature.

Put a large strainer over the brewpot. Pour the closed hop bag and hop water into the strainer. Press the bag with a paddle or spoon to get all the liquid from it. Remove the hop bag. Put the grain bag into the strainer. Rinse the grains with 1 gallon (4 L) of hot water. Add water to the level in your brewpot that will yield 5 gallons (19 L) after adding the dried malt extract and D-180 candi syrup. Heat to 195–200 °F (90–93 °C). Turn off the heat and stir in the malt extract and candi syrup. Wait 15 minutes to pasteurize the wort. Chill the wort to the lower end of the ideal temperature range for the yeast you choose.

Aerate or oxygenate the wort, if using a liquid yeast strain, and add the yeast. When fermentation is complete, keg or bottle as usual.

CITRA® IPA

(5 gallons/19 L, extract with grains)
OG = 1.069 FG = 1.016
IBU = 55 SRM = 10 ABV = 6.9%

INGREDIENTS

7.2 lbs. (3.3 kg) light dried malt extract
1 lb. (0.45 kg) caramel malt (40 °L)
12.9 AAU Simcoe® hops (45 min.) (1 oz./28 g at 12.9% alpha acids)
26.4 AAU Citra® hops (hopstand) (2 oz./56 g at 13.2% alpha acids)
4 oz. (113 g) Citra® hops (dry hop)
1 tsp. gypsum
2 tsp. calcium chloride
SafAle US-05, LalBrew Voss Kveik Ale, or any clean fermenting yeast

STEP BY STEP

Boil Simcoe® hops in a muslin bag in 2–3 quarts of water for 45 minutes. At the same time heat 1 gallon (4 L) of water to 160 °F (71 °C), then steep the caramel malt for 30 minutes.

Put a large strainer over the brewpot. Pour the closed hop bag and hop water into the strainer. Press the bag with a paddle or spoon to get all the liquid from it. Remove the hop bag. Put the grain bag into the strainer. Rinse the grains with 1 gallon (4 L) of hot water. Add water to the level in your brewpot that will yield 5 gallons (19 L) after adding the malt extract. Heat to 195–200 °F (90–93 °C) and add your salts. Turn off the heat and stir in the extract. Wait 15 minutes to pasteurize the wort, or longer if necessary to get the temperature down to 170–176 °F (77–80 °C). Add the bagged hopstand hops and hold for 90 minutes.

Remove the hops and chill the wort to the lower end of the ideal temperature range for your yeast. While the wort is chilling, put a strainer on top of the brewpot and put the hopstand hops bag into the strainer. Press the bag with a sanitized paddle or spoon to get all the liquid. Aerate or oxygenate the wort if using a liquid yeast, and then pitch the yeast.

When the fermentation is 80% to 90% complete, add the dry hops. After two or three days remove the dry hops. Put a strainer over the top of your carboy if it is a wide mouth. Otherwise, put the strainer over a sanitized saucepan. Press the hop bag with a sanitized paddle or spoon to get all the liquid out of it.

When fermentation is complete, keg or bottle as usual.

Photo by James Roth

After boiling your hop additions in water on the stovetop, drain them and add the hop water into your brew kettles.

expense if you're doing stovetop brewing with 3 gallons (11.5 L) of wort and top off water. It's more with larger brew pots and propane burners. You will definitely need two large carboys, buckets, or other fermentation vessels. And you'll need more bottles or kegs if you want to have a number of styles in stock.

• **Your beer may not be as fresh if you keep several styles in stock.** For most styles that's not a real problem, but hop-forward styles like pale ales and IPAs are definitely best fresh.

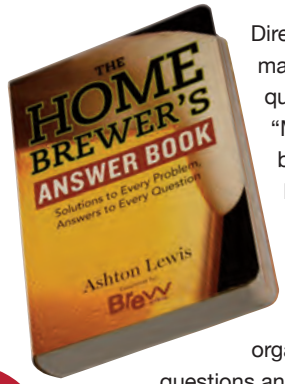
• **You will never fully master the science and art of brewing without going all-grain.** Depending on what you really want from your hobby this may or may not be an issue. I very much enjoy the extract brewing process and relative ease and time savings, but I understand that others would rather focus on all-grain brewing. It's a personal choice.

CONCLUSION

Brewing two batches a day is not for everyone. But if you want to minimize your time and impact on the environment, are organized and have the ability to multitask (and can also handle a little additional stress), it might be worth giving it a try. And if you'd like to have a number of styles in stock, it really helps to minimize the number of brew days you need to get there. BYO

GOT BREWING QUESTIONS?

The Homebrewer's Answer Book



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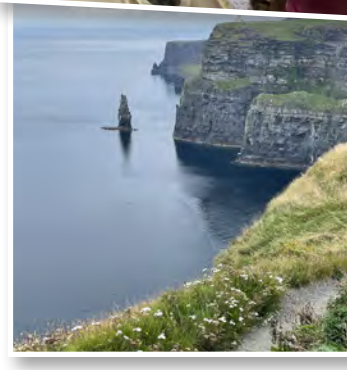
ERIN GO BREW!

BYO's Brewery & Hiking Tour Brings Readers to Ireland

Brew Your Own readers including Publisher Brad Ring recently spent a week exploring Ireland's breweries, distilleries, and scenic countryside. With visits to 14 breweries and distilleries, the group was lucky to experience the incredible beer and whiskey culture of Ireland first-hand during *BYO*'s Brewery, Distillery, and Hiking Adventure in late August. We visited an amazingly broad spectrum of breweries from the multi-media, multi-story Guinness Storehouse in Dublin to the family-owned 9 White Deer Brewery in County Cork run by longtime *BYO* subscriber Gordon Lucey who set up temporary tables in his brewery serving us a lunch of fish and chips brought over from the neighborhood pub paired along with their tasty craft beers produced a few feet from where we sat. All along the way we had the chance to experience that legendary Irish hospitality meeting with friendly local brewers from Ireland's growing craft beer community and ask plenty of questions while enjoying their beers and whiskeys.

Plus, each day we also took to the trails for scenic hikes to earn



those pints along seaside cliffs and through the beautiful and rugged Irish countryside.

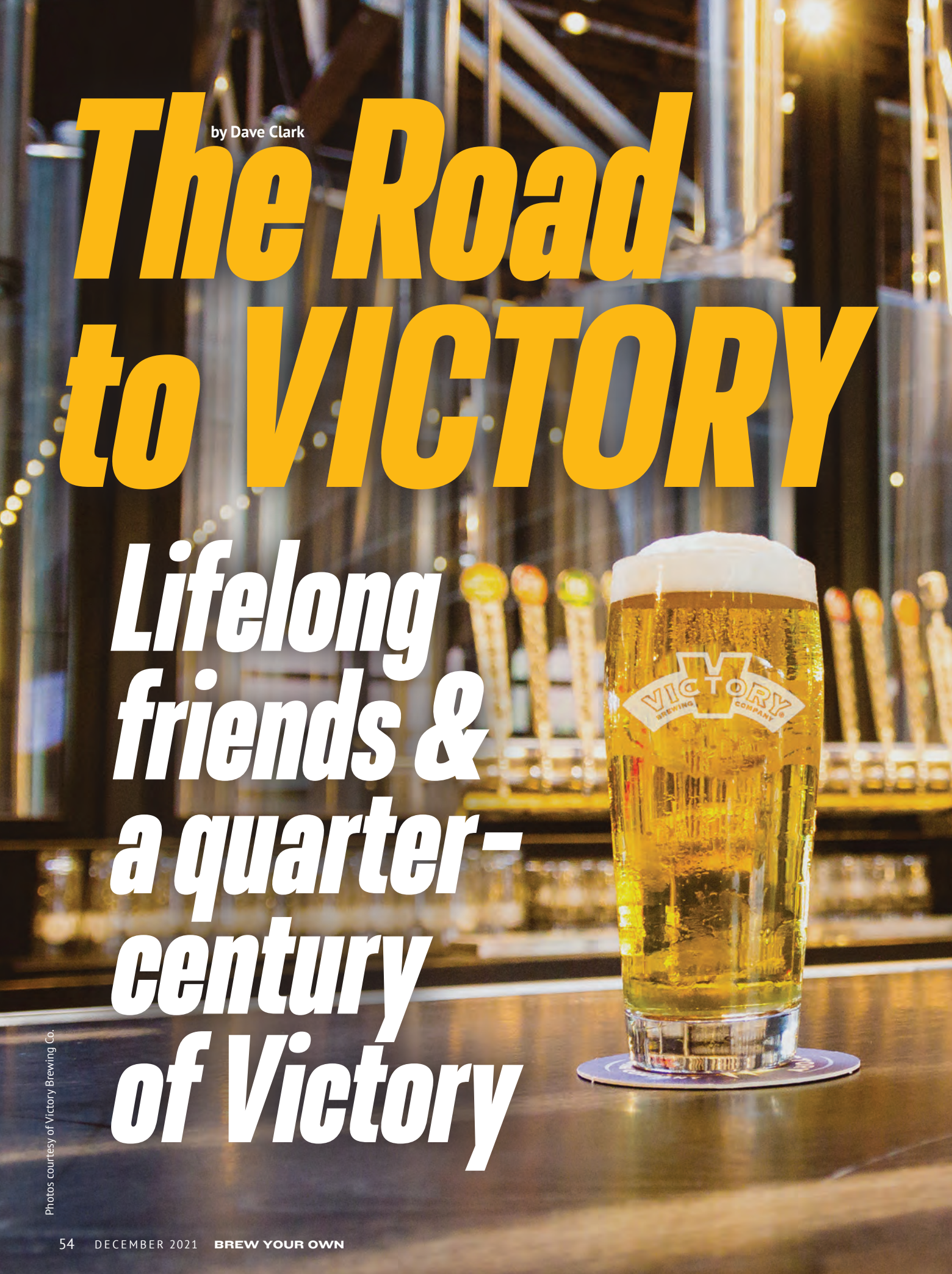
From dry stouts to Irish red ales, it was a special chance to enjoy classic beer styles at the source. Plus all that beer had plenty of great hearty Irish food paired alongside giving plenty of fuel for hiking to the next stop. It was a treat to have fresh beer samples right out of the fermenter at Galway Bay Brewing, try small-batch experimental beers from Guinness' pilot brewery in Dublin, enjoy an incredible assortment of styles at Metalman Brewing in Waterford, and sit down to a whiskey tasting of top-shelf offerings at Jameson. And it was a week made all the more special by sharing it with fellow homebrewers passionate about beer, whiskey, and exploring the incredible cities, countryside, and culture of Ireland.

We have two *BYO* trips planned for 2022 including a brewery and multi-sport adventure in Oregon July 17-21 and a Biking and Brewery Tour in the Wallonia region of Belgium September 9-15. Details on these two upcoming 2022 trips can be found at byo.com/trip. We hope you can join us on a future beer adventure. Sláinte!

by Dave Clark

The Road to VICTORY

Lifelong friends & a quarter-century of Victory



Photos courtesy of Victory Brewing Co.

Possessing common interests can be advantageous when it comes to going into business with someone, especially when the goal is to create a world-class craft brewery. In the case of Victory Brewing Company's co-owners Bill Covaleski and Ron Barchet, the similarities they share are uncanny, if sometimes also serendipitous.

The lifelong friends both studied brewing abroad in Germany, later honing their craft working for the same brewery. They each married their wives in September of 1992 and share the same title of Founder/Brewmaster. This series of commonalities goes all the way back to fifth grade, where the two friends took the same bus to their elementary school. You could say those bus rides, where the two struck up a friendship, are where the story of Victory Brewing Company began.

HUMBLE BEGINNINGS

Both kids came from families that enjoyed good beer, making it part of the family fabric. Ron's family had lived in Munich, Germany for three years, giving him an awareness of the culture and the language, while his parents became acclimated with the country's fine beers. Bill's father took up the hobby of homebrewing around the year 1979 as it became legalized during the Carter administration. His father immediately enlisted Bill as his unpaid assistant, giving Bill

Victory Founders Ron Barchet and Bill Covaleski around the time the lifelong friends began homebrewing together in the mid-1980s.

an early look and feel for the process of brewing.

Over the years the fascination with brewing persisted, and on one memorable Christmas, 1985 to be exact, Bill purchased an extract homebrew kit as a Christmas gift for his good friend Ron. The two agreed to brew together and their first joint effort turned out to be — no surprise here — a German beer style.

"We made a weissbier," recalls Ron. "The first attempt dumped all over the floor during a transfer, scalding hot. After that mishap, we pretty quickly decided to move off the kitchen stove to all-grain brewing, 'professional style.' Our unfortunate mistake may have inadvertently sped up our brewing learning curve."

A PLAN COMES TOGETHER

As is so common in the craft beer industry, the draw to beer and brewing came from dejection of other career options. Ron was working for the Defense Department near Washington D.C., less than inspired with his then current job and future prospects. Bill achieved a Bachelor of Fine Arts degree in 1985 and then began working as a graphic artist. Both single at the time, they could change career paths relatively easily toward something more fulfilling.

"Looking at the landscape at that time, I believed there was a market for this thing we'd later call 'craft beer,'" said Ron. "I had no idea how big that market would be, but I felt strongly that there would be opportunities to make a career in that field."

The two friends set out on a beer-centric overseas vacation in 1987 where they got to experience some of the world's finest brewing cultures first hand. Traveling to Belgium, then Germany, it was somewhere in Germany's Black Forest where the two finally began contemplating creating a brewery of their own.

THE INFLUENCE OF THEO

Taking action toward his ever-crystalizing goal a couple years later, Ron got a job as an apprentice working for legendary lager brewer Theo DeGroen, with the "still-in-planning" Baltimore Brewing Company (BBC). Not only would this provide extremely valuable real-world experience, it would also satisfy an apprenticeship requirement for the next step of his plan: Studying at world-renowned brewery Weihenstephan's Technical University of Munich in Germany, where some of the world's best future brewmasters are trained.

Working alongside DeGroen as the brewery was built and opened benefited Ron in many ways. Not only did he learn the nuances of producing world class lagers (in an otherwise nascent ale-dominated craft landscape), working through the process with BBC gave him the confidence to repeat the process on his own a few years later. Meanwhile, knowing Ron would be giving up his post at BBC for his German studies, Bill applied and became Ron's successor at BBC. Becoming Baltimore Brewing Company's second apprentice, Bill also gleaned valuable industry knowledge from DeGroen, where he stayed on for five years until he and Ron had their business plan fully completed in January 1995. During his stay at BBC, Bill also had the opportunity to study for a time at the Doemens Academy in Germany, a private school for brewers.

"I did the Doemens International Course in Brewing Technology in 1993," said Bill. "You had to be working in the beer industry at the time to get into this school. It brought people together from all over the globe. Phil Leinhart (who would later go on to become the Brewmaster at Brewery Ommegang for more than a dozen years) was my roommate."

In reflecting on the impact of working with a brewing legend such as DeGroen, the two future Victory owners reminisced about their fond memories and positive experience.

"I think that Theo entered our lives at the perfect moment in that we were hungry for the vast knowledge and opportunity he afforded us and he was pleased to have two guys younger than himself who were willing to work their butts off," said Bill. "All parties appreciated the arrangement!" Ron added: "My time with Theo was literally life changing. He gave me the chance to make a living doing something I really loved — brewing. He also stressed the importance of doing things correctly from the start. And last but not least, he opened a beer hall where I met my future wife and mother of my four children!"

WHAT'S IN A NAME?

Having both completed their German studies and returned working stateside (Bill back at Baltimore Brew-

ing and Ron at Old Dominion Brewing Company), the longtime friends ramped up their conversations about brewing for themselves. The pair made a commitment to write a business plan at a New Year's Eve party in 1993. Now both married for just over a year to incredibly supportive wives, the plan came together quickly and was completed in just under three months. With each wife holding down a career-type job, it allowed the husbands the time and financial stability to start the business. Incidentally, the site of the party was Bill's home, a home the two friends refurbished that would later become the collateral for the SBA loan needed to finance Victory Brewing Company.

Nowhere in that business plan was the name Victory Brewing Company. In fact, Independence Brewing was the company's first unofficial name. The inspiration behind the original name not only reflected nearby Philadelphia's Liberty Bell and its symbol of independence, but it was also about independence from the Reinheitsgebot, the German brewing law limiting brewing ingredients to water, grain, hops, and yeast. While wanting to honor and respect German brewing tradition, they did not want to be limited to strictly traditional ingredients.

"I wanted to bring German quality to America but to be 'liberated' from the Reinheitsgebot," said Bill. "I wanted 'brewing independence.'"

Before long, a cease and desist letter arrived from another group claiming to own the rights to the name. Feeling as if progress was stalling, and with money getting tighter and tensions rising, Bill recalls saying "this will be a real victory if we actually achieve our goal." At that moment, a new name was born.

VICTORY IS THEIRS

February 15, 1996 saw the opening of Victory Brewing Company. The celebratory honeymoon period didn't come without its fair share of challenges, however. A decision to self-distribute and sell on-site caused waves with local wholesalers. One wholesaler approached retail accounts encouraging them to not support the fledgling brewery. Their argument was that because Victory was selling its beer on site, the company should be considered a competitor. Despite the unforeseen challenge, Victory forged on undeterred — not to upset wholesalers, but simply believing it was the only way its nascent new brand would see the light of day.

"By taking the reins and making our success dependent on what we did, rather than being buried among a bunch of imports and contract breweries with a wholesaler, was one of our biggest keys to success," said Ron. "Today, we certainly consider our wholesalers to be our partners."

"We originally resisted wholesalers because they didn't know the value of our product at the time," said Bill. "We sensed that if we created our own story through festivals, self distribution, and other creative methods, we could eventually hand them something that had a market."

A market opened up, indeed, and the brewery continued to grow, expanding its footprint rather rapidly. Victory started to become a household name far beyond Pennsylvania, making its mark throughout a large portion of the United States. Currently, Victory distributes its beers in 32 states.

The brewery reached its zenith as the 26th largest American craft brewery in 2016, according to the Brewers Association. In 2020, Victory produced a high water mark of 154,000 barrels of beer, steadily reaching new highs year-after-year.

Now part of Artisanal Brewing Ventures, along with Southern Tier, Sixpoint, and Bold Rock Hard Cider, the partnership now ranks #8 on the Top 50 craft brewing companies based on sales volume and #17 of the Top 50 breweries, overall, according to the Brewers Association's annual report of 2020. (Read more about Artisanal Brewing Ventures in the sidebar on Page 60.)

FINDING A HOME IN DOWNINGTOWN, PENNSYLVANIA

Why Downingtown? With water being

In 2013 Victory opened a new brewhouse in Parkesburg, Pennsylvania that now produces the majority of their packaged beers distributed across 32 states.

PRIMA PILS:
A German classic with an American twist

Pilsner has been the "world's beer" since shortly after its creation in 1842 by German Brewmaster Josef Groll. Groll was contracted to brew "something new" for the people of the (now) Czech Republic. As the beer made its debut in the Czech city of Plzen, it was named after the town that inspired it. The beer's popularity exploded, spawning many variations and offshoots of the style, quickly leading to lagers becoming the most popular and most consumed beer style in the world.

Prima Pils gives a nod to both German and Czech brewing heritage, but with an American twist. The same four ingredients used to make any traditional German or Czech Pils can be found in Prima Pils: Water, Pilsner malt, hops, and yeast. The difference lies in the amount of hops used. In true American spirit, the co-brewmasters at Victory upped the ante and delivered a Pilsner brimming with hop flavor and aroma, checking in at almost 50 IBUs.

The first Prima Pils was brewed on January 19, 1996. All hops found in Prima Pils are sourced from Germany and the Czech Republic. Saaz, Mittelfrüh, Spalt, and Tettnang are the four "noble" hops employed, along with Spalt Select. At times, Hersbrucker is sometimes used, depending on inventory and brewer's discretion.

As a brewery grows over time, it begins to use different equipment and processes, each of which can have an impact on the beer's profiles.

"Different types of mills were used throughout the years," said Ron. "The boiling method went from high pressure steam jacketed kettle to low pressure steam external boilers. The size and design of the hopback was changed four times. With these step changes, efficiencies of extraction changed, so recipes needed to evolve in order to get the same results. For instance, our IBU efficiencies increased dramatically, requiring fewer hops to achieve the same IBUs/bbl. On the other hand, for late hopping and aroma, no efficiency gains were found. We use the same or more hops/bbl for the late hopping, which accounts for the vast majority of the hops in Prima Pils."

While subtle recipe changes are required to capture the preferred profile of a beer, the intent and philosophy of Prima Pils has always been the same.

"The recipe changes yearly to account for crop year aroma/flavor changes and intensities in the hops," said Ron. "Over the years we have not changed the aroma profile. In 2014, we did drop the IBUs from 55 to 50, followed in 2017 with another drop in IBUs to 45, where it currently stands as the target. The hops were shifted to the hopback, resulting in a more intensive aroma with 5 less IBUs. I believe this evolution has had a beneficial impact on drinkability."

At the end of the day, Prima Pils can be considered a late-hop addition lager.

"As you can see by the recipe, we do not add much at all as a bittering hop," said Ron. "Ninety-plus percent of the IBUs result from late additions of these aroma-type hops. For the *BYO* recipe, I used the Hersbrucker hop for this first addition. Homebrewers could easily substitute any of the other hops for that first small charge."

Close relationships with hop growers ensure Victory has access to the finest hops available.

"We source our Tettnang hops directly from Bentele Hopfen in Tettnang, grown by Robert Bentele, a third-generation hop grower," said Ron. "Those Tettnang hops make up a large plurality — if not majority — of the hops used in Prima Pils. We source our Spalt Select hops directly from Hopfen Kontor, a family farm in the Jura region of Hallertau. Interestingly, the majority of Spalt Select hops are grown in Hallertau, not Spalt. The Spalt Select supercharges the noble aroma notes."

The remainder of the hops used in Prima Pils are purchased from these growers or local brokers who allow the team to select their choice of hops during or immediately following harvest.

Any Pilsner consists of over 90 percent water. To brew a beer as pure as Prima Pils, having the best quality water is paramount. The fresh, brewing-ready water from the head-

waters of the Brandywine River is ideal for brewing a clean Pilsner. The East Branch of the Brandywine Creek feeds Victory's Downingtown brewery while the West Branch of the Brandywine Creek feeds its Parkesburg brewery.

"The water we use for brewing is super soft and not high in alkalinity, giving us a nice, blank slate with which to craft our beers," said Ron. "It's important to have softer water and lower alkalinity, especially for beers like Pilsners."

At 5.3% ABV and almost 50 IBUs, Prima Pils brings nuanced complexity together with smooth, easy drinkability. Despite the heavy handed use of hops that provide notes of floral, spice, citrus, and lemon, Prima Pils will never be confused for a hop bomb of a beer. The beer drinks crisp and easy; the ingredients working together in perfect harmony.

This year, Victory released a small batch of dry-hopped Prima Pils using Southern Hemisphere hops (Motueka™, Vic Secret™, and Galaxy™). The release was hugely successful, and this specialty version of Prima Pils may make a reappearance as a more broadly available seasonal release in 2022.

Even though Prima Pils never had the honor of being the brewery's flagship offering (that honor first went to HopDevil IPA and then transitioned to current flagship, Golden Monkey, in 2014), the beer is, nonetheless, adored by many. A silver medalist at the prestigious Great American Beer Festival in 2007 and Grand Champion of the United States Beer Tasting Championship in 2002–2005, 2013, 2014, and 2018, Prima Pils is an American craft classic, a favorite of craft beer fans and aficionados alike, as well as the favorite beer of both Victory founders, Ron and Bill.

the predominant ingredient in beer, having a great water source, as well as a location that could process large volumes of wastewater, was absolutely essential in considering where the brewery would be located.

Ron's brother-in-law worked in radio marketing and helped Bill and Ron study demographics of three major metropolitan areas: Harrisburg, Philadelphia, and Baltimore. With "microbrewed" beer being a very new (and unresearched) concept, the group instead focused on studying "import" beer consumption trends. They came to find that the west side of Philadelphia showed great promise when it came to import beer consumption. It just so happened that a western suburb, Downingtown, was filled with manufacturing facilities and was set on a nearby water source ideal for brewing.

The search led Bill and Ron to a defunct Pepperidge Farms facility, equipped with sloped floors and professional drainage, precisely what a brewery requires. Since the building was abandoned, the price was right and the pair were able to rent 23,000 square feet, eliminating a need to relocate as the brewery grew.

Between the East Branch and the main brewery primarily lies Amish and Mennonite farms, with no industry beyond agriculture, helping the water to remain extremely pure. Interestingly, along the river's path lies a township called West Nantmeal. "*Nant meal*" is a Welsh term meaning "sweet water." A bit of serendipity for a brewery that requires it.

"The very clean incoming water is a significant part of making quality beer," said Ron. "It's only a dozen or so miles from the headwaters of the Brandywine Creek. With little to no industry in between that and us."

IT'S ALL ABOUT THE BEER

A brewery can muster an impressive beer list over a 25-year period. HopDevil and DirtWolf lead the way for hopheads, driven by lifelike images (and singular names without spaces) that personify the beers. Prima Pils delivers the goods for lager traditionalists by honoring hundreds of years of brewing tradition while pushing it to the stylistic edge. Golden Monkey, the company's flagship and biggest selling beer, sets the standard for Belgian tripels brewed in the U.S.

Sought after and temporarily retired, Storm King imperial stout made its triumphant return in 2021. For years, a specialty pale ale named Headwaters paid tribute to the water that makes all of Victory's beers so enjoyable. Mad King's Weiss, St. Victorious Doppelbock, and Festbier all pay tribute to the owners' rever-

Victory's core lineup includes German lagers, Belgian ales, American IPAs, and everything in between.

ARTISANAL Brewing Ventures

The old brewery playbook went something like this: Open a brewery, develop a following, expand your brewery with new tanks and more space, and if all goes extremely well, open another brewery. Victory has followed this playbook to a certain degree while simultaneously writing a new, interesting chapter.

When Victory Brewing Company was founded in 1996, it preceded the impending brewery explosion. Sure, breweries were opening with regularity, but not in the rapid-fire fashion to come soon thereafter. According to the latest data of the Brewers Association, there were 8,764 breweries in existence in 2020, almost ninefold compared to what existed when Victory opened its doors. For those wishing to compete on a bigger stage outside the local state or region, reimagining the business has become necessary to continue to grow in today's market.

The brewery's original location is at 420 Acorn Lane, Downingtown, Pennsylvania. Like most breweries, Victory began to grow as its market grew, eventually necessitating a second (and later a third and fourth) location.

As popularity grew, a new facility that now produces the bulk of the company's packaged beers in Parkesburg, Pennsylvania was built in 2013. Further expansion took place with the emergence of the Kennett Square brewery and taproom (unfortunately, this facility is currently closed due to a fire that occurred in the building that houses this brewery). In October 2021, the newest Victory Brewery & Taproom opened in Philadelphia.

While expansion may be great for a beer brand, especially in developing a foothold in a home market, other creative options need to be in play to compete on a national level. Not only have mega conglomerate breweries such as AB InBev and MolsonCoors built up large craft beer portfolios by purchasing breweries, shelf space in the retail environment has continued to shrink with so many breweries competing for that space. Breweries that want to compete must become creative and maximize their strengths.

While some breweries have sold off to larger, well-funded brewing entities, others have found strategic alliances to be the key to success, including Victory. On February 16, 2016, Victory partnered with Southern Tier Brewing Company of Lakewood, New York, creating a new parent company called Artisanal Brewing Ventures (ABV). Sixpoint Brewing (Brooklyn, New York) and Bold Rock Hard Cider Company (Nellysford, Virginia) have since joined the venture to increase the efficiency and offerings of ABV in the marketplace.

"While seeking to retain our identity, the idea of creating our own platform of like-minded brewers on a scale and efficiency level struck us," said Bill. "This led us to private equity investors that shared our vision, who had already started vetting the model that would become Artisanal Brewing Ventures. We admired the delicious beers and success that Phin and Sara DeMink had built at their Southern Tier Brewing Co. and so we decided to join them, to form ABV."

Bill Covaleski and Ron Barchet are celebrating the 25th anniversary of Victory Brewing Co. in 2021, which has been aided by the collaboration through Artisanal Brewing Ventures.

The best part of the joint venture is that it allows each principal owner to remain involved in his/her original project and also have influence over the larger entity if they so choose.

"This model allows us to use capital and resources more efficiently, something that can be challenging as a solitary enterprise," said Bill. "Having procurement, finance, human resources, engineering, and more as shared services amongst the four entities is tremendously more productive. Because of this model, we are a larger, consolidated buyer and we can better compete with the scale of other conglomerates."

Besides the advantage of greater capital and buying power, the consolidation allows the best practices of each company to be extrapolated into the greater whole, as an "idea multiplier," of sorts.

"The legacy we've created in our brands is methodically being handed over to the next generation of leaders within our company as we are afforded a Board of Directors view and position to continue to guide the successful outcomes," said Bill. "It is working. I can assure you that the integrity of the partner brands is honored and respected while we solve evolving challenges of craft beer with a broader base of experience and empathy. But back to the scale aspect. At 26th in the U.S., Victory was more than a nuisance to the world's largest brewers and, therefore, we had to acknowledge their competitive focus aimed at harming our prospects. Artisanal Brewing Ventures, at 438,000 bbls. in 2020, up from 235,000 bbls. in 2016, is of a scale where it can survive and thrive."

The partnership with Bold Rock was key to expanding the portfolio beyond beer. And now, Victory has released its own line of craft hard seltzers known as Victory Waves that will ensure the company continues to appeal to the next generation of consumers.

While there are no current plans to expand the venture, the Victory brain trust won't rule it out.

"It can grow, with new partners, but will only do so in an intelligent manner that respects the synergies already created and gained," said Bill. "ABV is a proud step in our history to help preserve our independence in the face of incredible competition."

With over 25 years dedicated to creating a craft brewing icon and all the amazing good fortune that came along during that time, one might say that the success of ABV is yet another in a long line of victories for Ron Barchet and Bill Covaleski.

ence for their German brewing background. The list goes on, but let's dig a little deeper into a few of the fan favorites (and with which we are providing clone recipes straight from Victory on pages 63–67).

DIRTWOLF

Victory employs the use of whole cone hops, believing they provide the best flavor and aroma experience. As the market evolved and consumers craved hops like never before, the brew team developed a line of beers called *The Ranch Series,* which focused on single varietals of hops from specific hop growing ranches. DirtWolf was one of the later creations that came from this specialty line of beers, and became its first year-round bottled beer to be dry hopped.

A purposefully unbalanced beer to the hop side, DirtWolf retains some gravity at fermentation's end to help balance out the abundant hop character, but to a lesser extent than Victory's caramel malt-driven traditional IPA, HopDevil.

STORM KING

The former #1 ranked beer on RateBeer.com in the summer of 2003, Storm King imperial stout returned to the Victory lineup of beers in 2021 as a limited special release in honor of Victory's 25th anniversary following a brief four-year hiatus. This extremely dark, hop-forward, robust stout was seemingly ahead of its time.

While most imperial stouts are designed to showcase the malt first and foremost, Storm King was always about the hops. Storm King doesn't possess the body of a thick and viscous imperial stout, nor the traditionally subdued hop flavor and aroma.

Storm King won "Best of the Mid-Atlantic/Southeast region" at the United States Beer Tasting Championship in 2003, 2004, and 2005, but never received recognition from some of the larger national and international competitions — possibly because there wasn't a real home for it, stylistically.

"It's a hop-forward imperial stout, making it unique. It struggles

Victory has long been known for brewing classic styles with an American twist, often increasing the hop additions — as illustrated in the recipes for Prima Pils, Storm King, and Mad King's Weiss.

in contests because of that," said Ron. "When we entered the beer in competition in the past, there was no proper category for this beer that would now likely be considered by many to be a double black IPA. The hops make it an outlier for the style."

MAD KING'S WEISS

Bill and Ron's European vacation from 1987 was on display in the creation of Mad King's Weiss. Looking to traverse the bounds of a traditional hefeweizen, they created a beer that combined traditional German ingredients with Belgian characteristics.

Inspired by a local Philadelphia restaurant named *Ludwig's Garden*, Mad King's Weiss was built partly out of creativity and necessity. The restaurant wanted a beer contract brewed for them year-round, so Victory needed to employ a yeast that was always available. Mad King's Weiss was designed to be a bigger, fuller-bodied, hoppier version of a hefeweizen that is fermented with a Belgian yeast strain, the same strain that ferments the brewery's flagship beer, Golden Monkey.

At 35 IBUs, Mad King's Weiss is significantly hoppier than traditional hefeweizens that generally clock in somewhere between 12–15 IBUs. The Belgian yeast strain delivers the traditional banana character of a hefeweizen, but without the clove, providing a familiar yet unique experience. At 6.2% ABV, a slight alcohol warmth can be detected, uncharacteristic of traditional hefeweizens. All these brewer's interpretations may be considered "mad" by beer traditionalists, which led to the name that coincided with the famous German king, "mad" King Ludwig.

ST. VICTORIOUS DOPPELBOCK

One of the few doppelbocks in the beer world that doesn't end with the traditional "-ator" suffix, St. Victorious is a beer (and a character) created out of the owners' appreciation for European brewing tradition.

"Salvator Doppelbock was always one of our favorite versions of the doppelbock style," said Bill of the beer from Munich's Paulaner Brauerei. "We loved the Monastic style of brewing. In that spirit, we created our own character, and built a beer around this fictional 'Monastic saint.'"

The key to this beer was taking the characteristics of a traditional doppelbock and infusing a wildcard ingredient to add to the beer's complexity. In a nod to another famous brewing region of Germany, a slight smoked malt addition took the traditional doppelbock base to a whole new and exciting level.

"It comes back to our love of German-style beers," said Ron. "Instead of making a standard doppelbock, we made it like they might make it in Bamberg. The point was to create something different about it, even if the drinker wasn't sure what that was."

First brewed in 1996, Prima Pils is a classic American craft beer and still the favorite of Victory's founders.

PRIMA PILS

The favorite beer of both Victory Brewing co-founders, Prima Pils is a Great American Beer Festival (GABF) award-winning traditional German Pilsner that pushes the limits of hopping within the style. Inspired by a beer they brewed while at BBC, the two set out to create the cleanest, most authentic Pilsner possible while packing as much hop character as the style would permit. At 5.3% ABV and almost 50 IBUs, mission accomplished. (Read more about Prima Pils in the sidebar on page 58.)

VICTORY 2.0: THE NEXT GENERATION

While proud of all that has been accomplished over the past 25 years, the entire Victory Brewing team always has their focus set on the future. Preserving the company's legacy, while remaining relevant in an ever-changing craft beer landscape is a constant challenge. A key component to accomplishing both is through the creation of Artisanal Brewing Ventures (ABV), a joint venture between Victory and a few other like-minded companies. This joint venture has given each of these companies a much larger presence when it comes to purchasing power, capital, and distribution opportunities. In addition to having new partners in the brewing business, Victory has joined the rapidly growing segment of seltzers with their line called Victory Waves.

While keeping one foot steeped in tradition, Victory Brewing Company has an eye toward the next 25 years and beyond in order to continue to satisfy its biggest fans while meeting the constantly changing demand of new consumers that may or may not yet have discovered this west Philadelphia brewing icon.

Victory Brewing Co.'s DirtWolf Double IPA clone

(5 gallons/19 L, all-grain)
OG = 1.076 FG = 1.010
IBU = 75 SRM = 6 ABV = 8.7%

A spectacular double IPA that fuses all the exciting flavors of modern hops in a way that does not focus on any one particular aroma, but rather the symphony of tropical fruits, citrus, pine, and wood.

INGREDIENTS

12 lbs. (5.4 kg) North American Pilsner malt
6 oz. (170 g) Carahell® malt (10 °L)
2 oz. (57 g) acidulated malt
1.66 lbs. (750 g) dextrose sugar (5 min.)
3 g $CaSO_4$ (50 min.)
3 AAU Mosaic® hops (50 min.) (0.21 oz./6 g at 14.1% alpha acids)
2 AAU Citra® hops (15 min.) (0.14 oz./4 g at 14% alpha acids)
2 AAU Mosaic® hops (15 min.) (0.14 oz./4 g at 14.1% alpha acids)
6.9 AAU Citra® hops (10 min.) (0.49 oz./14 g at 14% alpha acids)
2 AAU Mosaic® hops (10 min.) (0.14 oz./4 g at 14.1% alpha acids)
2.9 AAU Simcoe® hops (5 min.) (0.21 oz./6 g at 13.7% alpha acids)
5.3 AAU Azacca® hops (5 min.) (0.46 oz./13 g at 11.6% alpha acids)
5.5 AAU Citra® hops (5 min.) (0.39 oz./11 g at 14% alpha acids)
3 AAU Mosaic® hops (5 min.) (0.21 oz./6 g at 14.1% alpha acids)
0.71 oz. (20 g) Citra® hops (hopback)
0.35 oz. (10 g) Simcoe® hops (hopback)
0.95 oz. (27 g) Chinook hops (hopback)
0.71 oz. (20 g) Simcoe® hops (dry hop)
1.4 oz. (40 g) Mosaic® hops (dry hop)
1 g Yeastex yeast nutrient (15 min.)
1 Whirlfloc tablet (15 min.)
Wyeast 1056 (American Ale), White Labs WLP001 (California Ale), or LalBrew BRY-97 (West Coast Ale) yeast
¾ cup corn sugar (if priming)

STEP BY STEP

Mash in at 122 °F (50 °C) employing a medium-thin mash. Hold at 122 °F (50 °C) for 10 minutes. Raise temperature to 149 °F (65 °C) and hold for 10 minutes. Raise temperature again to 158 °F (70 °C) and hold for 15 minutes. Raise to 170 °F (77 °C) for mash out.

Recirculate for 10 minutes, or until clear. Once the wort is running fairly clear, start wort collection. Begin sparging the grains when they are first exposed during runoff, collecting 6.5 gallons (25 L) of wort.

Boil for 90 minutes, adding ingredients at times indicated. If using whole flower hops, use a big enough bag to contain them while allowing proper circulation. Otherwise, use pellet hops, because it is imperative to have proper hop/wort contact time. When boil is complete, whirlpool and let set for 20 minutes. Chill to 61 °F (16 °C) and transfer to fermenter. Pitch a healthy, large amount of yeast and oxygenate thoroughly if using liquid yeast. Pitch at 61 °F (16 °C) and allow to ferment at 64 °F (18 °C). When beer falls below 1.030 SG, raise fermentation temperature to 68 °F (20 °C) to finish fermentation. Hold there until no diacetyl is detected, usually 1–2 days. Rack to remove yeast.

Cool to 50 °F (10 °C) and add dry hops. Hold at 50 °F (10 °C) for three days then remove or rack off. Cool the beer down to 32 °F (0 °C) over 3–4 days, then hold at or below 32 °F (0 °C) for a minimum of 1 week. Force carbonate to 2.5 v/v or add priming sugar to bottle ferment for carbonation.

Extract with grains version:
Replace the Pilsner and acidulated malts with 6.75 lbs. (3.1 kg) Pilsen dried malt extract and ½ tsp. 88% lactic acid. Heat 3 gallons (11 L) of water to about 155 °F (68 °C) and steep the caramel malt in a muslin bag for 15 minutes. Meanwhile, pre-boil then chill 3 gallons (11 L) of water to use later for topping up the fermenter. Once the steeping is complete, remove the bag, letting the liquid drain into the kettle.

Raise to near-boiling temperatures, remove pot from flame and stir in half of the malt extract. Return to flame and boil for 50 minutes, adding the hops according to the schedule in the ingredient list. Add the gypsum with the first hop addition, the Yeastex and Whirlfloc with 15 minutes remaining, and the remainder of the dried malt extract with 5 minutes left in the boil.

Follow the remainder of the all-grain recipe, topping the fermenter up to 5 gallons (19 L) after chilling with pre-boiled water.

TIPS FOR SUCCESS:

Dextrose is added late in this recipe simply to boost gravity while keeping the beer's color intact (as opposed to the Storm King recipe where it is added earlier to aid in additional color development).

The timing and temperature of the dry hopping step can greatly influence the dry hop character of the finished beer. To best replicate DirtWolf, dry hop at 50 °F (10 °C) for the right balance of pure dry hop grassiness (a little), the juicy tropical notes (a fair amount), and citrus (a fair amount).

Victory Brewing Co.'s Prima Pils clone

(5 gallons/19 L, all-grain)
OG = 1.047 FG = 1.006
IBU = 45 SRM = 3 ABV = 5.3%

Victory Brewing Co.'s award-winning, amped up German Pilsner with fresh noble hop aroma, bracing hop dryness, gentle malt character, and ultra clean fermentation.

INGREDIENTS

9 lbs. (4.1 kg) German Pilsner malt
4 oz. (113 g) acidulated malt
1.6 AAU Hallertau Mittelfrüh hops (60 min.) (0.5 oz./14 g at 3.1% alpha acids)
2.3 AAU Hallertau Mittelfrüh hops (15 min.) (0.75 oz./21 g at 3.1% alpha acids)
0.9 AAU Tettnang hops (5 min.) (0.25 oz./7 g at 3.6% alpha acids)
1 AAU Spalt hops (5 min.) (0.33 oz./11 g at 3% alpha acids)
1.25 AAU Spalt Select hops (5 min.) (0.25 oz./7 g at 5% alpha acids)
1.65 AAU Czech Saaz hops (5 min.) (0.66 oz./13 g at 2.5% alpha acids)
0.5 oz. (14 g) Hallertau Mittelfrüh whole hops (hopback)
1.6 oz. (45 g) Tettnang whole hops (hopback)
0.5 oz. (15 g) Spalt whole hops (hopback)
0.15 oz. (4 g) Spalt Select whole hops (hopback)
0.28 oz. (8 g) Czech Saaz whole hops (hopback)
1 Whirlfloc tablet (10 min.)
0.5 g Yeastex yeast nutrient (10 min.)
SafLager W-34/70, White Labs WLP830 (German Lager), or Wyeast 2124 (Bohemian Lager) yeast
⅞ cup corn sugar (if priming)

STEP BY STEP

Using a medium-thin mash, achieve a protein rest mash temperature of 122 °F (50 °C). Hold at 122 °F (50 °C) for 20 minutes. Raise to 149 °F (65 °C) and hold for 45 minutes for beta amylase conversion. Raise to 158 °F (70 °C) and hold for 15 minutes for additional alpha amylase conversion. Raise to 170 °F (77 °C) for mash out. Recirculate for 10 minutes. Once the wort is running fairly clear, begin wort collection.

Begin sparging the grains when they are first exposed during runoff. Using sparge water around 5.2 pH is ideal. Collect 6.5 gallons (25 L) of wort.

Boil for 90 minutes, adding ingredients at times indicated. A vigorous, rolling boil is critical to limiting dimethyl sulfide (DMS). If using whole flower hops, use a big enough bag to contain them while allowing proper circulation. Otherwise, use pellet hops to have proper hop/wort contact time to achieve the correct results.

Once boil is complete, whirlpool through your hopback (or add these hops directly to your kettle if you don't have a hopback or are using pellet hops), and let settle for 20 minutes. Chill as quickly as possible, then transfer to a sanitized fermenter. Once wort is at 52 °F (11 °C), pitch yeast and oxygenate thoroughly if using liquid yeast or repitching from a slurry. (Being a lager, it's best to pitch at least double the amount of yeast as you would for an ale. You can accomplish this by making a starter if using liquid yeast, or pitching two sachets.) Pitch at 52 °F (11 °C) and let the beer ferment for about two weeks. Allow to rise to 56 °F (13 °C) to finish fermenting. Hold the beer at 56 °F (13 °C) until no diacetyl is detected, usually 1–3 days. Remove yeast or rack beer off of it.

Slowly cool the beer down to 32 °F (0 °C) over 10–14 days, then hold at or below 32 °F (0 °C) for a minimum of one week, but a longer lagering period of a few weeks is even better. If you plan to fine or filter the beer, do so before packaging. Package with proper carbonation of 2.7 v/v or add priming sugar to bottle ferment for carbonation.

Extract only version:
Replace malts with 5.1 lbs. (2.3 kg) Pilsen dried malt extract and 1 tsp. 88% lactic acid. Heat 3 gallons (11 L) of clean brewing water to near-boiling temperatures, remove from flame and slowly stir in half of the malt extract. Return to flame and bring to boil. Boil for 60 minutes, adding the hops according to the specified schedule in the ingredient list. Add Whirlfloc and Yeastex with 10 minutes left in the boil, and the remainder of the malt extract with 5 minutes remaining.

Follow the remainder of the all-grain recipe, topping the fermenter up to 5 gallons (19 L) after chilling with pre-boiled water.

TIPS FOR SUCCESS:

The correct amount of clean, healthy yeast (coupled with good aeration if using liquid yeast) will result in a clean fermentation, which will allow all of the malt and hops goodness to shine.

High-quality hops in their freshest state will impart that beautiful bouquet. It is better to use fresh hops that are not on the ingredient list than to use older, less fresh hops that are.

Victory Brewing Co.'s Storm King Imperial Stout clone

(5 gallons/19 L, all-grain)
OG = 1.086 FG = 1.018
IBU = 100 SRM = 50 ABV = 9.1%

A Victory classic that came out of the brewmasters' love for rich malts and intense hops, the robust malt flavors are complemented and balanced with a huge charge of classic hop types. Storm King is a well-attenuated beer possessing a mouthfeel more reflective of a double IPA rather than a prototypical imperial stout.

INGREDIENTS

13.5 lbs. (6.1 kg) Pilsner malt
2.25 lbs. (1 kg) Vienna malt
3 oz. (86 g) Caramunich® malt (58 °L)
11 oz. (325 g) Carafa® Special III
11 oz. (325 g) black roasted barley
6 oz. (170 g) dextrose (60 min.)
6.5 AAU Centennial hops (60 min.)
(0.7 oz./20 g at 9.2% alpha acids)
4.9 AAU Centennial hops (30 min.)
(0.5 oz./15 g at 9.2% alpha acids)
6.4 AAU Cascade hops (30 min.)
(1.1 oz./30 g at 5.8% alpha acids)
6.5 AAU Centennial hops (15 min.)
(0.7 oz./20 g at 9.2% alpha acids)
6.4 AAU Cascade hops (15 min.)
(1.1 oz./30 g at 5.8% alpha acids)
7.2 AAU Chinook hops (15 min.)
(0.5 oz./15 g at 13.6% alpha acids)
6.4 AAU Cascade hops (5 min.)
(1.1 oz./30 g at 5.8% alpha acids)
9.3 AAU Cascade hops (hopback)
(1.6 oz./45 g at 5.8% alpha acids)
1 Whirlfloc tablet (15 min.)
1 g Yeastex yeast nutrient (15 min.)
Wyeast 1056 (American Ale), White Labs WLP001 (California Ale), or LalBrew BRY-97 (West Coast Ale) yeast
¾ cup corn sugar (if priming)

STEP BY STEP

Mash in all malts (except the unmalted roasted barley) at 122 °F (50 °C) with a medium thick mash. Raise to 149 °F (65 °C) and hold for 45 minutes. Raise temperature again to 158 °F (70 °C) and hold for 30 minutes. Raise temperature once more to 170 °F (77 °C) for mash out. Spread the roasted barley grist evenly over the top of the grain bed. Recirculate for 10 minutes, or until clear. Once the wort is running fairly clear, begin wort collection. Lauter slowly to avoid a stuck lauter bed. Begin sparging the grains when they are first exposed during runoff, collecting 6.5 gallons (25 L) of wort.

Boil for 90 minutes, adding ingredients at times indicated. If using whole flower hops, use a big enough bag to contain them while allowing proper circulation. Otherwise, use pellet hops, because it is imperative to have proper hop/wort contact time to achieve the correct results.

When the boil is complete, whirlpool and let set for 20 minutes. After whirlpool has settled, chill to 59 °F (15 °C) and transfer to the fermenter. Pitch a large, healthy amount of yeast and oxygenate thoroughly. As fermentation begins to slow, let rise to 60 °F (16 °C) to finish fermenting. Hold the beer at 60 °F (16 °C) until no diacetyl is detected, usually 1–2 days. Remove yeast or rack beer off yeast.

Cool the beer down to 32 °F (0 °C) over 3–4 days, then hold at or below 32 °F (0 °C) for a minimum of one week. Fine before packaging if desired. Carbonate to 2.55 v/v or add priming sugar to bottle ferment for carbonation.

Extract with grains version:
Replace Pilsner and Vienna malts with 7.3 lbs. (3.3 kg) Pilsen dried malt extract and 1.3 lbs. (0.6 kg) Goldpils® Vienna dried malt extract.

Heat 3 gallons (11 L) of water to about 155 °F (68 °C) and steep the caramel, Carafa®, and roasted barley in a muslin bag for 15 minutes. Once the steeping is complete, remove the bag, letting the liquid drain into your kettle. Raise to near-boiling temperatures, remove pot from flame and slowly stir in 4.3 lbs./2 kg of the Pilsen dried malt extract. Return to flame and bring to boil for 60 minutes, adding ingredients per the schedule and the remainder of the malt extract with 5 minutes left in boil.

Follow the remainder of the all-grain recipe, topping the fermenter up to 5 gallons (19 L) after chilling with pre-boiled water.

TIPS FOR SUCCESS:

The roasted barley and Carafa® (in the all-grain version) can make lautering difficult. Start slow and steady and only increase the rate of runoff midway through sparging.

The correct amount of clean, healthy yeast, good oxygenation (if using liquid yeast strain), and the cooler recommended fermentation temperature will result in a clean fermentation that will allow all of the malt and hop goodness to shine.

The mashing and fermentation should be intense, as one of the unique aspects of this recipe is it should yield a well-attenuated beer, with a mouthfeel more similar to a double IPA than the typical imperial stout. Mashing a little longer won't hurt, but not mashing long enough may be problematic.

Victory Brewing Co.'s Mad King's Weiss clone

(5 gallons/19 L, all-grain)
OG = 1.055 FG = 1.008
IBU =30 SRM = 4 ABV = 6.2%

Originally made decades ago for the former Ludwig's Garden Restaurant in Philadelphia, this beer continues to amaze with its balance of spice and esters. Hoppier and stronger than a typical Bavarian hefeweizen, yet more estery than a Belgian blond ale, the wheat malt plays well with the Belgian Trappist strain making it a favorite of many Victory Brewing fans.

INGREDIENTS

9.8 lbs. (4.5 kg) German Pilsner malt
1 lb. (0.45 kg) European wheat malt
5 oz. (142 g) acidulated malt
6 AAU Spalt Select hops (40 min.) (1.2 oz./34 g at 5% alpha acids)
3.3 AAU Spalt Select hops (30 min.) (0.66 oz./19 g at 5% alpha acids)
Wyeast 3787 (Belgian High Gravity), White Labs WLP570 (Belgian Golden Ale), or Mangrove Jack's M41 (Belgian Ale) yeast
¾ cup corn sugar (if priming)

STEP BY STEP

Mash in with a relatively thin mash at 144 °F (62 °C). Hold at this temperature for 15 minutes. Raise to 149 °F (65 °C) and hold for 50 minutes, then raise to 158 °F (70 °C) and hold for 30 minutes. Raise to 170 °F (77 °C) for mash out. Recirculate for 10 minutes or until clear and then begin collecting wort.

Sparge the grains when they are first exposed during runoff, preferably using sparge water acidified to 5.2 pH. Collect 6.5 gallons (25 L) of water to account for boil-off and boil for 90 minutes, adding the hops according to the specified schedule in the ingredient list. When boil is complete, whirlpool and let set for about 20 minutes. Chill to 63 °F (17 °C) and transfer to fermenter, pitching twice as much yeast as usual. Oxygenate light to normal if using a liquid yeast strain. Note: Less oxygenation may increase some of the yeast character. As fermentation slows, allow temperature to rise to 65 °F (18 °C) to finish fermenting. Hold the beer at 65 °F (18 °C) until no diacetyl and minimal sulfur is detected, usually 1–2 days. Remove yeast or rack beer off yeast.

Cool the beer down to 32 °F (0 °C) over 3–4 days and hold for a minimum of two days.

Carbonate to 2.6 v/v or add priming sugar to bottle ferment for carbonation.

(5 gallons/19 L, extract only)
OG = 1.055 FG = 1.008
IBU =30 SRM = 4 ABV = 6.2%

INGREDIENTS

5.1 lbs. (2.3 kg) Pilsen dried malt extract
1 lb. (0.45 kg) wheat dried malt extract
1 tsp. 88% lactic acid
6 AAU Spalt Select hops (40 min.) (1.2 oz./34 g at 5% alpha acids)
3.3 AAU Spalt Select hops (30 min.) (0.66 oz./19 g at 5% alpha acids)
Wyeast 3787 (Belgian High Gravity), White Labs WLP570 (Belgian Golden Ale), or Mangrove Jack's M41 (Belgian Ale) yeast
¾ cup corn sugar (if priming)

STEP BY STEP

Raise 3 gallons (11 L) of clean brewing water to near-boiling temperatures, remove pot from flame and slowly stir in 3 lbs. (1.35 kg) Pilsen dried malt extract (DME). Return to flame and bring to boil. Meanwhile, pre-boil then chill 3 gallons (11 L) of water to use later for topping up the fermenter.

Boil wort for 90 minutes, adding the hops according to the specified schedule in the ingredient list and lactic acid at the start of the boil. A vigorous, rolling boil is ideal, but watch closely to avoid a boilover. Add the remainder of the DME with 5 minutes left in the boil.

Upon completion of the boil, chill to 63 °F (17 °C) and transfer to fermenter, adding pre-boiled and chilled water to top up fermenter to a total volume of 5 gallons (19 L). Pitch twice as much yeast as usual. Aerate light to normal if using a liquid yeast strain. Note: Less oxygenation may increase some of the yeast character. As fermentation slows, allow temperature to rise to 65 °F (18 °C) to finish fermenting. Hold the beer at 65 °F (18 °C) until no diacetyl and minimal sulfur is detected, usually 1–2 days. Remove yeast or rack beer off yeast.

Cool the beer down to 32 °F (0 °C) over 3–4 days and hold for a minimum of two days.

Carbonate to 2.6 v/v or add priming sugar to bottle ferment for carbonation.

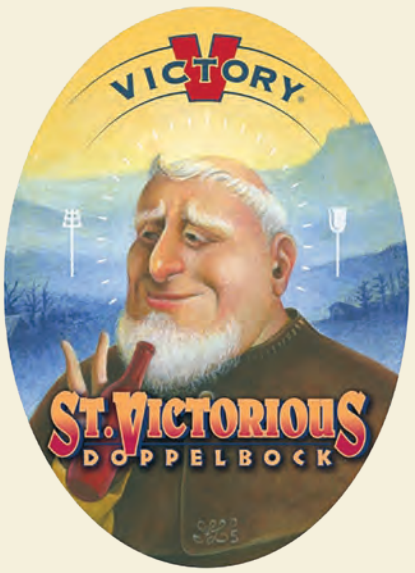
TIPS FOR SUCCESS:

Package within 3 weeks of brewing to accentuate the yeasty mouthfeel.

Experimenting with the oxygenation rates will result in slightly different aroma profiles. For more ester production, try limiting the oxygenation. For a cleaner aroma and finish, oxygenate more vigorously.

Another option is to experiment with a new strain of Belgian yeast that is POF- (phenolic off-flavor negative). The yeast strains listed in this recipe are all POF+. Omega's OYL-400 (Bananza) is one such strain that is a POF- weiss strain.

Victory Brewing Co.'s St. Victorious Doppelbock clone



(5 gallons/19 L, all-grain)
OG = 1.080 FG = 1.022
IBU = 27 SRM = 21 ABV = 7.6%

A strong lager featuring many malts to add complexity across the palate, St. Victorious Doppelbock takes it a step further by adding a small addition of Beechwood smoked malt, a nod to the Franconian region in and around Bamberg, Germany.

INGREDIENTS

9.5 lbs. (4.3 kg) German Pilsner malt
5.25 lbs. (2.4 kg) dark Munich malt (9 °L)
12 oz. (340 g) Caramunich® III malt (58 °L)
12 oz. (340 g) Weyermann Beechwood Smoked malt
8 oz. (227 g) Caraaroma® malt (150 °L)
2.5 oz. (70 g) Carafa® Special I malt
5.3 AAU Tettnang Mittelfrüh hops (60 min.) (1.33 oz./38 g at 4% alpha acids)
3 AAU Tettnang Mittelfrüh hops (15 min.) (0.75 oz./21 g at 4% alpha acids)
1 Whirlfloc tablet (15 min.)
1 g Yeastex yeast nutrient (15 min.)
SafLager W-34/70, White Labs WLP830 (German Lager), or Wyeast 2124 (Bohemian Lager) yeast
¾ cup corn sugar (if priming)

STEP BY STEP

Mash in at 122 °F (50 °C) using a thick mash. Immediately raise to 149 °F (65 °C) and hold for 10 minutes. Remove about a third of the mash using a colander to strain out most of the liquid. Raise this portion to 158 °F (70 °C), hold for 10 minutes, then raise to boil and boil for 15 minutes. Move the boiling mash to the main mash and stir, with the combined mash hitting a temperature of 158 °F (70 °C).

Decoct again, removing about 30% of the mash, and bring it to a boil for 5 minutes. Move the boiling mash to the main mash and stir, with the combined mash hitting a temperature of 170 °F (77 °C). Recirculate for 10 minutes, or until clear, and then begin wort collection.

Begin sparging the grains when they are first exposed during runoff, collecting 6.5 gallons (25 L) of wort to account for the longer boil. Boil for 90 minutes, adding the hops, Yeastex, and Whirlfloc according to the specified schedule in the ingredient list.

Chill to 52 °F (11 °C) and transfer to the fermenter. Pitch a large, healthy dose of yeast and oxygenate thoroughly if using a liquid yeast strain. Three packages of yeast in a starter or two packages started separately should give you the right amount of liquid yeast to effectively ferment this huge beer. If using dried yeast, pitch three sachets. As fermentation begins to slow, allow to rise to 58 °F (14 °C) to finish fermenting. Hold the beer at 58 °F (14 °C) until no diacetyl is detected, usually 2–4 days. Rack beer to remove yeast.

Cool the beer down to 32 °F (0 °C) over 7–10 days and hold for a minimum of four weeks. Force carbonate to 2.6 v/v or add priming sugar to bottle ferment.

Partial mash version:
Replace Pilsner malt with 5.2 lbs. (2.36 kg) Pilsen dried malt extract. This large lager will require a 3-step extract process. The main base malt will come from the dried malt extract, while the dark Munich and smoked malt will need to be mashed. The caramel and Carafa® malts will only need to be steeped.

Raise 3 gallons (11 L) of clean brewing water to achieve a mash temperature of 149 °F (65 °C) once you add the muslin bag containing the crushed Munich and smoked malts. Hold for at least 60 minutes. Meanwhile, pre-boil then chill 3 gallons (11 L) of water to use later for topping up the fermenter. During the last 15 minutes of the mash, add the muslin bag of steeping grains (containing the caramel and Carafa® malts). Once the mash/steeping is complete, remove the bags, letting the liquid drain into the kettle.

Raise to near-boiling temperatures, remove pot from flame and slowly stir in half of the malt extract. Return to flame and bring to boil for 60 minutes. Add ingredients at times indicated and the remainder of the malt extract with 5 minutes left in the boil.

Follow the remainder of the all-grain recipe, topping the fermenter up to 5 gallons (19 L) after chilling with pre-boiled water.

TIPS FOR SUCCESS:

The decoction mashing (in the all-grain version) can make lautering difficult. Start slow and steady and only increase the rate of runoff after you have begun sparging.

The decoction routine in this recipe took several iterations to hit the correct temperatures so use this as a guide knowing you may need to adjust to the peculiarities of your system. Decoction does increase the color, so if you cannot (or do not want to) use the described decoction method, increase one of the darker malts to achieve the same color.

As with all lagers, but particularly strong dextrinous doppelbocks, yeast quantity and quality is critical to determine the ultimate drinkability and quality of the beer.

It is practically impossible to over age this beer. As it ages, the flavors smooth, and the drinkability increases. Victory prefers a minimum tank time of two months but even better results can be achieved in 3–4 months. BYO

CONTINUAL IMPROVEMENTS

Making better beer through incremental recipe adjustments

by Stephen Stanley

Most brewers want to make better beer. Whether we define "better" as tastier beer, conformance to the Beer Judge Certification Program (BJCP) guidelines, or a more efficient brew day, we want to improve our processes and outcomes. My day job is helping people improve business and production processes where improving a process generally means increasing the quality or reducing the cost of the product.

My profession defines quality as conformance of a product to expectations. Mass-market American lagers conform to consumers' expectations very closely, the hallmark of a high-quality product. Many of the procedures I like to call "beer lore" are industrial solutions to produce beer more efficiently. That mass-market American lager is the beer that consumes the least resources, including ingredients, energy, labor, and time, in the production of what most Americans, thanks to efficient marketing, consider potable beer.

A process is what needs to be done to make something, a procedure is how a step is done. An example of a process step is "chill wort to pitch temperature." All brewers do this. Where I use a counterflow chiller and water, another brewer may use the "no-chill" process to save water. Moving my boil indoors using an induction cooktop rather than boiling outdoors on a propane burner is another example of using a different procedure to accomplish the same task. No-chill brewers changed their procedure to save resources, I changed mine for convenience: Here it always seemed the wind kicked up right about the time the hot break formed. My procedure change also saved resources: The electricity to power my cooktop comes from my rooftop solar panels and I no longer have to buy propane.

In 2009, Sir Dave Brailsford created Britain's first winning Tour de France team. To do this, he decided to focus on small improvements to the team's racing and support procedures such as painting shop floors white to easily detect dirt (which could undermine bike maintenance) or bringing team members' mattresses along to ensure a good night's sleep. In three years, the team won the Tour, then went on to win it three of the following four years.[1] The team's goal was to improve the outcomes of each of their procedures by just 1%; the outcome of all those tiny improvements was their Tour wins. Brailsford called this "marginal gains." We call it "continual improvement."

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Winning the Tour de France is easy to measure: The rider that finishes the race in the least amount of time is the winner, some rather Byzantine rules aside. Beer quality is not quite that cut-and-dried. Winning brewing competitions depends on intangibles — are the flavors what are expected for a style? Are there flaws? What is the overall impact of the beer? Is it a world-class example of the style? Does taking a sip make you want to take another? Is something missing? To define these factors, most competitions turn to the BJCP Style Guidelines.

Love them or hate them, the BJCP guidelines are a global standard for classifying beers. It was pretty cool seeing the BJCP guidelines used in Gdansk, Poland to signal drinkers what to expect from what is in their glass. But the style guide is not the only possible measure of your beer's quality. You may be brewing an experimental style not described in the style guide, or you may choose not to accept the style guide as a definition of your beer's quality. Neither approach is wrong. To excel at brewing you have to measure the beer's quality, and to measure quality you must calibrate the most important instrument in your brewer's toolbox — your palate.

Improvement is based on measurement and measurement requires calibrated instruments. Fortunately, the BJCP provides us an excellent calibration tool, the Checklist Scoresheet.[2] While most competitions use the "free-form" scoresheet, the Checklist Scoresheet breaks the score down into the important aspects for each scoring category, then helps provide a vocabulary to describe the aspects of beer flavor, appearance, mouthfeel, aroma, and overall impact. Figure 1, below, shows what this looks like in the section describing a beer's flavor.

The major aspects of the beer's flavors are listed down the left side along with a five-point (six if you count the box for absence) scale indicating the level perceived. A very malty English barleywine could score a 5 for "malt" while an American lager may score a 1, and both could be correct for their styles. This scale corresponds with the levels listed in the BJCP guidelines. For example, if a beer should have moderate to high hop flavor, any score of 3 to 5 would be acceptable. The scoresheet also provides detailed flavor descriptors for the major aspects of the category. You may want a "piney" and "citrusy" hop finish in an American pale ale, or you may want something completely off-the-wall if your beer is your own creation. Either way, the scoresheet provides you with a scale and a vocabulary for scoring your beer.

To further calibrate your palate, the style guidelines list reference beers for each style. You may use these reference beers to help calibrate your palate: Get one of the beers, understanding if it is not domestic you may be tasting a beer that has been in the supply chain for months. By tasting a beer you know to be an excellent example of the style, you can determine what is meant by moderate malt flavor, grainy with some dark fruit notes. Or, if you are not brewing to style, fill out the scoresheet as a prediction of what your brew will be. Then brew your beer.

I've spent a good deal of ink on calibrating your palate for a reason. For continual improvement purposes, treat every brew session as an experiment. To design an experiment, you must make a prediction of the outcome. To keep yourself honest, it pays to document your prediction and then refer to it once the experiment, in our case a beer, is done. As an example, I'll use a recreation experiment I have done, with the most recent recipe provided on page 71.

While in Houston, Texas with my wife, we stopped by a Mexican restaurant for dinner and a beer. I rolled the dice and asked for "something dark" and looked forward to being surprised. I had no idea what the beer was but I liked it, so I wrote down some notes:

- Dark, almost black, ruby highlights
- Table-strength
- Not roasty; chocolatey, dark chocolate with a hint of sweetness, corn
- No esters apparent
- Medium bitterness
- Limited hop nose; noble hop character

Back home in Colorado, I put a recipe together to replicate the beer based on those characteristics. I have brewed it five times since with minor modifications every time. On a subsequent trip to Houston we visited the same restaurant. This time I asked the bartender what it was. It turns out the beer was Saint Arnold's "Santo," which the brewery calls a dark Kölsch. My version was a bit stronger and I did it as a lager using Mexican lager yeast; otherwise, the results were very close.

The notes were a description of what I wanted to brew. A newly formulated recipe is a starting point. Start with an idea of what you want to produce and describe it. You may do so as I did, by taking notes, or you can use the Checklist

Figure 1: The "flavor" section of the BJCP Checklist Scoresheet

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FLAVOR			Malt	Hops	Esters	Other	Balance	20
# Aspect	⦸	L M H	☐ Grainy	☐ Citrusy	☐ 'Fruity'	☐ Brett.	☐ Malty	
Malt	☐	☐☐☐☐☐	☐ Caramel	☐ Earthy	☐ Apple/Pear	☐ Fruit	☐ Hoppy	
Hops	☐	☐☐☐☐☐	☐ Bready	☐ Floral	☐ Banana	☐ Lactic	☐ Even	
Esters	☐	☐☐☐☐☐	☐ Rich	☐ Grassy	☐ Berry	☐ Smoke		
Phenols	☐	☐☐☐☐☐	☐ Dark Fruit	☐ Herbal	☐ Citrus	☐ Spice		
Sweetness	☐	☐☐☐☐☐	☐ Toasty	☐ Piney	☐ Dried Fruit	☐ Vinous		
Bitterness	☐	☐☐☐☐☐	☐ Roasty	☐ Spicy	☐ Grape	☐ Wood		
Alcohol	☐	☐☐☐☐☐	☐ Burnt	☐ Woody	☐ Stone Fruit	☐ _____		
Acidity	☐	☐☐☐☐☐						
Harshness	☐	☐☐☐☐☐						
_____	☐	☐☐☐☐☐						
_____	☐	☐☐☐☐☐	Comments >					

☐ Flawed

MAMACITA'S DARK KÖLSCH

(5 gallons/19 L, all-grain)
OG = 1.050 FG = 1.014
IBU = 27 SRM = 21 ABV = 4.7%

An homage to St. Arnold Brewing's Santo, which was in the brewery's regular rotation from 2011 until they discontinued brewing it in 2021.

INGREDIENTS

4 lbs. (1.8 kg) American six-row malt
2.5 lbs. (1.1 kg) Munich dark malt (20 °L)
2.5 lbs. (1.1 kg) Munich light malt (10 °L)
1.5 lbs. (0.68 kg) flaked corn
3.5 oz. (100 g) Carafa® II (425 °L)
3 oz. (86 g) American chocolate malt (350 °L)
5 AAU Tettnanger hops (first wort hop) (1.1 oz./31 g at 4.5% alpha acids)
4.5 AAU Tettnanger hops (15 min.) (1 oz./28 g at 4.5% alpha acids)
SafAle K-97 or other Kölsch/German Ale yeast; SafLager 34/70 or other German lager yeast; or White Labs WLP 940 (Mexican Lager) yeast
¾ cup corn sugar (if priming)

STEP BY STEP

Mash in with 4.1 gallons (15.5 L) of water treated to moderate alkalinity at 152 °F (67 °C) and hold for 60 minutes if doing single-infusion mash. If doing a step mash, mash in at 144 °F (62 °C) for 30 minutes and then raise the temperature to 156 °F (69 °C) and rest an additional 30 minutes. Mash out at 170 °F (77 °C) for 10 minutes if desired. Recirculate the wort until clear, add first wort hops to the brew kettle and drain the first runnings into the kettle. Batch or fly sparge to collect 6.5 gallons (24.6 L) of wort, this should take approximately 4.1 gallons (15.5 L) of additional water.

Boil for 90 minutes, adding hops as indicated. Yeast nutrient and kettle finings may also be added, if desired.

Chill the wort to 2–3 °F (1–2 °C) below your yeast's lowest recommended fermentation temperature and pitch an adequate quantity of healthy yeast (1 packet of dry ale yeast, 2–3 packets of dry lager yeast, or a minimum of a 3-L/3-quart starter of liquid yeast plus adequate oxygen). Let the temperature rise to the desired fermentation temperature, hold until high kräusen or half of extract has been consumed, then let the temperature rise uncontrolled.

When fermentation is complete, the beer benefits from lagering appropriate to the yeast type, 2–4 weeks for ale, 4–6 weeks if a lager yeast was used. Spund, force carbonate, or bottle condition to 2.5 volumes.

Partial mash option:

Replace the six-row and both Munich malts with 3.75 lbs. (1.7 kg) of light or Pilsen dried malt extract and 1.5 lbs. (0.68 kg) light Munich malt.

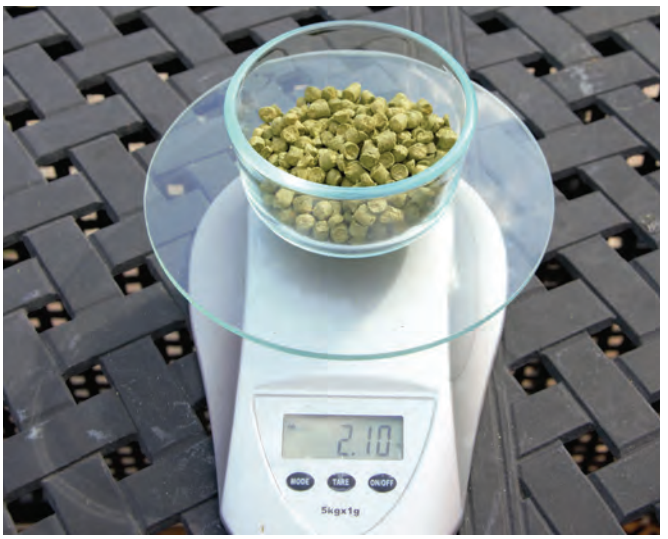
In order to convert the starch in the flaked corn, use about an equivalent (1.5 lbs./0.68 kg) of light Munich malt. Place both grains in a muslin bag and submerge in 5 quarts (4.8 L) of 164 °F (73 °C) water. The mash should stabilize around 152 °F (67 °C). Try to maintain this temperature for 45 minutes. In a separate small grain bag, add the crushed roasted malts. Steep those in the mash for the final 15 minutes. When one hour has passed, remove both bags, place them in a colander and slowly rinse them with 1 gallon (3.8 L) of hot water. Add water to make 3 gallons (11 L) of wort and stir in 2 lbs. (0.91 kg) of a light or Pilsen dried malt extract and the first wort hops.

Bring to a boil and boil for 60 minutes adding the second hop addition for the final 15 minutes along with a yeast nutrient and kettle fining if desired. With 10 minutes remaining, add the remaining 1.75 lbs. (0.8 kg) Munich dried malt extract. After the boil is complete, chill the wort, transfer to your fermenter and top off to 5 gallons (19 L). Follow the remainder of the all-grain recipe.

RECIPE NOTES:

The name for this beer came from enjoying a beer at Mamacita's restaurant in Pasadena, Texas that inspired this recipe. I didn't know what the beer I ordered was, but I was enchanted! I took notes on the flavors (chocolate, malt, breadiness, low to no hop character, some maize flavor, no esters, table strength) and, unfortunately, forgot to ask what the beer was on the way out.

Back in Denver I attempted to reproduce it. The first brew was close, at least to my notes. It was a clean, dark lager, good chocolate notes, perhaps a bit more intense than I intended. I was on the sixth iteration before we were back in Pasadena. It was then that I sat at the bar and chatted with the bartender, eventually figuring out that the beer in question was Santo, a dark Kölsch from Saint Arnold Brewing. This recipe is iteration #9 for me, and the first I've done with a German ale yeast. Previously I've used a Mexican lager strain. Both versions are quite delicious. The key to success is to manage the fermentation well using temperature control appropriate to your chosen strain of yeast and pitching plenty of it.



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Making one change at a time, recording exactly what it is (such as increasing the amount of hops added in a step), and then carefully evaluating the resulting impact it had on the recipe are keys to continual improvements.

Scoresheet. Then formulate your recipe and brew it.

Brew the beer exactly as you planned. No audibles, on-the-fly changes, nor substitutions. Follow the recipe and procedures as closely as you can using your standard brewing procedures. Once the beer is carbonated, taste and fill out another score sheet without referring to the first one, then compare your outcome to your prediction, answering the questions:

- Is the beer what you expected? If not, how does it deviate from your prediction?
- What could have caused the deviations?
- Is the beer good? Are there flaws?
- What could have caused the flaws?
- What could be improved?

Another approach is to have your "brain trust" taste the beer. Your brain trust could be your homebrew club or other beer aficionados. Asking them for honest feedback could identify potential areas of improvement. Our local homebrew shop puts on a "Homebrewer's Night" every two months. Putting your beer out there will result in feedback (the more honest that feedback is the more helpful). Another potential source of feedback is competitions. Judges are trained to find and write about one thing you can do to improve your beer.

Now that you have identified what could be improved, it's time to start improving.

MAKING IMPROVEMENTS

You now have a choice in how to approach improving your beer. You have hopefully documented what you originally intended and know how the beer deviates from your intent, including flaws. If your beer contains more than one flaw or you missed some major brewing parameter such as original gravity or attenuation, you may want to make major changes for your next brew of the beer, particularly if two factors are not related. Otherwise, if the beer is close to your prediction, the experimentation style most recommended in my field is called One Factor at a Time (OFAT) experimentation.

OFAT is the style of experimentation most often used by the Toyota Motor Company, the originators of the continual improvement process. Workers on the shop floor are encouraged to change things using a variation of the scientific method called "Plan-Do-Check-Act," most often abbreviated as PDCA. Employees change something about the procedure and then observe the result. If the change results in an improvement in efficiency or quality, the change becomes the new procedure. If not, the change is abandoned and something else is tried. Using this method, Toyota rose from being a laughingstock in the late 1950s and early 1960s to become the world's dominant automaker by the 1990s due to the compounding effect of these changes over time.

Here is where all the ink about calibrating the palate and documenting results pays off. After you have eliminated flaws and are hitting your numbers on brew day, start improving. Pick one of the factors on your score sheet and research what you need to do to change it. As an example, if your malt flavor is low, you may want to change base malt, yeast, fermentation temperature, or look at potential oxygen ingress. This is important enough to deserve all caps: DO NOT CHANGE MORE THAN ONE FACTOR! If you do, you will not know what worked.

It may be helpful when planning your changes to know what factors have the most effect on a beer's outcome. For that, I'd refer readers to my article "Brewing Priorities for Beginners" from the March-April 2021 issue. No amount of recipe adjustment will remove a harsh phenolic taste in your beer unless you are brewing a smoked beer; however, a Campden tablet might. Water chemistry is a low-order factor in beer's flavor but if you are brewing a light lager, it is an important one and a bit of chloride or sulfate may be just what your beer needs.

Make your change to ingredients or process and brew the beer. When it is finished, fill out a new score sheet and compare to both the previous brew and to your desired outcome. You may have gotten closer to your intention or you may be farther from it. If you are closer, great! You have improved your beer. If there is no change or if you are farther away from what you intended, you have learned something that does not work and you can revert to your previous recipe and process. Time to try another change. Using this method, which works best with more frequent brews of smaller batches, will allow you to zero in on the results you want.

Using the continual incremental approach, I've known brewers to progress from producing seriously flawed beers to winning large competitions in just a few years. Applying continual improvement practices to your own brewing will not win you the National Homebrew Competition overnight but it will, gradually, improve your beer. BYO

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BY DREW BEECHUM & DENNY CONN

PACKAGING BEER

Practical tips to minimize problems

You've devised a recipe that makes your mouth water when you just look at it. You've gathered the best ingredients you can source and prepped them to perfection. You've mashed, boiled, steeped, and hopped exactly as you had intended. You've fermented at exactly the right temperature for exactly the right amount of time. You're ready to finally try the beer you've worked so hard on and given so much thought and love to.

While you could just dipper out a cup of your mostly flat warmish brew and give it a swig — isn't that what you do with the hydrometer samples? — the best drinking experience comes after you've packaged your beer. Whether it's bottles, cans, or kegs, packaging is the final step in the brewing process and deserves as much love and attention as any other part of it. (We'll leave casks for another column.)

A WORD ON PACKAGES

Today's homebrewers have an embarrassment of riches when it comes to package choice. From the crown-capped and flip-topped bottles of yore to modern home-sized canning rigs, you might get baffled as to which way to go.

Our Package Thoughts:

- **Keg** — yes, they require startup capital to pay for a cold space, tanks, and kegs, but honestly if Drew had to bottle all of his beers he would have stopped brewing around batch #6 in 1999 . . . incidentally his first kegged batch.
- **PET plastic bottles** — when we send beer back and forth the easiest thing to use is brown PET beer bottles. We fill straight from our kegs and screw the caps on and go. Easy to use and hard to break.
- **Glass bottles** — your standard 12-oz. (355-mL) long neck beer bottle is ubiquitous because it only requires a tiny effort to use and they're cheap and replaceable . . . if breakable. If you don't have kegs, it would be hard to argue for a better thing to use. (If you don't want to bother with crown caps and don't mind the expense, invest in flip-top bottles. Just mind that your gaskets stay in good shape!)
- **Cans** — Drew loves cans and the ability to make his own gleaming metal beer cylinders. There are a number of options, but cans are by far and away the most finicky means of packaging. So many things can go wrong, but when you get them right, they sing. (For instance, cans are the most sensitive to bad packaging practices due to their broad, open surface.)

But regardless of what you choose to hold your beer there are a few rock solid practices we encourage:

- Everything must be clean and sanitary. It should go without saying, but if you don't keep things spic and span, you'll be having a bad day.
- Fight oxygen at every step. Oxygen is the enemy of every finished beer, especially beers with a ton of dry hops. Flush bottles, flush kegs, flush cans with CO_2 to remove as much oxygen as you can.
- Fill slowly with minimum of splashing and fill from the bottom. (Don't just stick a hose in at the top and let 'er rip.)
- If you're filling cans or bottles from a keg, keep everything cold during filling. Gases release less in cold liquid – and you'll get less mixing for O_2. (We're a little less worried when bottle conditioning as the yeast will help some with absorbed oxygen.)
- Once the beer is carbed keep it cold at all times. One of the greatest

Whether it's bottles, cans, or kegs, packaging is the final step in the brewing process and deserves as much love and attention as any other part of it.

Photo by Charles A. Parker/Images Plus

A bottling wand is a handy device to make sure brewers are filling from the bottom to minimize splashing and mixing with air.

homebrewer advantages is that we have the ability to keep our beer continuously cold. With meticulous low oxygen practices and cold storage, Drew has kept low-alcohol beers on tap nearly two years with minimal damage.

FIGURE OUT YOUR FIZZ

Whether you put your beer in bottles, kegs, or cans, your first task is to be sure it's properly carbonated. The basics of carbonation are the same — determine how much fizz you want captured in your brew, how much sugar (or CO_2 for forced carbonation) you need, and how to lock it into your beer.

How much fizz you want is going to be style- and taste-dependent. For brewers this is most commonly gauged as "how many volumes of CO_2 for this beer?" For example, traditional British pub ales would have relatively low carbonation levels: 1.5–2.0 volumes of CO_2. In contrast, a number of Belgian styles are renowned for their lively and spritzy natures, tending to have 3–3.5 volumes.

Taste-wise, lower carbonation levels tend to leave a beer with a richer mouthfeel and allow the malts to shine and push the hops to the background without feeling overwhelming. Higher carbonations cut the malt character and reduce the residual body while sharpening flavors like hops and spicy phenols. From our examples, that's why low-gravity session ales work well with low carbonation to seem fuller while big and spicy Belgians sing with high carbonation, helping to punch up the yeast character and reduce any apparent sweetness (even if it's just from esters). Many American craft ales shoot the gap and end up around 2.5–2.7 volumes of CO_2.

Once you've picked the level of carbonation you desire, we recommend using a priming calculator to figure out the needed amount of sugar or CO_2 required. (If you spund your beers for carbonation, the same numbers apply as those that are used for forced carbonation. But more on this later.) A good calculator will ask you about the temperature of your beer. Not written in the fine print of the calculator, this means the highest temperature your beer has reached during the late fermentation process.

Why? Beer produces CO_2 during fermentation. Not all of it goes flying out the airlock. Some of that CO_2 remains in the beer and you need to compensate for that amount when you carbonate your beer. Cold liquid retains more CO_2 than warmer liquid. When your beer warms up, CO_2 escapes from solution. So, the calculator is adjusting for what's left behind after your beer warms up and your yeast stops adding carbonation. This residual dissolved carbonation does effect fizz levels after packaging.

If you want to get advanced you can try taking advantage of your fermentation's generation of CO_2. It requires two things, a vessel capable of handling pressure (a keg or pressure-rated conical, for instance) and a special pressure relief, or "spunding," valve. Attaching a spunding valve to a fermenter allows you to maintain a level of CO_2 pressure in the vessel. If the beer generates CO_2 above that pressure, the valve releases it. Otherwise, the CO_2 is retained in your beer.

Brewers usually wait to attach the spunding valve until the ferment is almost done to avoid pressure-related fermentation issues. (Many yeasts will stall/stop fermentation if the pressure of the environment gets too high – hence the use of specific strains that are recommended for pressurized fermentation.) If you time it right, (generally 0.004 points above terminal gravity) by the time fermentation is finished your beer is carbed and ready to go. For the love of safety, don't try this in a glass carboy!

> **Remember: Oxygen Is The Enemy! Brewers have developed multiple means of dealing with it.**

ADDING SUGAR

This is pretty straightforward: If you're bottle conditioning, you'll need sugar and yeast. We recommend keeping your sugar source simple — plain old dextrose/sucrose/glucose (corn sugar) is readily available, easily consumed by yeast, and easily administered. Legends abound about dried malt extract priming creating "finer carbonation" and "better head," but we've never detected a difference in our experience with any alternate sugar sources. And we've never had any luck with carbonation drops. It's difficult to get exactly the carbonation level you expect.

In other words, keep it simple – use dextrose, boil with a little bit of water and gently add it to your beer in bulk. We don't recommend trying to prime individual bottles since it leads to uneven carbonation.

For homebrew, you rarely need to provide additional yeast since we usually have enough left in suspension. Drew never re-pitched his massive Belgian Champagne beers even after the finished beer sat for months and the yeast were about to be stressed by producing 3.5–4.5 volumes of carbonation! That said, if you do decide to add a packaging yeast, it will not hurt the beer and may only speed the process.

AVOIDING OXYGEN DAMAGE

Remember: Oxygen Is The Enemy! Brewers have developed multiple means of dealing with it.

The first rule to a fight is to avoid entangling with the enemy unless necessary. With the exception of bottle-conditioned beer, that means removing as much oxygen out of the package and filling mechanism as possible before packaging. With bottles and cans, you want a slow, low-pressure flow of CO_2 to discourage mixing. Gases will always mix, so even in an ideal world, a CO_2 blanket is closer to a myth than a truth. By going slow, say about at 3 psi, you'll help discourage the mix. It won't be perfect but it beats nothing.

With kegs, you can do even better by using a sanitizing

solution. Simply fill the keg with a liquid sanitizer like Star-San or Iodophor and fill it to brimming. Close the keg and push the liquid out with gas. The keg will fill with almost nothing but carbon dioxide. This works miles better than the old method: "Purge the keg and pull the pressure relief valve, repeating 3–7 times."

Some people use additives at packaging to help prevent oxidation. The two most commonly used are metabisulfite and ascorbic acid (vitamin C). If you go the sulfite route, we recommend potassium metabisulfite (K-meta or KMBS) over sodium metabisulfite so you don't increase the sodium load in the beer.

Both are pretty easy to use. Per 5 gallons (19 L) of beer, add 1 tsp. of ascorbic acid. Metabisulfite is pretty strong stuff so you need to measure more carefully: 0.3 g in 5 gallons (19 L) will give you about 10 ppm of sulfite, which is a good amount for beer (KMBS is highly dependent upon the pH). Campden tablets are KMBS and weigh 0.44 g each tablet for reference. Put either in your bottling bucket and rack the beer onto it, or gently stir it into the beer.

Disclaimer: Neither of us has actually tried either of these, but the science is sound and many homebrewers have used them. KMBS is almost universally used in the winemaking world to prevent oxidation of wines too. There are varying reports of efficacy and flavor impacts in beer. Try them if you're so inclined and decide for yourself.

We have used Brewtan B, a gallotannin compound used in the mash tun and kettle. It slows oxidation by binding with or removing compounds that are susceptible to oxidative damage. It's also easy to use and provides fairly inexpensive insurance!

ONE LAST POINT FROM YOUR LOCAL OCCUPATIONAL SAFETY REPRESENTATIVE

As in all other things, keep yourself safe and in good shape while packaging. You're potentially dealing with wet glass, gasses under pressure, and lots of physical activity. If you're filling with a counter-pressure system, wear safety glasses just in case. Again our usual caveat applies about drinking while doing anything related to brewing — don't or wait.

And take a lesson from Denny and save your back and knees! Make sure what you're doing keeps your body comfortable. Denny used to bottle on his floor, killing his knees, until he realized that it was just as valid to bottle while comfortably sitting.

Package and carbonate your beer properly and you'll get the maximum enjoyment out of the next pint. BYO

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BY GEOFF PARKINS

BETWEEN PITCH AND PINT

Advanced fermenter/dispenser automation

Most pro brewers (and a growing number of homebrewers) are using some sort of control panel to interact and control their brewstands. But many of these same brewers revert to fully manual measurement and simple thermostats once the wort has been handed off to the cellar. This article takes a look at what is possible with modern automation, between pitched yeast and a poured pint.

THE BASICS

Let's start by making sure we are all on the same page regarding what is and is not automation. Being able to walk up to a control panel and push a button to start a wort transfer is not automation, nor is a digital display of the temperature inside a fermenter. An automated system is one that can, for example, measure when the specific gravity of beer in a fermenter has fallen to 1.020, close a valve to stop chilled glycol from flowing through the fermenter's jacket, allowing the temperature of the beer to rise to 60 °F (16 °C) for a diacetyl rest for a lager. In the automated system, the gravity, temperature, and duration of the diacetyl rest are pre-determined and occur without intervention from the brewer.

The processor in an automation system interacts with a controller. The controller serves as the middleman between the processor and the various inputs and sensors in the system. On the output side, the controller can tell various bits of equipment in the system to turn on or off. Some systems that use a Programmable Logic Controller (PLC) have both the processor and the controller in the same part. PLCs are industrial-grade process control equipment and usually require extensive programming (and the debugging that goes with it!) in order to perform as intended. Larger regional breweries will probably use custom-developed PLC controls in their fermentation systems. Huge industrial breweries for AB InBev and MolsonCoors make use of PLC-based automation extensively. The high cost of a custom-programmed PLC system puts that option out of the reach of most small, startup breweries as well as homebrewers.

While we may not have the industrial-grade hardware found in a PLC, there are systems that are suitable for smaller breweries all the way down to the ubiquitous 5-gallon (19-L) homebrew batch scale. Two of the most common systems that are suitable for development of a fermenter/dispenser automation system are Raspberry Pi (RPi) systems and BruControl systems. Raspberry Pi is an open-source, System on a Chip (SoC) computer that uses the also open-source Linux operating system. Software packages like CraftBeer Pi and Raspberry Pints have been developed to provide the basic controller interface. BruControl is a Windows front-end application. Both systems interact with various microcontrollers and interface boards that are between the computer and the cellar. From a straight-up cost perspective, the cheapest path to automation is with an RPi processor, but brewers will need to learn some programming or pay someone to develop the automation routines called "steps." BruControl is a powerful, flexible system that can run both the brewery and the cellar, and it has an easy-to-learn native scripting language to handle the hands-off automation.

The automation and robotics world is exploding, and microcontrollers are the heart of the explosion. There is a dizzying array of choices for microcontrollers and the support equipment

In the automated system, the gravity, temperature, and duration of the diacetyl rest are pre-determined and occur without intervention from the brewer.

Photo courtesy of Wikimedia Commons

Arduino boards are cheap and popular microcontrollers that homebrewers can use to automate one or several processes in their brewery or cellar.

used for projects like brewing and cellaring beer. Elegoo, Adafruit, and SparkFun are good websites to start learning about automation capabilities as well as places to purchase the necessary equipment.

By far, the most common microcontrollers are the Arduino boards. Depending on the amount of Inputs and Outputs (I/O) required to build an automated cellaring system for your brewery, microcontrollers can range from $10–$37 (USD). Several microcontrollers can be connected to a single processor, which means that highly complex systems with several hundred I/O are feasible within a budget that is a small fraction of an equivalent PLC-based system.

By far the most challenging part of developing an automated cellaring system is the integration of the various bits and pieces of hardware, microcontrollers, valves, sensors, relays, circuit breakers, contactors, etc. that all have to work together and be compatible with each other in order to make a functional automation system. For the hobbyist trying to get control of a couple of repurposed refrigerators and a big keg freezer (keezer), there is a tremendous amount of information and expertise available on the internet. Most of it is from other hobbyists who have been willing to share what they learned. For a small-scale pro brewer, it might be more cost-effective to contract with either an experienced hobbyist or a commercial integrator. More information about what's involved with integration will be discussed later in this article.

Not as challenging, but still something that has to be thought through carefully, is the actual implementation of the system. Where will the touchscreen be mounted? Do I need one enclosure or three? Where will I route my sensor wiring? How do I get Wi-Fi into my all-metal walk-in cooler? Do I need to get a professional to punch holes in my fermenters and bright tanks? How will I clean the stuff that comes into contact with beer? There are those questions and a hundred others. Again, the automation threads on HomeBrewTalk.com and other online brewing forums are a terrific resource.

INPUTS

At its most basic level, inputs tell the processor what's going on in the system (i.e. your fermenter) and the processor tells the system what to do next via the outputs. The term used to describe the processor's inputs and outputs is I/O (it's "eye-oh," not "one-zero"). Generally speaking, inputs are sensors, and outputs are controls. Also generally speaking, there are three pricing tiers for the sensor and control hardware. The least expensive tier falls into the "caveat emptor" category. It's the least accurate, the least precise, and is built from the poorest quality materials. Alibaba and Amazon's Chinese suppliers often fall into this category. Up from there are sensors that are built from higher-quality materials and have a Mean Time Between Failure (MTBF) rating several times that of bottom-tier equipment. This second tier would be recommended for homebrewers with some budget flexibility, and any pro brewers who feel their time is better spent brewing than fixing stuff. The top tier is reserved for laboratory-grade equipment. It's the gold standard. Measuring equipment at this level can run in the tens of thousands of dollars, but it's as close to "Absolute Truth" as humans can manage. Lab-

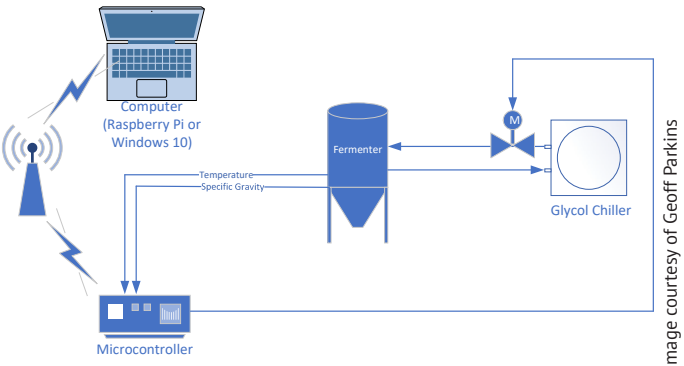


Image courtesy of Geoff Parkins

One basic automation many cellars have is a way to control fermentation temperature. This can be done remotely via Wi-Fi or Bluetooth connectivity.

grade stuff is beyond the scope of this article, and often not suitable for installation in a brewery.

Since the topic at hand is cellaring, the following list of inputs would be expected in an automated cellar:

Temperature: Includes ambient, individual fermenters and bright tanks, walk-in coolers, heat exchangers, kegerators and keezers, fermentation chambers, and glycol reservoirs. Understanding and controlling fermentation temperature is the most important part of cellaring. Temperature sensors are found in three main varieties: Resistance Temperature Detectors (RTD) measure the resistance across a thin piece of platinum wire whose resistance changes as the temperature rises or falls. PT-100 sensors are the most accurate of the commonly available probes. Thermocouples (TC) are the most common form of sensor, but are not as accurate as an RTD sensor. They measure the voltage change between dissimilar metals as temperature rises and falls. Thermocouples are the sensors shipped with most off-the-shelf thermostats. The final commonly available sensor is the 1-wire, where each sensor provides a digital signal that includes the measured temperature and an ID number unique to the sensor. While not as accurate as an RTD/PT-100 sensor, they are very useful, as their digital signal can be sent over a far greater distance than that of the analog signal of a PT-100 or thermocouple.

Specific Gravity (SG): The next most important measurement for a fermentation is the specific gravity of the beer in the fermenter. It's how we know that the yeast has done its job and it's time to keg. For homebrewers, the Tilt hydrometer is the most popular choice, but several other similar devices are available. The Tilt unit is a waterproof capsule that drops into the fermenter and reports temperature and specific gravity readings to any nearby Bluetooth device. Accuracy and precision are not laboratory-grade, but the convenience and ease of integration into an automated system have proven to be tough to beat. For small-scale professional brewers, an in-tank sensor with an external connection may be a better solution (though they should not take the place of a proper quality control program). But Tilt does now offer a larger unit for professional brewers as well as a repeater to allow use in larger stainless tanks. Bluetooth devices traditionally have a reduced range when inside stainless steel containers.

Pressure: Fermenting under pressure, or spunding, is an established technique in the professional brewing world and has been increasing in homebrewing spaces. Unitanks have

an undeniable appeal, but using this technique requires the ability to measure and control the pressure inside the vessel. While a spunding valve is all that is really needed, Atlas Scientific does market a sensor and interface board that is suitable for measuring pressure. Controlling pressure would be a function of the output side of the processor and will be discussed later in this article.

Flow and Weight: The dispensing side of the cellar has its own measurement requirements. Flowmeters, pressure sensors, and strain gauges are the input tools available to measure the volume of a liquid (beer) as it moves from fermenter to keg to glass. You can set up a system to measure how many pints you have poured from a fresh keg. In a small-scale brewery, it can alert taproom staff of an imminent keg change. You can gauge how much beer you have pumped into each keg.

Integrated Sensors: Some manufacturers are now selling multi-sensor units that use either a portable sensor unit that hooks into a dedicated sampling port, where the active fermentation vessel is connected to a magic box that pumps out a sample every couple of hours, analyzes it for several measurements, and reports the measurements to the system's processor; the other unit is a probe that stays immersed in the beer and reports the periodic measurements to the processor. These units measure temperature, specific gravity, dissolved oxygen, pH, color, clarity, and conductivity. While I mention these, some of them range in the tens of thousands of dollars.

OUTPUTS

Now that the processor has all of the information it needs to make decisions, its scripts and other programming tells the microcontroller what to have the cellar's equipment actually do. The actions are performed by outputs, which are, when boiled down to the basics, just switches. Some switches operate occasionally, while others operate hundreds of times per second. Our perception of automation depends on when each of these switches changes state or is turned on or off. Here are some examples of equipment that is controlled by an automation system's outputs:

Valves: Valves can control liquid flow, directing beer from a fermenter to a bright tank, from a bright tank to a keg filler, or from a reservoir of caustic cleaner into a keg washer. Valves can run off of DC power at 12 or 24 Volts, and AC power at 120, 208, or 240 VAC. Motor-operated valves are available in all NPT sizes commonly found in breweries. The combination of automated control of pumps and valves means a huge reduction in both labor and mistakes when transferring large volumes of liquid from one place to another in a brewery. It also means a lot less time is spent dragging hoses and pump carts from tank to tank.

Motors: Like valves, the use of relays and contactors means that pumps, from a basic homebrewer's Chugger pump to the largest pumps in a 50-BBL brewery, can be controlled with the cellar's automation system. It's just a matter of scaling the relays and contactors to handle the voltage and current. The control signals for everything in the brewery are low-voltage, low-current signals.

Alarms: One of the key outputs from an automation system are alarms. When a process or function strays from its defined parameters, it's up to the processor to let the operator know that something is amiss. Any automation system worth installing in a brewery should have an alarm capability that can trigger a horn/buzzer, a strobe light, or an email. Some even offer to send a text message if a number goes sideways. Alarms are particularly useful to notify brewers of a power failure or some other catastrophe that could result in the loss of an entire batch. At a far less destructive level, alarms can also notify the brewer that (for example) it is commencing a diacetyl rest process, that primary fermentation has completed, or that your last keg of Fat Cat IPA is about to blow.

INTEGRATION: THE 800-LB. GORILLA

System integration is where the happy dreams of a fully automated touchscreen control system with a sci-fi grade interface meet the rough pavement, skinned-knee reality of mismatched voltages, incompatible communications protocols, and voltage spikes from improperly managed electromagnetic interference (EMI). It's the part that requires knowledge and planning.

There are two tables that have to be defined at the start of the integration planning. The first is the overall power consumption of the system, and the second is an accurate count of the I/O needed for the system to be able to do what you want it to.

The power requirements are listed as the first priority because you can't have a workable system if breakers and fuses are tripping and blowing every time you try to ferment a batch. I/O is listed second because it's not exactly "automated" if you have to unplug one temperature sensor in order to free up an input port for a pH meter.

LOAD ANALYSIS

In order to understand how much power you need, you need to perform a load analysis. Every component in the system you are planning consumes electricity, and you need to figure out exactly how much electricity is being used in order to scale the power distribution components of the system so that adequate power is available to each component. Most people develop a spreadsheet that lists each component of the system, the voltage and current it requires, and the percentage of use it will see during normal operations.

High-voltage, high-current devices like glycol chiller compressors, heaters, and large pumps are the first to get added to the analysis, as they have the biggest impact on breaker size and the overall power consumption of the system. Every piece of equipment you evaluate will have a specification sheet available that lists the power consumption of the equipment. Compressors, pumps, and valves will provide specifics, but some sensors and signal-level components will not. Equipment with specified power consumption will need to be itemized in the load analysis, but signal-level components can be lumped into a group that is allocated an Ampere or two of capacity. In reality, those signal-level components only use a milliamp or two of current, so a 2A allocation should be adequate. Now is the time to make certain that every component has the power it needs.

Be careful with the current numbers you use in your load analysis. Compressors are a prime example of why. Some equipment that have a compressor may only list a recommended breaker value, like a residential refrigerator repurposed as a fermentation chamber. The installation manual may recommend connection to a 15A circuit, but the ID plate may state that starting current (Full Load Amps, or FLA) is only 12A, and running current is only 6A. ALWAYS use the FLA figure.

You should develop a list of the current requirements at each voltage in your system, and scale the power supplies accordingly. The glycol system may need 20A at 240VAC, but the bank of low-voltage relays may only need 8A at 24VDC. The motor-operated valves may need 3A at 12VDC. Whatever voltages and current the equipment needs should be reflected in the load analysis so that you know how to properly scale your power supply circuits and equipment.

I/O ANALYSIS

A second spreadsheet needs to be developed that lists every input and output that your system needs. This analysis needs to list whether the I/O is digital (e.g. a switch) or analog (e.g. a Hall-effect flow meter sensor), what its operating voltage is, and what type of signal it uses. An RTD will use low voltage to provide a reading in ohms, and a DC pump may use a 24VDC PWM (pulse-width modulation) digital output. All of this information needs to be laid out in advance of final equipment selection.

Once the power and I/O requirements are known, the controller and power supplies can be finalized. Once the power supplies are specified, the overcurrent protection requirements can be specified. Contactor and relay selections can be made after the power supplies and overcurrent protection choices have been made.

After the power-handling equipment has been specified, the next step is to define the communications protocols for each sensor. Some will use UART-based serial communications, some will use the I2C bus, and some will use Wi-Fi or Bluetooth connectivity. More advanced and pro-level PLC systems may use the Modbus communications protocol. Note that some of these communications protocols can be sensitive to EMI and need to have the cable connections shielded and routed away from any wiring that carries AC power. Other protocols may have a maximum cable length, which can affect decisions about where to place the equipment.

BILL OF MATERIALS

Once you have refined the load analysis and I/O analysis, the final step is to develop a preliminary Bill of Materials (BOM) that includes every component that will be utilized in the system. You should build a final spreadsheet that lists each component, its part number, source, cost, voltage, amperage, and a link to the specification sheet that shows its electrical connection diagram.

The end of this phase of the project should leave you with a clear understanding of every component in the system, how it is going to be connected, the parts that are needed to connect the component — both mechanically and electrically, and how those components will connect to the microcontroller and to the processor you have selected.

IMPLEMENTATION

Rubber, meet road. The implementation process begins with the development and careful review of an electrical schematic and connection diagram. All of the design ideas need to be put down on paper to define exactly what it is you need to do to have the system work. You cannot shortcut this process. Accurate schematics are critical for any kind of diagnostic effort later on. A professional electrician should be consulted to review your design. But there are some online resources available, including sample schematics and integration hardware available from BruControl.

Building the system will mean making lots of decisions, mostly involving mounting and placing equipment and sensors, running wires, building enclosures, and making connections. Don't hurry this process. The temptation to do a big push to finish everything up across a long weekend will lead to mistakes borne from haste. They are avoidable if you take your time and cross-check your work as you go. It can be helpful to enlist a buddy to come in for a review of your work. But if you feel even some hesitation, there is no shame in bringing in a professional to lend a hand during the build.

TESTING

The importance of testing cannot be overstated. It needs to be done methodically and carefully, with the primary focus on protecting the equipment you just bought from a catastrophic meltdown. I promise that you don't want to live with the empty wallet and burned equipment smell when you inadvertently apply 24VDC to a digital input on a microcontroller rated to run on 3.3VDC. Your best tool will be a written test checklist that describes each test, and the expected result.

In general, begin testing with a meter set to test continuity. Where there are connections that you expect to see line voltage on an AC circuit, check for continuity to ground. If there is continuity, you might have an issue when you plug it in. Next, check all of the low-voltage DC circuitry. Look for correct continuity for both positive and negative circuits.

When you connect AC power for the first time, open all of the circuit breakers and pull all of the fuses. Close breakers and insert fuses one at a time and look for the correct voltages at each test point.

Once all of the basic electrical testing is completed, it's OK to begin the mechanical testing. Make sure the valves open and close. Make sure the pumps turn on and off, and that they are pumping fluid in the expected direction. Check the functionality of each switch.

The last round of testing should involve batch-sized amounts of water or a simulated glycol reservoir. Make sure that your liquid connections do not leak, and that you don't accidentally pump glycol into a fermenter.

Also, the testing protocol needs to include a thorough exercise of the control interface of the automation system you have chosen. Any scripts that have been developed also need to be tested and debugged with water testing.

Once the final liquid tests are done (and ALL glitches have been resolved), your system is ready to go live! BYO

BY WAYNE HANNO

CO_2 CYLINDER STAND

Avoiding the tip-over

There always seems to be something that needs attention with my brew-making hobby that requires some creative action to solve a nagging issue. This time, it was my spare 5-lb. CO_2 cylinder that had a mind of its own wanting to get tipsy (but not from drinking too much homebrew). That double gauge pressure regulator with two product outlets, two gas line hoses each with a gas-in ball-lock fitting on the end and installed on the gas cylinder valve adds extra weight at the top of the cylinder. This makes it all too easy for the cylinder to tip over, especially when the tank contents start running on empty.

One of the concerns was a tip-over event when using the cylinder for purging activities. The first thing I do after filling a keg of homebrew and before placing it in the kegerator is to perform numerous CO_2 pressurize-and-vent cycles to rid the headspace of oxygen. This keeps the beer fresh while it chills and carbonates. Even when gently tugging on the gas line hose to connect it to the keg gas-in post, that tug will tend to tip the cylinder over. Careful attention is required to keep the cylinder in the upright position. This concern also applies when using my Tapcooler counter-pressure bottle filler to purge bottles prior to filling.

Another issue is storing of the cylinder when not in use. In my brewing storage area, I have many items nearby that could cause a tip-over when moving things around. So, I always worry that the cylinder will get accidently knocked over. These worries revolve around two potentially disastrous results: Either the valve breaking off and the cylinder becoming a projectile or the regulator breaking from a bad fall.

These concerns led me to do some internet searching to gather some ideas for a do-it-yourself (DIY) project that I could make to add some stability for my CO_2 cylinder. Efforts focused on finding a solution for my desired design constraints that included being light in weight, easy to construct, stable, portable, use readily available materials, and kept at a minimal cost. I found PVC to be the ultimate make-anything-toy-set, as you can pretty much make anything you can think of by just using some fittings and pipe.

Other considerations that factor into a satisfactory solution are taking advantage of tools and extra stuff that you might already have. Of course, like all DIY projects, there are countless ways to end up solving a particular issue that one may have. The final solution therefore features PVC materials and wood scraps that best satisfied my design constraints.

If you are somewhat handy, have the time, want to make something simple, and stop your cylinder and regulator from meeting a tragic ending, this solution is for you.

This makes it all too easy for the cylinder to tip over, especially when the tank contents start running on empty.

Photos by Wayne Hanno

Tools and Materials

- (4) ½-in. 90-degree PVC side outlet elbow
- (8) ½-in. 90-degree PVC tee
- (4) ½-in. schedule 40 PVC cap
- (5) ½-in. x 2 ft. (61 cm) 600-psi schedule 40 PVC white.
- PVC cement
- Doorjamb scrap (about 8-in. long x 4⅝-in. wide x ⅝-in. thick or 20 cm x 11.4 cm x 1.5 cm)
- 1x2 wood scraps
- Miter saw
- Wood glue
- Danish oil (natural oak)

STEP BY STEP

1. MATERIAL SELECTION

I decided to use half-inch PVC piping to keep the stand bulk and weight to a minimum, while still being rigid and sturdy. PVC side outlet elbows, PVC tees, and PVC caps are used to provide the necessary piping connections for the stand. PVC cement was used to provide a permanent structure. The critical material selection factor is to lay out the design to determine the overall length of PVC piping required.

2. DIMENSIONS

The first thing you need to do is determine the overall length of PVC pipe required. My general design focused on the stand height, length, and widths. Stand height is limited to the overall height of the CO_2 cylinder, while avoiding interference from the gas regulator, hoses, and fittings. With the stand height now determined, the stand base width and length were chosen to match the cylinder height as measured from the cylinder bottom to the threaded male connection on the gas cylinder valve, as this seemed to make the most sense to provide the desired stability while at the same time not being too excessive. Some factors to consider when measuring the desired piping lengths are to account for the maximum insertion depth of the pipe into the fitting as well as the fitting dimensions. These dimensions may be different for each PVC manufacturer.

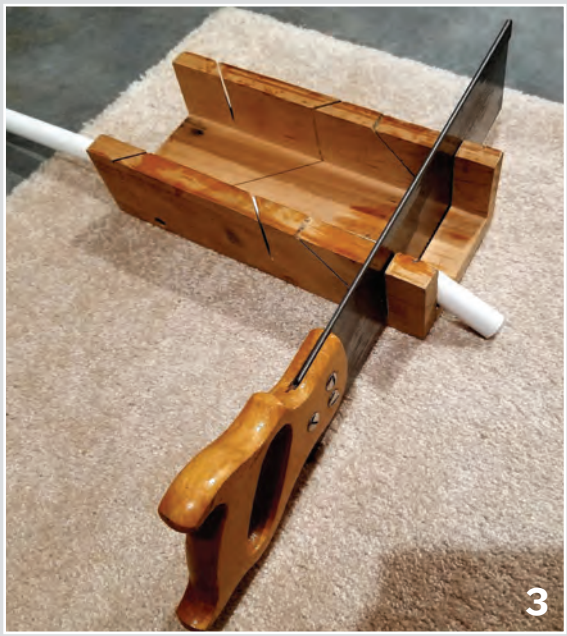
3. PVC CUTS

Before cutting the PVC piping, you may want to remove the ink markings for a clean finish. If this is desired, then wipe off the ink print with nail polish remover and an old rag. Another option would be to use furniture-grade PVC.

First, cut four 9.5-in. (24-cm) vertical pipes. Make sure that when the wooden base is installed, the top of the PVC fittings will not interfere with the gas hoses.

Then cut eight 4.75-in. (12-cm) pieces to be used to surround the cylinder in a square configuration, making sure the lengths are long enough so that the cylinder can be inserted and removed easily from the stand, yet short enough to keep the cylinder snug within the stand. Four 4.75-in. (12-cm) pieces will be installed at the top, and the other four pieces at the bottom. After installing the piping into the fittings, the square length and width inside measurements should be slightly larger than the cylinder diameter.

For the stand length and width extensions on the bottom portion, cut four 3.25-in. (8.3-cm) pieces (to be used with the pipe caps) and four 3.75-in. (9.5-cm) pieces. These lengths are not too critical, but should be enough to use most of the remaining PVC piping.



4. ASSEMBLY

Assemble the top square using the 90-degree side outlet elbows and four of the 4.75-in. (12-cm) pieces. Before gluing with PVC cement, make sure the cylinder will fit within the square. Attach the four vertical legs at the bottom of the side outlet elbows.

Next, assemble the stand bottom section using the remaining PVC piping pieces, eight tee fittings, and four PVC pipe caps. Check for overall fit-up before gluing with PVC cement. As an option, you may wish to make some of the extensions removable, if desired, for your particular application and usage.

Finish the assembly by joining the stand bottom section with the top vertical section. Once assembled, the overall length and width of the stand was a few inches longer than the stand height.


4

5. BASE

I always keep a pile of wood scraps around at the completion of any woodworking project. In my scrap pile, I found a small section of doorjamb and some 1x2 scraps to construct the base where the cylinder rests when in the stand. I cut the doorjamb to match the width of the stand (7.5 in./19 cm), and cut two 1x2 pieces to fit tight and snug between the PVC piping on the underside of the base. I sanded smooth with sandpaper and then stained the wood pieces with Danish Oil natural oak (another woodworking project leftover) to provide a neat and professional look. The 1-inch x 2-inch pieces were then glued and clamped to the base, and then installed in the stand after the glue dried. With the wood base installed, the total weight of the CO_2 stand was 3 lbs. (1.4 kg).


5

6. STEADY EDDIE

Finally, it is now time to insert the cylinder into the stand. A gentle tug on the gas line hose should reveal that the base stabilizes the cylinder to ensure it is no longer tipsy. For bottle-purging activities I can now place the stand on my countertop, which I find to be much more convenient and comfortable. Problem solved! BYO


6

BrewYour Own THE HOW-TO HOMEBREW BEER MAGAZINE '21 STORY INDEX

BrewYourOwn '21 RECIPE INDEX

Photo by Charles A. Parker/Images Plus

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BY JASON RICH

SNOW ALE

Beer brewed from snowmelt water

Every fall-time, similar to a squirrel building up their winter storage, I store up enough nuts to last the winter; except in my analogy the nuts are my homebrew. In October I start a fury of brewing strong, fortifying beers to get me through the winter — Belgian quads, smoked tripels, strong stouts, and my annual Christmas beer. I brew in my garage, and as winters in Indiana are unpredictable, I generally don't brew much from December through February. However, when the beer gods call, you'd better pick up the phone.

A January snowstorm last season provided us with over a foot (0.3+ m) of the pristine white stuff that winter lovers dream about. Kids' excitement over having school closed in the morning transitions to thoughts of going sledding and building snowmen. Meanwhile adults toil at shoveling, snow blowing, and other snow-related chores. Then there is me, a homebrewer, whose thoughts turn to brewing with it. My phone was ringing . . . the beer gods had called.

OK, so I do have a reverse osmosis water system, which is really pretty sweet. But why not make a beer with melted snow? There are several positives here. There is an unlimited supply after a big snowstorm like what just fell in my neighborhood. It's pure, well at least it looks that way. And finally, how could I pass up the opportunity of spending hours scraping up snow into kettle after kettle while my neighbors watch in confused amusement? This was one of the most entertaining aspects of the whole endeavor. Finally, after arriving back inside from all that work, you get to crack a quad or a stout (usually both) or something else hefty to warm you up! My adult hot cocoa.

Now, onto the negatives. First off, it turns out it takes a TON of snow to melt enough brewing water for a 5-gallon (19-L) batch. I repeatedly filled every pot and kettle I had, brought them indoors, and slowly watched them melt over days until I had enough water to brew with. It takes just over 8.3 lbs. (3.8 kg) of snow to create a gallon (3.8 L) of water . . . that is a lot of shovelfuls of snow.

But, as it's winter and I had plenty of time, I decided to just let the ambient room temperature in my house melt the snow. And, as pure as it looks, I wasn't prepared for the amount of dirt, leaf particles, bugs, and more dirt that is in "pure" snow. This required a coarse filtering while pouring into the main brew kettle. Still, I decided I would like to send a sample to Ward Labs, which revealed a pH of 6.7, calcium 2 ppm, sulfate <1 ppm, chloride 5 ppm, bicarbonate 5 ppm, and total alkalinity 4 ppm (among many other measurements that were also very low or negligible). A pretty good canvas to paint a beer with!

I had plenty of leftover ingredients from the autumn brewing frenzy; some light dried malt extract (DME), some amber DME, some crystal 90, and the malt I absolutely cannot live without, Special B. Some leftover hops and some dry American ale yeast, a pinch of this salt and a teaspoon of that salt, and several weeks later, ta-da! Turned out to be a delicious beer that met no style guidelines but was fun as all get-out to make. Snow Ale! (No, I'm not very creative at naming my beers . . .)

Did I need to endure the stares of the neighbor kids out doing "normal" winter activities like sledding and making a snowman? Did I really need to go through the effort of collecting and melting snow over several days to make this beer? Of course I did! I'd never made a beer with snow, which made it fun! And isn't that why we're homebrewers in the first place? BYO

Turned out to be a delicious beer that met no style guidelines but was fun as all get-out to make.

Photo by Jason Rich

The author found out it takes a lot of snow to melt down enough water for a brew session.

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