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Brew Your Own

THE HOW-TO HOMEBREW BEER MAGAZINE

JANUARY-FEBRUARY 2019, VOL.25, NO.1

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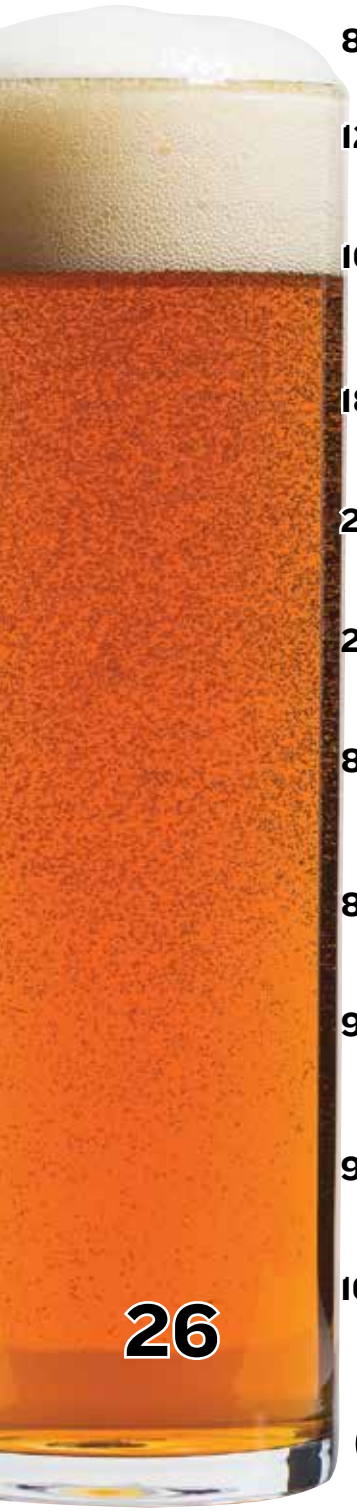


departments

where to find it

RECIPE INDEX

RECIPE STANDARDIZATION

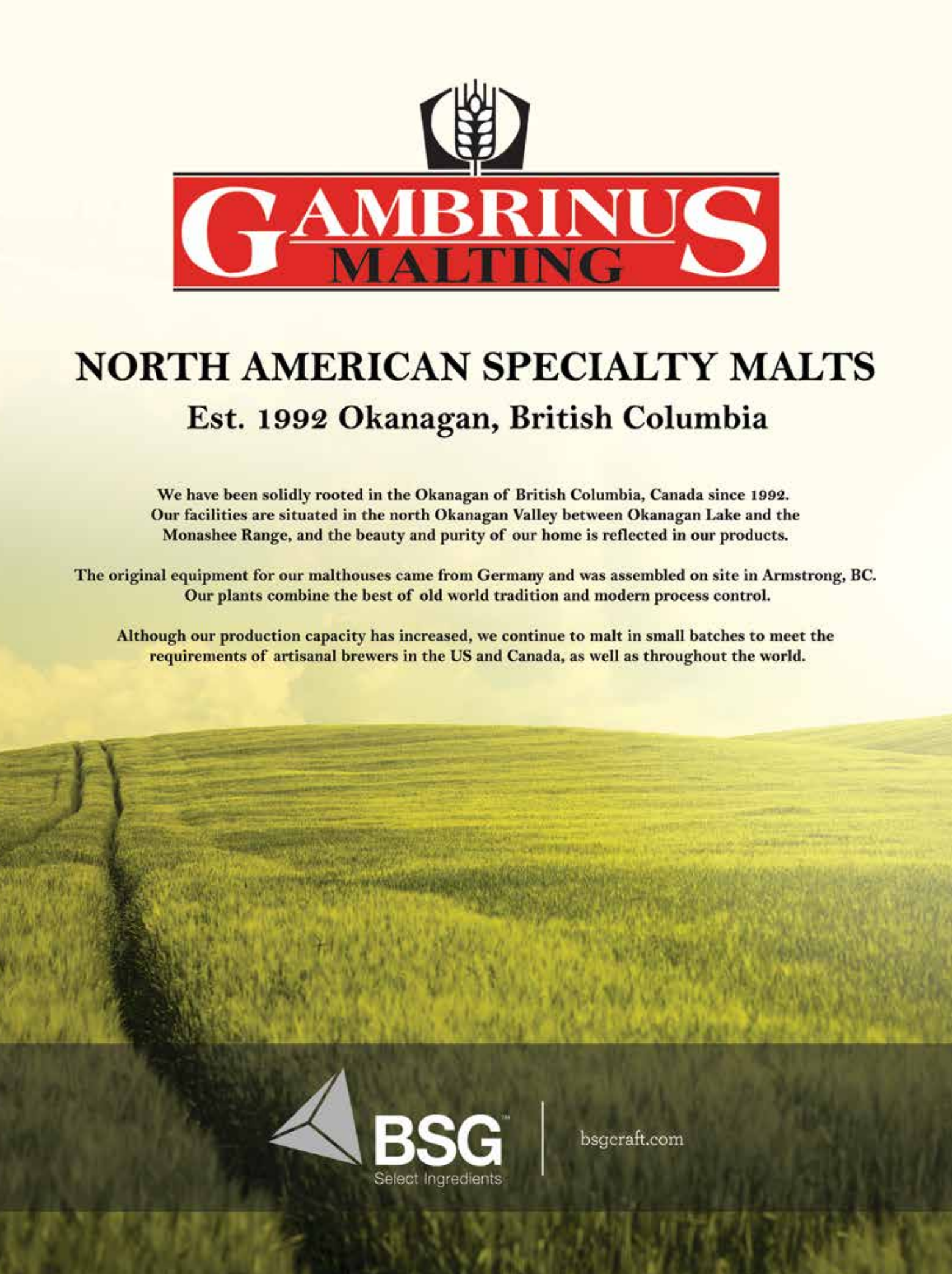
EXTRACT EFFICIENCY: 65%
(i.e. — 1 pound of 2-row malt, which has a potential extract value of 1.037 in one US gallon of water, would yield a wort of 1.024.)

EXTRACT VALUES FOR MALT EXTRACT:
liquid malt extract (LME) = 1.033–1.037
dried malt extract (DME) = 1.045

POTENTIAL EXTRACT FOR GRAINS:
2-row base malts = 1.037–1.038
wheat malt = 1.037
6-row base malts = 1.035
Munich malt = 1.035
Vienna malt = 1.035
crystal malts = 1.033–1.035
chocolate malts = 1.034
dark roasted grains = 1.024–1.026
flaked maize and rice = 1.037–1.038

HOPS:
We calculate IBUs based on 25% hop utilization for a one-hour boil of hop pellets at specific gravities less than 1.050. For post-boil hop stands, we calculate IBUs based on 10% hop utilization for 30-minute hop stands at specific gravities less than 1.050. Increase hop dosage 10% if using whole leaf hops.

Gallons:
We use US gallons whenever gallons are mentioned.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Cover Photo Illustration:
Charles A. Parker/Images Plus

Q

What hop variety do you feel doesn't get the respect it deserves?

First Gold needs more respect, as the first commercial dwarf hop, which can rise to great heights of flavor in an ale. Besides, if it got the gold medal for coming first it must be good, mustn't it?

I believe the hop that has gotten poor recognition would be the mighty Cluster. It is almost gone from production today but for a number of decades it made up towards 70 percent of the US total. Great bittering hop and a wonderful hop to warehouse. Very stable in regards to oxidation. We always called it the work horse hop.

Nugget is a great hop with an alpha of around 13%. It grows good, is reasonably priced, has a nice clean bitterness, stores well, and when used late it imparts a nice resinous hoppy flavor. Also not patented so anyone can grow it. We use some in all of our Oregon Trail Ales.

Volume 25, Number 1: January-February 2019

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The Lowdown on Lagering

Lagers can often be the red-headed stepchild in a homebrewer's annual brew cycle. But they don't have to be. By following some basic steps, choosing the right yeast, and optimizing what you have available to you, you can easily produce clean, bright, and tasty lagers of your own. https://byo.com/article/the-lowdown-on-lagering-advanced-brewing/

MEMBERS ONLY

Glassware For Your Brew

It wasn't too long ago that the utilitarian shaker pint glass ruled the US beer world. Glassware here in the States has come a long way in the last few decades as has the beer we are pouring into them. Find more tips and suggestions for matching your brew up with the proper glassware. https://byo.com/article/choosing-glassware-to-showcase-your-brew/

Barrel-Aging: Pro Brewer Tips

Oak alternatives are a great solution for homebrewers that would like to add oak character to their brews without the hassle of obtaining, cleaning, storing, and other tedious tasks that come along with oak barrel ownership. But for those dedicated few . . . there is no other option. https://byo.com/article/professional-barrel-aging/

MEMBERS ONLY

Fermentation Temperature Control System

There are many ways to gain control over your fermentation temperature. For those that don't have room for an added fridge, a temperature control system utilizing a pump to circulate warm or cool water is a great solution. Check out this build if you would like to get control in a space as small as a closet. https://byo.com/project/build-fermentation-temperature-control-system/

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MAIL

BREWING WITH FENUGREEK

I read the "Pastry Beers" article by Josh Weikert in the October 2018 issue, and had a question on adjunct usage. Josh recommends using fenugreek as a maple flavoring. I have no experience using the herb/spice. How would you recommend using fenugreek in a beer?

I'm thinking of brewing a Scotch ale . . . would you use the raw herb? The seeds? Or an extract?

Jarod Rehkemper • *via e-mail*

Hey Jarod, great timing on this question as Josh Weikert actually provides a lot more information on brewing with spices in this issue's "Techniques" column, beginning on page 84. But for this specific question, we reached out to Josh for a response. Here's what he had to say: "Maple Scotch ale sounds fantastic! Fenugreek is simple enough to incorporate in the brewing process. I recommend two tablespoons of cracked fenugreek seeds (you can usually buy them pre-cracked) in a vodka tincture, just enough to cover the seeds. Let it sit for a few days to a week, and then decant off the liquid (which should now taste like maple vodka). Add to taste. Done and done! You'll dial in the flavor as you get more experience, but the two tablespoon measurement should be in the ballpark. Now, you can also steep the cracked seeds in the beer proper, post-fermentation, but I have more luck with the tinctures. Hope it works out, and thanks for reading!"

PARTIAL MASH ADVICE

I am very interested in your website and have subscribed for the 14-day trial digital membership. The recipes in *BYO* look amazing and I am keen to learn more about the partial mash recipes. Have all of them been tried and tested or are some theoretical?

Alan Dickenson • *via e-mail*

BYO *Recipe Editor Dave Green responds: "Specific to partial mash recipes, the answer is no, not all have been tried and tested. Many of these partial mash recipes are theoretical in nature, based on all-grain recipes that have been converted into a format that brewers who would prefer the simplicity and more manageable extract-based versions of the all-grain recipe can utilize. But follow-*

contributors

Jadon Flores is a Support Technician for Premier Stainless Systems, where he helps professional brewers troubleshoot various problems around their brewhouses and kegwashers. He has achieved the title of Certified Cicerone® and has held a number of beer pairing dinners, off-flavor classes, as well as beer glassware classes. He has been homebrewing and working in the brewing industry for over 5 years ranging from brewing and production, packaging, beertending, and homebrew shop sales. He and his wife live in Southern California and are expecting a little girl in the next few months (he has already purchased her pink brewing boots.)

In this issue, Jadon examines the impact various styles of beer glassware have on how beer is perceived, beginning on page 42.

Andrew Reudink started homebrewing a decade ago after trying a friend's homemade beer. He now shares his love of craft beer with the homebrew community in Vancouver, Washington where he works at Bader Beer & Wine Supply and is a member of Cascadia Brewers Alliance. He enjoys teaching many classes including beer, wine, cider, and spirit making to help others foster their love of fermentation at home. He spends much of his free time on his "suburban farmstead" with his wife Kate, daughter Fiona, two dogs, cat, and sixteen chickens. His philosophy for beermaking is simple — never brew the same beer twice — and he doesn't, preferring to change at least one ingredient per batch to experiment and innovate with new combinations of flavor.

Andrew makes his *BYO* writing debut beginning on page 70 with an exploration of the various oak alternative products and how to use them in your homebrews.

Jason Phelps started homebrewing nearly 15 years ago, and like many hobbies it became a life changing experience. After first learning to make beer Jason branched out into cider, wine, and ultimately mead. Along the journey Jason has received more than 120 competition medals for a wide range of fermentations. As an author of articles in both *Brew Your Own* and *Wine-Maker* magazines, Jason loves to share his experiences and knowledge with other beverage makers. After recently retiring from a 25-year career in IT, Jason and his wife Margot opened Ancient Fire Mead & Cider, a new producer of meads, ciders, and wines in Manchester, New Hampshire, in 2017.

In this issue, Jason shares the knowledge he gained from opening his own commercial meadery with other homebrewers considering going pro, starting on page 78.

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ing some basic guidelines, there is no reason that partial mashes can't produce a beer as equally complex and solid as their all-grain counterparts. Here are a couple things partial mashers need to be cognizant of to be successful:

***1.** Diastatic power of the mash — my rule of thumb is not to exceed a 1:1 ratio of base malt to specialty grains.*

***2.** Don't add crystal malt and roasted grains to the mash — Gordon Strong advocates that all-grain brewers do this as well, but I especially urge partial mashers to restrain from adding crystal malts and roasted grains to the mash until the mash's starch conversion is complete. These grains mess with mash pH, which has been shown to greatly affect the mash. Make sure to add those grains into your strike water calculation so that when you do add them, your water:grain ratio is in a good place. Let those steep for about 15 minutes longer.*

***3.** Perform an iodine test — if you don't have iodophor or iodine, pick up a small jar of iodophor from a homebrew shop. It's an easy test and will give you ease of mind to know the mash is complete.*

***4.** Don't sweat the mash temperature — use the mash temperature as a rough guideline . . . don't fret if you miss the mark or the temperature starts to drop faster than you hoped. Remember this is only a portion of your final wort's fermentables.*

For more information on brewing partial mash batches, check out this story: https://byo.com/newbrew/partial-mash.

BELL'S TWO HEARTED RECIPE

I just received the December 2018 issue of *BYO*. The Bell's Two Hearted Ale recipe lists hops additions at 45 and 30 minutes and a dry hop. In the step by step it says "Turn off the heat, add the final hop addition . . ."

Bill • *via e-mail*

The ingredients are correct in this recipe but there was an unfortunate error introduced into the step by step instructions during our formatting steps. There is no need to do a whirlpool or 0-minute hop addition for this recipe according to Bell's Brewery, which graciously sent us this clone recipe. For anyone interested in brewing the Two Hearted clone, the correct online version is available at https://byo.com/recipe/bells-brewerys-two-hearted-ale-clone

WRITE TO *BYO*

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

BEGINNER'S BLOCK

BY DAVE GREEN

TALKING BREWER'S WATER LINGO

Over the past several issues I've covered some of the terminology that surrounds the main ingredients of beer: Malt, yeast, and hops. In my mind, it's fairly apropos that I saved the last for water. Often it's the last of the major components of beer that homebrewers explore on a homebrewer's learning curve. So with that in mind, let's jump into the topic of understanding water lingo in brewer's terms.

WATER COMPOSITION

A water molecule is a fairly simple molecule with two hydrogen atoms covalently bound to an oxygen atom. It's a highly stable molecule chemically and it exists in three forms on this planet: Gas (vapor), liquid (water), and solid (ice). As most of us know, water boils at 212 °F (100 °C) under 1 atmosphere of pressure (normal pressure at sea level) and freezes at 32 °F (0 °C). Water's *polarity* means it acts as a magnet with two ends to each molecule, a positive and a negative end. Polarity drives a lot of the properties we find in water including the fact that these phase-change temperatures are very high for such a small molecule: The magnetic nature of the molecules allows them to stay linked together longer than most similar-sized molecules. The boiling temperature fluctuates as pressure changes but the freeze temperature does not — something of note for high elevation brewers where pressure is lower. Water's freeze temperature will decrease, though, when things get mixed or dissolved into the water, such as sugar, salt, or ethanol. This allows brewers to lager beers below normal freezing temperatures. Water's polarity also means that it likes other polar molecules such as ethanol (and many acids, bases), allowing those two to be *miscible*, or mixed. On the flip side, water does not like non-polar molecules such as oil, meaning those two are *immiscible*, and will remain separate.

UNDERSTANDING BREWING WATER SALTS

Salts dissolve in water in varying rates and their ability to dissolve often depends on certain conditions like the water's temperature and pH. Some salts dissociate (fall apart) easily such as table salt, while others will not, such as calcium carbonate (chalk). The polarity of water molecules actually pulls certain salt molecules apart. Brewers tend to hone in on a few key salts found in drinking water: Table salt (NaCl), calcium chloride ($CaCl_2$), chalk ($CaCO_3$), gypsum ($CaSO_4$), and Epsom salt ($MgSO_4$). These salts will be found at various levels in their *ionic* (dissolved) form in typical tap water. Because of their overall effects on the chemistry of the beer and the finished beer's flavor profile, brewers will often tweak these ion levels by various additions or removal and/or dilution procedures to hone in the beer's profile.

ACIDS AND BASES

Besides salts, acids and bases often will dissolve easily in water as well. pH is a measure of the level of a compound known as hydronium $[H_3O]^+$, a compound that occurs naturally in purified water. A pH of 7 means there are 1×10^{-7} hydronium ions per liter of water. Acidifying the water means you increase the hydronium ions present in solution, dropping the pH below 7. The more hydronium ions, the lower the pH, the more acidic the solution. The less the hydronium ions, the higher the pH, the more basic the solution. For brewers that are looking to acidify water (and wort), brewers can add calcium chloride, gypsum, lactic acid, and/or phosphoric acid. The calcium salts are weak acids in wort (calcium drops pH by reacting with phosphates from malt, creating hydronium ions in the process) while the lactic and phosphoric acid have a higher efficacy for brewers looking to drop the pH. On the flip-side, brewers generally try to avoid stronger *alkaline* (basic) compounds such as lye (NaOH) but may still add weak alkaline salts like chalk ($CaCO_3$) or baking soda ($NaHCO_3$) if an increase in pH is desired.

BREWER'S JARGON

On brew day, all-grain brewers will use various terms to designate the purpose of various water volumes. *Strike* water is the water that will get mixed into the grain to start the mash's conversion. The temperature of the strike water is very important as is the chemical composition (pH and salt levels) since these two factors will help guide enzyme activity in the mash. The next volume of water that is important to all-grain brewers is the *sparge water*. Sparge water is the water brewers use to help rinse the grains of all the sugar that was created during the mash. The overall composition of sparge water is less important, but during the washing (sparging) phase of the grains, brewers look to avoid the pH of the mash from rising above 5.8. This is called oversparging and only a concern with pale, low-gravity beers. My rule of thumb is to not exceed one and a half times the strike water volume when sparging a low-gravity, pale beer.

Once water picks up sugars from the malts, it is no longer called water, it is now called brewer's wort. Wort then ferments into beer by brewer's yeast.

Finally, we brewers need chilling water, which is used to bring the wort down to room temperature after the boil. If done properly, some of the cooling water should be repurposed to use as cleaning water as well since it takes a large amount of thermal capacity (water) to bring the wort down from a boil to yeast pitching temperature.

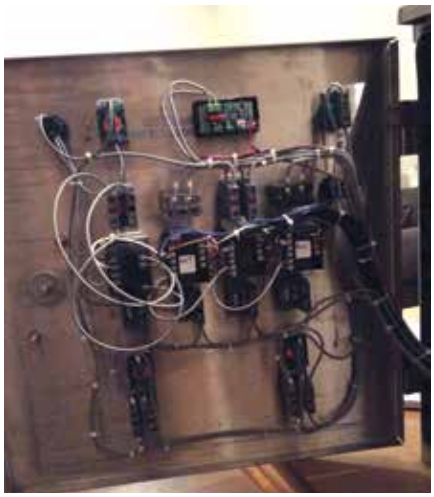
HOMEBREW DROOL SYSTEMS

LES STAINES – APOPKA, FLORIDA

This brew set up started back in early 2015 when I saw a YouTube post about The Electric Brewery (you can check out the web site at www.theelectricbrewery.com).

That's when I said I could build that and started to collect all the parts from ebay, Amazon, and other Internet sites to keep the cost down. I would estimate it cost me about $400 to build the main control panel and brew pots. I marked out the main panel, cutting holes for the components inside of the door then fitting all the components and finally wiring it all up. The first day I turned it on — no smoke, so I wiped the beads of sweat from my brow. Next was fitting the boil pot and the hot liquor tank with valves and heating elements, all fitted and water leak tested — no leaks! Finally was the first brew day, which overall went well, but I realized I needed to change the boil control. Wort would get to a boil and I had to manually turn the element off and on to slow the boil. So I wired in a simmer stat, this meant when the boil temperature was reached, I could turn the power down and have a good rolling boil — all working great. Afterwards, I decided to build the brew table for my system, which I finished by putting it on wheels in order to make it mobile.The system runs on 240 V and can easily brew 10-gallon (38-L) batches.

I'm a constant tinkerer, always making stuff and changing parts. Recently I made a small brew system to do 5-gallon (19-L) batches like a Robobrew using an Arduino as a small computer (see picture below).



WHAT'S NEW

OMEGA YEAST OYL-033 (JOVARU™ LITHUANIAN FARMHOUSE)

Omega Yeast has partnered with Jovaru™ Alus brewery in Lithuania to bring a new and unique yeast strain to their growing line of Northern European farmhouse strains. Some key points, this strain did test positive for the STA1 gene, an indicator of *Saccaromyces cerevisiae* var. *diastaticus* so a higher than normal level of attenuation may occur. This strain can also handle higher than normal fermentation temperatures, ranging as high as 95 °F (35 °C). Lemon citrus, black pepper, and a soft mouthfeel are a few key characteristics of this yeast strain. For more information visit omegayeast.com.

OKTOBER DESIGN SLI HOMEBREWER CAN SEAMER

This unit is designed for homebrewers and homebrew clubs looking to can their beers. The SL1 can seamer is designed as a more utilitarian seamer at a lower price point than their MK line. The SL1 can seal both 16 oz. and 12 oz. cans with the same motor and drive, upper and lower chuck assemblies, and manual seaming roll operation as the MK line. The SL1 starts at $879 (USD). For more information, visit oktoberdesign.com.

2018 HOP HARVEST

According to the Hops Growers of America, yield was up 16% in the big three states of Washington, Idaho, and Oregon. Qualitatively according to Yakima Chief Hops, yields were strong with high-quality of cones due to favorable weather conditions. Across the pond in Europe, a long-term drought affected the continental hop growing regions in the Czech Republic and Germany. According to Barth-Haas Group yields were 10% below expectations in Germany and 40% below in Czech leading to what looks to be a tight market for these hops. Dryness also affected the UK with many early pick varieties and traditional varieties suffering the most according to Charles Faram. Goldings were reported to be down by about 30% while Phoenix was up 20% on average.

BYO NANO CON

NANOCON BURLINGTON

Brew Your Own magazine hosted the first annual NanoCon for small-scale commercial brewers, located in Burlington, Vermont. 325 people descended on the city in early November with roughly 221 breweries or breweries-in-planning attending and 42 sponsoring vendors. The event was met with a lot of positive feedback and the 2019 NanoCon is already in planning for November 1–2 in Vancouver, Washington, located near Portland, Oregon. Mark your calendars and visit byo.com/nanocon for more information.

OZONE FOR SANITIZING?

BYO reader Michael Larkin from East Yaphank, New York submitted a suggestion. "I have found that ozone offers a convenient way to sanitize everything that touches my homebrew. I use it for wine bottles also as I make wine as well. Ozone leaves no residue, no mixing of chemical, and no expenses after purchasing. The downside is that you must use the ozone water right away. It reverts back to regular water in 15 minutes. I installed a splitter that comes from the ozone maker and can fill a keg, carboy, conical, or whatever you need sanitized. $300 initial investment is a lot, but I also use it for the clothes washer. I wash clothes with little or no soap, only cold water, no fabric softener, and no bleach. I recommend homebrewers look into it!"

Upcoming Events

Brew Boot Camp

JANUARY 22 — Early Bird discount deadline for BYO Boot Camp in Asheville, North Carolina. Boot camps will be March 22–23 2019. Register by January 22 to save $100: https://byo.com/byo-boot-camps/asheville-byo-boot-camp-overview/

JANUARY 29 — 2019 National Homebrew Competition open enrollment is January 22–29 while beer registration and payment are February 1–14. This competition is for AHA members only and cost per entry is $16. To learn more visit: https://www.homebrewersassociation.org/national-homebrew-competition/

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REPLICATOR

BY MICHAEL BURY

DEAR REPLICATOR, Ummm…I'm not sure if anyone at *BYO* has tried a beer from Against the Grain, but you guys owe yourselves some samples. And while you're at it, could you have Replicator get a recipe for their Kamen Knuddeln?

Nicki Forster
Rochester, New York

Thanks for the amazing request Nicki! You picked a unique, interesting, amalgamation of a beer. But the same could easily be said for any number of Against the Grain's brews, which are numerous. Despite being in business for only seven years, Against the Grain (AtG) has produced a whopping 312 different beers at their 8,000-barrel Louisville, Kentucky facility; that's a pace of nearly a different beer every single week. And why not? With the plethora of beer ingredients available to brewers nowadays, any conceptual idea can be turned into reality.

At AtG, they pride themselves on their uniqueness, creativity, the ability to laugh at themselves, along with bucking common practices. These qualities make them, and their beers, very approachable. They don't really have any flagship beers, but you'll recognize them by both the artwork on their bottles and cans as well as the inventive names. These names pull from a variety of pop culture and music references like Citra A@@ Down, Dwead Piwate Woberts, Wheaton Wine, and Rauching Tiger, Hidden Flagon. If you need a good laugh, head over to their website (www.atgbrewery.com). While laughing, you can marvel at the fact that these individuals really know how to brew. One of their brews, 70K Amburana, a dark, silky smooth milk stout with additional spice from the Amburana barrel, won a gold medal at the 2018 GABF in the Wood and Barrel-Aged Strong Stout category.

AtG is Louisville, Kentucky's first brewer-owned brewery and smokehouse located in the southeast corner of Louisville Slugger Field, home to the minor league baseball team the Louisville Bats. They're situated in a former train station that was restored to highlight the ornate industrial architecture that is visible in both the dining room and the brewhouse. The whole operation is powered by one of the nation's only Victorian-styled, three-story, copper-clad 15-barrel brewhouse . . . a work of art.

The concept for Kamen Knuddeln came out of necessity; a local bar called the Nachbar needed a beer to be ready for an event in only a couple of weeks that was unique and stood out from the crowd. Being in the heart of Bourbon country, AtG decided to brew a Kentucky common and use kettle souring to produce a flavorful, unique creation. (Side note: the BJCP 2015 Guidelines recognize that the Kentucky Common (27B) should not be sour for those judges following along.) Brew day and the subsequent fermentation came and went, and it was time to sample the result. The beer was good but not quite where the brewers wanted it. But how to make it more colorful? One of the brewers decided to blend the kettle-soured Kentucky common with a bit of Bourbon barrel-aged imperial stout that they had on hand. The result was perfection.

This beer and its components really shine when brewed as an all-grain batch as many of the components are tough to mirror in the extract versions. Flaked maize, for instance, needs to be mashed and while you can get rye malt extract, it's usually a combination of 2-row, rye malt, and crystal 40. Finally, due to the ratio of soured ale to imperial stout (4:1), you should have plenty of opportunities to tweak the kettle-soured portion to pair nicely with a single batch of imperial stout. Consider each variation unique creations and then learn from them and keep on making excellent homebrew. Cheers!

AGAINST THE GRAIN KAMEN KNUDDELN CLONE

Blend 4 parts kettle sour beer with 1 part Russian imperial stout for the clone. Carbonate to approximately 2.5 volumes.

KETTLE-SOURED ALE

(5 gallons/19 L, all-grain)
OG = 1.054 FG = 1.013
IBU = 26 SRM = 25 ABV = 5.3%

INGREDIENTS

7 lbs. (3.18 kg) Pilsner malt
1 lb. (0.45 kg) rye malt
1 lb. (0.45 kg) crystal malt (80 °L)
1 lb. (0.45 kg) acidulated malt
0.5 lb. (0.23 kg) chocolate malt
0.5 lb. (0.23 kg) flaked maize
0.5 lb. (0.23 kg) flaked barley
0.1 lb. (0.05 kg) roasted barley
7 AAU Nugget hops (60 min.) (0.5 oz./14 g at 14% alpha acids)
White Labs WLP672 (*Lactobacillus brevis*)
Wyeast 1028 (London Ale) or White Labs WLP013 (London Ale) or Lallemand Nottingham yeast

STEP BY STEP

Mill the grains, then mix with 3.6 gallons (13.7 L) of 169 °F (76 °C) strike water to achieve a single infusion rest temperature of 154 °F (68 °C). Hold at this temperature for 60 minutes. Mashout to 170 °F (77 °C). Vorlauf until your runnings are clear before directing them to your boil kettle. Batch or fly sparge the mash to obtain 6.5 gallons (25 L) of wort. Boil for 15 minutes to sanitize the wort before cooling

it to 105 °F (40 °C).

Pitch the *Lactobacillus* and allow it to work for 18 hours. pH of the beer should be 3.2–3.4. Feel free to adjust the acidity using 88% lactic acid. Boil for 60 minutes, adding hops at the beginning of the boil. At 15 minutes left, you may want to add either Irish moss or Whirlfloc as fining agents.

After the boil, rapidly chill the wort to slightly below fermentation temperature, which is 68 °F (20 °C) for this beer. Pitch yeast.

Maintain a steady fermentation temperature to avoid excessive ester formation.

KETTLE-SOURED ALE

(5 gallons/19 L, extract with grains)
OG = 1.053 FG = 1.013
IBU = 26 SRM = 24 ABV = 5.1%

INGREDIENTS

7 lbs. (3.18 kg) rye liquid malt extract
0.5 lb. (0.23 kg) chocolate malt
0.1 lb. (0.05 kg) roasted barley
2 tsp. 88% lactic acid
7 AAU Nugget hops (60 min.) (0.5 oz./14 g at 14% alpha acids)
White Labs WLP672 (*Lactobacillus brevis*)
Wyeast 1028 (London Ale) or White Labs WLP013 (London Ale) or Lallemand Nottingham yeast

STEP BY STEP

Bring 5 gallons (18.9 L) of water and the 2 tsp. of lactic acid to ~155 °F (68 °C). Steep your milled, bagged grains for 15 minutes before removing them. Then add the liquid rye extract while stirring and stir until completely dissolved. Boil for 15 minutes to sanitize before cooling it to 105 °F (40 °C).

Follow remainder of instructions from the all-grain recipe.

RUSSIAN IMPERIAL STOUT

(5 gallons/19 L, all-grain)
OG = 1.115 FG = 1.029
IBU = 52 SRM = 68 ABV = 14%

INGREDIENTS

15 lbs. (6.8 kg) 2-row pale malt
2 lbs. (0.91 kg) rye malt
2 lbs. (0.91 kg) wheat malt
1.25 lbs. (0.57 kg) chocolate malt
1.25 lbs. (0.57 kg) chocolate rye malt
1.25 lbs. (0.57 kg) crystal malt (120 °L)
1.25 lbs. (0.57 kg) honey malt
1.25 lbs. (0.57 kg) roasted barley
17 AAU Columbus hops (60 min.) (1 oz./28 g at 17% alpha acids)
Wyeast 1028 (London Ale) or White Labs WLP013 (London Ale) or Lallemand Nottingham yeast

STEP BY STEP

Mill the grains, then mix with 7.9 gallons (29.9 L) of 167 °F (75 °C) strike water to achieve a single infusion rest temperature of 152 °F (67 °C). Hold at this temperature for 60 min. Mashout to 170 °F (77 °C). Vorlauf until your runnings are clear before directing them to your boil kettle. Batch or fly sparge the mash to obtain 6.5 gallons (25 L) of wort. Boil for 60 minutes, adding hops at the times indicated. At 15 minutes left in boil, add either Irish moss or Whirlfloc as fining agents.

After the boil, rapidly chill the wort to slightly below fermentation temperature, which is 69 °F (20 °C) for this beer. Pitch yeast.

Maintain fermentation temperature to avoid excessive esters and fusel alcohol production. Age the beer for 3–4 months in a Bourbon barrel. If you're using other higher surface area to volume sources of oak, you'll need to decrease the contact time to avoid over-oaking the beer.

RUSSIAN IMPERIAL STOUT

(5 gallons/19 L, extract with grains)
OG = 1.111 FG = 1.028
IBU = 52 SRM = 67 ABV = 13%

INGREDIENTS

7 lbs. (3.2 kg) extra light dried malt extract
2 lbs. (0.91 kg) rye liquid malt extract
1.25 lbs. (0.57 kg) chocolate malt
1.25 lbs. (0.57 kg) chocolate rye malt
1.25 lbs. (0.57 kg) honey malt
1.25 lbs. (0.57 kg) roasted barley
1 lb. (0.45 kg) crystal malt (120 °L)
17 AAU Columbus hops (60 min.) (1 oz./28 g at 17% alpha acids)
Wyeast 1028 (London Ale) or White Labs WLP013 (London Ale) or Lallemand Nottingham yeast

STEP BY STEP

Bring 5 gallons (19 L) of water to ~155 °F (68 °C). Steep all your milled, bagged grains for 15 minutes before removing them. Then add all the extract while stirring and stir until completely dissolved. Top up kettle to 6.5 gallons (25 L) then bring to a boil.

Follow remainder of instructions from the all-grain recipe.

TIPS FOR SUCCESS:

Before adding any hops, you should sanitize the wort via boiling for several minutes. That will give the *L. brevis* a clean, uncompetitive slate to work on. Feel free to use 88% lactic acid to adjust the pH if needed. Speaking of pH, if you don't have a pH meter, now may be the time to make the investment. Many are user-friendly and relatively inexpensive and can transform your brew day. In addition, you can use them for other fermented products.

The next aspect is the barrel-aged stout. If using staves or cubes, the contact time will need to be decreased. Start tasting every other day after a couple of weeks to prevent too much oaky, woody, tannic character from creeping in. Finally, AtG uses a ratio of one-part RIS to four-parts soured ale. Depending on the character of each of your two beers you may find a different ratio is more palatable. BYO

BY DAVE GREEN

CONTINENTAL-STYLE LAGERS

Finding the malt sweet spot

Continental-style lagers are one of the most challenging styles of beers for homebrewers to master. One of the key elements is the malt profile — layering in malted complexity, while melding those flavors seemlessly with the hops, water, and yeast. To help us better understand the intricacies of how malts factor into these styles, we talked to two masters in the art of layering in nuanced complexity.

The base malt for continental-style lagers is critical to the outcome of the beer. When we brew an IPA we are looking at combining 2–4 hop profiles to create a flavor profile; it is the same for malt with lagers. When brewing a beer like a helles, the main flavors you are trying to achieve are the balance between malt, fermentation, conditioning, and a touch of hops. We have found combining three different base malts for this beer to be beneficial. This allows opportunity to drive strong flavors or soften flavors. The key is to strike a balance between flavor and drinkability.

Sensory technique for testing malts is an underappreciated art. We recently started using ASBC Hot Steep Malt Sensory Evaluation Method: http://methods.asbcnet.org/summaries/sensoryanalysis-14.aspx. (You can view a version of this sensory evaluation in the July/August 2018 "Techniques" column "Sensory Methods" as well.)

You have to be very careful and intentional with specialty malts when it comes to continental-style lagers. A little goes a long way. In light color beers we use very little to none. In beers like dunkel, Märzen, and Vienna lager, specialty malts are needed to create the desired colors and flavors. We tend to lean towards the German maltsters for these delicate flavors. I won't give you specifics of which we prefer, but rather point you back to the sensory evaluation method mentioned earlier and say, "Give it a try!"

Base malt spec sheets are not often referenced at the homebrew level. But if you can obtain one for your next bag (s) of base malt, there are a few elements you should be looking for:

Friability — A measure of modification and homogeneity. Given as % friability. Low friability may lead to a higher viscosity and poor lauter performance.

Color — Lower color may have a higher dimethyl sulfide (DMS) potential as well as higher LOX enzyme problems. Longer boils can help alleviate these problems though.

Total protein — Higher protein can result in lower extract. If protein is too low then FAN (free amino nitrogen) might be compromised.

FAN — Low FAN is a sign of poor protein modification. If FAN is below 200 ppm then yeast nutrient should be used to supplement.

Our approach to brewing lagers will also vary depending on the specific style of lager we are brewing. We vary our mash profile based on the base malts and style of beer. We have found our ramp time and temperature between the mash steps can increase malt complexity.

For example our Mexican lager is a single infusion while our Oktoberfest is a multi-step mash with long temperature ramps. Playing around with different elements from the grist profile to the mash procedure keeps things interesting. Don't get locked into one way of approaching a beer style and continental-style lagers are definitely no exception.

We have found our ramp time and temperature between the mash steps can increase malt complexity.

Post-college, Josh Pfriem brewed at Utah Brewers Cooperative in Salt Lake City, Utah and Will Kemper's Chuckanut Brewery in Bellingham, Washington before landing at Full Sail in Hood River, Oregon. It was a bike trip through Belgium, knocking on the doors of some of Europe's greatest brewers, however, that cemented Josh's ambition to meld European and Northwestern brewing traditions to create his own signature brand. In August 2012, pFriem Family Brewers in Hood River opened its doors, Josh's vision payed off in 2018, winning the mid-size brewery of the year at the Great American Beer Festival (GABF).

Matt Brynildson graduated from Kalamazoo College and began his brewing career with KALSEC (Kalamazoo Spice Extraction Company) as a hop chemist. Matt served as Cellarman then Head Brewer at Goose Island Beer Co. in Chicago, Illinois before landing in California. He became Brewmaster at Firestone Walker Brewing Co. in Paso Robles in 2001 and has since helped earn five mid-size brewery of the year awards at GABF and four mid-size brewery of the year awards at World Beer Cup. Matt also was awarded the 2007 Russell Schehrer Award for Innovation in Brewing by the Brewers Association.

Having spent a good amount of time tasting beers in Europe, specifically Germany, it became clear that the Pilsner malts produced there create a subtle yet different flavor and character than the North American malts we were familiar with. That difference in character is in part derived from the barley varieties grown as well as the way that they are malted, typically focusing on low color and an enzyme package built for all-malt beer. We like to emulate the flavor, texture, and weight of German lager beers, so we sourced the raw materials from reputable German sources.

I believe the best continental-style lagers and Pilsners have little or no specialty malt. Brewers need to remember that people drink with their eyes first and these beers need to be bright and light in color. A cara-malt or even a perceivable toasted malt character is out of place in my book. Grainy cereal notes can be perceived as well as bready notes. Keep the recipe simple and focus on perfecting your yeast management and fermentation program. The best lager beers are simple recipes with perfect fermentations, good attenuation and low perceivable sulfur. We have used a small amount of foam-positive specialty malts to improve foam characteristics like Carafoam®, but keep it in check.

We practice a traditional step infusion method when brewing these beers. I like to start with a short 5-min. protein rest (122 °F/50 °C), step up to one or even two separate saccharification rests taking advantage of beta activity (148 °F/64.5 °C). We utilize an advanced steep conditioning mill that keeps the husks intact and results in lower polyphenol extraction. Most brewers are dry milling, so I would recommend to pay attention to your grist profile and try not to shred the husks, and don't over sparge. Test the pH of your last runnings and don't collect wort that is above pH 6 (in fact you should not collect wort above pH 5.8).

This is just a partial transcript; to read more tips from Matt Brynildson on this topic, find his complete transcript at byo.com/article/brewing-lagers BYO

BY ASHTON LEWIS

HOP CREEP EXPLAINED

Also: Backsweetening and maximizing malt freshness

Q ALRIGHT, CAN SOMEBODY PLEASE EXPLAIN THIS HOP CREEP PHENOMENON TO ME? I HAD A DIPA THAT I BOTTLED, WHICH ENDED UP WAY OVER-CARBONATED. A FRIEND MENTIONED IT MAY BE DUE TO HOP CREEP, BUT HE DIDN'T KNOW THE SPECIFICS OF IT.

JOHN SULLIVAN
AVON, INDIANA

A Hop creep is a term that has been recently popping up in commercial craft brewing circles to describe increased attenuation following dry-hopping. Reports in brewing literature indicate that a small handful of craft breweries may have been aware of this general phenomenon for the past few years, but most were not. The industry's understanding of what was happening was changed in 2017 by research conducted at Allagash Brewing that followed their very first dry-hopped beer, Hoppy Table Beer, brewed in May of 2016. Allagash closely follows the progress of carbonation and attenuation in their quality-control (QC) lab because they bottle condition almost all of their beers. Because of their diligent practices, they were able to flag that something was amiss with their first foray into dry hopping.

What they observed were increases in carbonation and decreases in real extract that exceeded their experienced expectations. After 3 weeks, the carbonation level in bottles of Hoppy Table Beer were over 4.5 volumes, or more than 1.5 volumes greater than their 3.0 volume target. On the surface, this looks similar to beer that contains *Brettanomyces*, but that was not the case here.

The QC group at Allagash embarked on a series of experiments to determine the root cause of this phenomenon and ended up using dry-hopped Coors Banquet beer as a model system. Their model system behaved like their Hoppy Table Beer when yeast was present and became dryer and more carbonated after being dry hopped; samples without yeast did not demonstrate the same behavior. Allagash collaborated with Dr. Tom Shellhammer's research group at Oregon State University (OSU) to further the investigation. Shellhammer's team began by repeating the trial using dry hopped Coors and were able to repeat Allagash's experiment.

After digging deeper into the potential causes of the phenomenon, the OSU team found the smoking gun; hops contain several amylolytic enzymes, including amyloglucosidase (AMG). When AMG is added to wort or beer, limit dextrins (those carbohydrates left behind after alpha and beta amylases hydrolyze amylopectin) are broken down into the fermentable sugar glucose. What Allagash and OSU observed in the model system with Coors Banquet, hops, and yeast was glucose production and subsequent fermentation by yeast as a direct result of AMG degrading limit dextrins in the beer. This is what brewers call hop creep, a phenomenon last reported in the brewing literature by Janicki and others in 1941 and, nearly 50 years earlier in 1893, by Brown and Morris.

The odd thing about this topic is that dry hopping bottle-conditioned beers is not a new thing for craft brewers, and reports of hop diastases are certainly not new. But over-car-

What makes hop creep a very big deal is its potential to cause package explosions at home or in the market.

Photo courtesy of Michael Tonsmeire

Due to certain enzymes that are found in hops, refermentation can occur in heavily dry-hopped beers, a phenomenon coined hop creep.

bonation in dry-hopped, bottle-conditioned beers does seem new. Take Sierra Nevada as an example; their Bigfoot Barleywine and Celebration Ale are both generously dry-hopped, contain plenty of chewy dextrins, are bottle-conditioned, and neither are known for their extreme levels of carbonation after cellaring (contrast this to Orval that is bottle-conditioned with *Brettanomyces*). Hop creep has turned into a very hot hop topic and it will be interesting to learn more about this as brewing scientists uncover more findings. Practical brewers anecdotally know that this phenomenon is not associated with all hops, and there does not seem to be any obvious association with specific varieties or hop growing regions. In other words there is still a lot of mystery in this occurrence.

What makes hop creep a very big deal is its potential to cause package explosions at home or in the market. It's bad enough for commercial brewers that hop creep results in over-carbonated beer and increases a beer's ABV beyond what the label states, but the liability concerns surrounding package failures is huge. Homebrewers definitely need to be mindful of hop creep by paying attention to changes in carbonation levels in bottle-conditioned beers and staying abreast of this topic as research continues peeling back the layers of this interesting topic.

Q I RECENTLY HAD AN EXCELLENT DRAFT HONEY WHEAT AT WHOLE FOODS. AS I ENJOYED THE BREW I REALIZED THERE WAS A NICE HONEY AROMA AND FLAVOR, BUT NONE OF THE ADDITIONAL ALCOHOL CAUSED BY THE HONEY. IN THE PAST WHEN I'VE ADDED ANY ADDITIONAL SUGARS (HONEY, FRUIT, ETC.) IN THE SECONDARY IT CAUSED ADDITIONAL FERMENTATION AND ADDITIONAL ALCOHOL.

I KNOW I CAN ADD PRESERVATIVES TO THE SECONDARY TO STOP OR AT LEAST LIMIT THE YEAST, BUT IF I DO ADD THESE HOW WILL I THEN BE ABLE TO BOTTLE CARBONATE THE BREW? WON'T THE YEAST BE PREVENTED FROM PROCESSING THE PRIMING SUGAR AND THEREFORE PREVENT CARBONATION?

JOE
MARS, PENNSYLVANIA

A Joe, thanks for the good two-part question about using brewing sugars like honey for special flavors and the question about how to bottle condition beers that may contain fermentable sugars. These are two independent brewing questions and are best addressed as such.

When adding fermentable brewing sugars to a batch, it is important to consider how these sugars will be expressed in your beer. I like formulating beers from the ground up, and factor in all ingredients when developing a recipe. This means that if the plan is to develop a brew with 5.5% ABV, for example, that everything added to the beer will be considered; a bit different than simply adding honey to a recipe that is designed to produce 5.5% ABV beer without any honey. The description of your tasting experience describes a beer that was designed with honey from the ground up with the honey an integral part of the beer's balanced flavor profile.

Using brewing sugars does take a bit of mental calibration however, because when most of these sugars are added to wort they are fermented along with the malt sugars (lactose being the one exception to this rule). This means that what we perceive as honey flavor, for example, expresses differently in the finished beer. The first word that comes to mind for most folks when pondering honey is sweet, but adding honey to wort does not necessarily make for a sweet beer. What honey does add to beer are honey aromas, and those aromas can cue the perception of honey in beer, especially when the beer may have a sweet finish that mirrors our natural perception of honey. This is one reason why a malty brown ale works well with honey.

Brewing with brewing sugars is not always about trying to preserve sweetness. The herbal and floral notes of honey marry well with the nose of a saison, and the simple sugars in honey ferment to dryness and can be used to produce a dryer finished beer if that is desired. Some brewing sugars, like Belgian candi sugars, may contribute color and special flavors. Table sugar can be used to boost alcohol and dry out a beer with little else. Fruit sugars usually bring acid, color, and aroma to the party. And lactose can be used to boost final gravity, add body, and serve as a canvas to layer decadent flavors onto an otherwise typical beer. The point is that most brewing sugars are used to contribute fermentables to wort and some sort of special component that malts are unable to achieve.

“Brewing with brewing sugars is not always about trying to preserve sweetness.”

A key thing to keep in mind when adding sugars to wort is that they dilute yeast nutrients. As long as they contribute less than about 25% of the total extract, the nutrient dilution is not an issue. But sugars can dilute wort nutrients when used in excess and lead to solvent-like and “hot” flavors. Keeping the yeast basics in mind is always important, especially when pushing sugar additions; always use fresh, healthy yeast cells, pitch appropriately, consider adding zinc and/or nitrogen and phosphorous in the form of yeast nutrients, and aerate your wort. Rome was not built in a day,

and using brewing sugars may require practice before yielding really great beers. Paying attention to off-flavors related to fermentation and adjusting your practices as needed is one tip that can really take these brews to a higher level.

Your second question is not so easy. Preserving residual sugars in a style like honey wheat, presents a real dilemma. One way to accomplish this goal is to use a preservative, such as sodium metabisulfite or potassium sorbate, to prevent re-fermentation. But as you point out, these preservatives will also prevent bottle conditioning. This is just one of those cases where a sacrifice has to be made, and the easiest thing to do is to force carbonate these types of beers and do something that prevents re-fermentation.

Current popular styles where in-package fermentables are desirable include fruit beers, pastry stouts, and milkshake IPAs. Not all brewers are keen on using preservatives and there are two other approaches that can be used. The best method is to pasteurize these beers in the package, but most breweries who are brewing these styles do not have tunnel pasteurizers, and pasteurizing at home is not a realistic option unless you simply want to conduct a science project. The other method many brewers are turning to is simply packaging beers with fermentables and storing cold. There are four words that succinctly describe this last method; it is no guarantee! Contrary to popular belief, ale and lager strains can continue fermenting at much lower temperatures than those used for rapid fermentation given the proper conditions.

This is where homebrewers really have a leg up on commercial brewers. What is the purpose of brewing beer at home? Is it to create a product that mirrors commercially available beers, or is it to brew something that you can enjoy at home? Dumb question, for sure, since the obvious answer is that homebrewers brew beer for friends and family. This means that you can give instructions to your consumers that probably would fail for a commercial brewer. Consider these styles as beers that require some user participation.

Imagine you want to brew a dry, tart, and slightly salty Gose, plus a little sweetness for balance. There are some clever things that could be done here, but the most solid options are in-package pasteurization or force carbonate plus preservatives. Or you could simply add a shot of sugar to the beer before drinking! Seriously, take a page out of the Berliner weisse playbook and add that shot of waldmeister syrup, herbed honey shrub, or flamed sugar and Bourbon when the beer is poured. Where does it say that all of the flavors in a glass of beer have to be in the bottle, can, or keg prior to imbibing, and where is written that Berliner weisse is the only style where finishing at the time of consumption is allowed? I hope this simple approach is not a disappointing answer to a challenging question. The one downside is that this won't work well if you plan to enter a competition!

HELP ME, MR. WIZARD

Q THERE IS A SPECIFIC FLAVOR AND AROMA THAT I AM TRYING TO COAX FROM MY BEER. THE BEST WAY I CAN DESCRIBE IT IS TRULY FRESH MALT FLAVOR AND AROMA, NOT MALT SWEETNESS, THAT MAKES IT INTO THE FINISHED BEER. I WAS SITTING AT FOUNDER'S A WHILE BACK AND ORDERED A PC PILS, THIS BEER HAD THE FLAVOR AND AROMA OF FRESH BAKED BREAD AND BOILING WORT. IT MELDED PERFECTLY WITH THE FRESH AMERICAN HOPS. I HAVE BEEN CHASING THIS DRAGON FOR QUITE SOME TIME. I HAVE TRIED DIFFERENT MALTS (MUNICH, VIENNA, AROMATIC, MELANOIDIN, ETC.), DIFFERENT MALTSTERS, SINGLE INFUSION MASHES, DECOCTION MASHES, EVEN DIFFERENT BOIL TIMES AND INTENSITIES. LOOKING FOR OTHER VARIABLES TO EXPLORE; MAYBE MASH pH? I RARELY, IF EVER, STRAY FROM 5.3.

BRAD LAWRENCE
VIA EMAIL

A I have been on this same journey before and it can be a real challenge chasing elusive flavors that sometimes seem impossible to capture, and perfect malt flavor is one such genie. It's hard to play this game without starting with malt: They may be lacking in the flavor you are chasing. Although you state in your question that you have tried different malts, don't walk away from that exploration. Malt flavor is influenced by where barley varieties are grown, the variety itself, and how the barley is malted. Try to uncover more about the malts used in the beers you really like; there may be some commonalities. For the sake of this question I am going to assume that you are seeking maltiness in styles like Pilsner and helles lagers, and pale, and lightly hopped, ales.

When I troubleshoot brewing problems, I roll through the brewing process in my head to think about places to focus attention. Water, malt, yeast, and hops. Milling, mashing, boiling, cooling, aeration, fermentation, racking, and packaging. I am going to venture out on a limb with this one and suggest that you focus on water, mashing, and oxygen pick-up in your process following wort production. The flavors you seek are delicate, and nuances do have a significant influence on things when you start to strip layers of complexity back to focus on the subtle.

Water represents ~90% of most beers and you need to check that box when embarking on this journey. Very pale beers, especially those with superb balance and cleanness of flavor, greatly benefit from water that has very little in it other than 50-100 ppm calcium and the requisite balance of calcium and chloride. Readers of my column know that I am a fan of reverse osmosis (RO) water because it is easy to adjust, and free of components that may not show up on the brewing radar until a problem pops up with flavor. Consider using RO water adjusted with an equal blend of calcium sulfate and calcium chloride (10 L/2.6 gallons of RO water with 1.7 g calcium chloride and 1.7 g calcium sulfate gives 100 ppm calcium, 96 ppm sulfate, and 107 ppm chloride).

When contemplating malt flavors, it is tempting to take a deep dive into thoughts about how decoction mashing just makes all traditional lager styles better. The problem with this sort of thinking is that traditional wort production methods were developed in conjunction with malt types that are all-but-extinct from the world of brewing. Most commercial breweries these days use relatively short and simple mashing methods when possible because modern malts are generally well-modified and highly enzymatic, and simply do not require long, complex mash methods. Plus, breweries with newer brewhouses are focused on minimizing energy consumption during wort boiling, reducing thermal stress caused by excessive wort boiling, and using engineering solutions to reduce wort dimethyl sulfide (DMS) that also reduces energy use. This means color and flavor development during wort boiling is something not seen much in many commercially-brewed craft beers. You reference Founder's Brewing in your question; Founder's is well-known for their use of infusion mashing. Their largest brewhouse in Grand Rapids, Michigan features a 300-BBL system where they mash directly into the lauter tun using two, very large, grist hydrators, and a kettle designed to minimize thermal stress while maximizing DMS removal.

How does mashing and boiling relate to preserving these delicate malt flavors? Depending on a variety of factors, such as lipoxygenase activity in very pale malts, degree of malt modification, and complexity of mash; wort composition and wort flavor can be skewed in a direction that often ends in aged-beer flavors. May I suggest for your winter reading, which may further your understanding of these general concepts including the relationship between malt lipoxygenase activity and staling flavors in beer, wort FAN and its influence on beer flavor, and how thermal stress during wort boiling influences the thiobarbituric acid index (TBI).

The last topic that I really believe relates to your quest is oxygen pick-up in the downstream processes following wort production. Chasing oxygen pick-up is all about the details, and examples include removing air from empty hoses used in racking, completely purging carboys and kegs of air before filling with fermenting or finished beer, evacuating air from bottles during filling, capping on foam, making sure that fittings and couplers do not have leaks that can suck air into the system during use via the Venturi Effect (especially real when pumps are used), and using deaerated water whenever adding water to fermenting or finished beer. This pursuit can be taken to the next level by pursuing low dissolved-oxygen procedures in the brewhouse, but I don't think those methods are required to sate your thirst for beautiful malt notes.

There is no single approach to chasing this dragon, but if I were to design a plan it would begin simply. Excellent base malt, very limited use of specialty malts, simple water, mash method aligned with malt, minimal thermal stress in wort boiling, clean fermentation, and obsessive attention to oxygen pick-up. Additional complexity only added as needed. Good luck in your pursuit of the elusive! BYO

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BY GORDON STRONG

DAS ALTBIER

Germany's old-school style

In the world of beer trivia, if you mention *altbier*, most people know two facts: That it comes from Düsseldorf in Germany, and that "*alt*" means "old" in German. But it's nothing like an English old ale . . .

As it pertains to altbier, "old" refers to the old style of brewing using top-fermenting ale yeast, not the more modern bottom-fermenting lager yeast. It was a style that was described in beer books, such as those written by Michael Jackson, but it was hard to find commercial examples and the style descriptions often had misconceptions and biases, and perhaps some Americanized examples. The current BJCP Style Guidelines are based on field notes from tastings I did in Düsseldorf in 2006, and are meant to describe the classic style as brewed at the source.

A funny story from that trip: I was there with another judge who really wanted to fit in with the locals. He had a Germanic surname, wore long-sleeved shirts, muted colors, and looked around disapprovingly at others. When it came time to order a beer, he held up his thumb (meaning 'one' in Europe) and said, "ein altbier." The old waiter stared at him and said, "ja, ein bier." He just made a tourist move, like ordering Buffalo Wings in Buffalo or Philly cheesesteak in Philadelphia (where they are just wings and steaks). So much for Mr. German; in Düsseldorf, bier is always altbier.

The beer had been described in older guidelines as a copper-brown lagered ale with chocolate flavors and astringency. I found mostly dark amber beer with rich malty flavors and variable bitterness. A later version of the style guidelines described what was essentially a Zum Uerige clone (a world-class beer, to be sure), but I found that example was a stylistic outlier in its home city, that was much more aggressively bittered than the other classic examples.

In the current (2015) BJCP Style Guidelines, altbier falls within Category 7, Amber Bitter European Beer as Style 7B. There used to be separate styles for Düsseldorfer altbier and North German altbier, but that latter style had no real basis in history or fact. It was really just a collection of moderately-bitter brownish lagers. So we extended the altbier style to cover the range of classic beers of Düsseldorf, while creating an International Amber Lager category to cover the other examples (along with similar beers from other countries).

ALTBIER'S HISTORY

Altbier as we know it today became established in the 1800s in Düsseldorf. The name altbier only makes sense once newer lager type beer started becoming popular in the early-1800s; the oldest pub making altbier is Schumacher, which opened in 1838. Several other well-known pubs followed in the mid-1800s; those making this style in the altstadt (old city) include Zum Uerige, Im Füchschen, and Zum Schlüssel, among other more recent ones. There were over 100 breweries in Düsseldorf in the late 1800s, but the impact of two world wars whittled those down considerably.

There is no historical evidence that there was a style of beer similar to altbier that was renamed altbier when (new) lager beer became popular. Mostly there is just history that Brauerei Schumacher started making the modern style first. The closest style is probably Adambier, although that was a stronger aged beer. I'm not suggesting these styles are linked, just that they are made in the same general region of Germany and share some (but not all) key characteristics.

There were over 100 breweries in Düsseldorf in the late 1800s, but the impact of two world wars whittled those down considerably.

ALTBIER BY THE NUMBERS

OG:	1.044–1.052
FG:	1.008–1.014
SRM:	11–17
IBU:	25–50
ABV:	4.3–5.5%

Photo by Charlie A. Parker/Images Plus

Some have attempted to tie altbier to older German beer styles such as Broyhan and Keutebier, but historical descriptions of those styles don't describe highly hopped beers. Often these older styles were sour, although it isn't clear that this trait was intentional. Altbier from Münster is somewhat sour, and the historical Adambier from nearby Dortmund is also described as sour (albeit as developed during long aging in wood, similar to historical porter). Modern Düsseldorf altbier definitely isn't sour. But it does serve to establish that there was a brewing tradition in that area of Germany prior to the development of lager beer.

For geographical context, Düsseldorf is in western Germany, on the banks of the Rhine (mostly on the right bank). It is a little north of center, and is about a 30-minute train ride north of Köln (Cologne), which is on the left bank of the Rhine. Both cities are in the state of North Rhine-Westphalia, in the industrial heartland of Germany. Düsseldorf is just a little south of the populous Ruhr Valley, where Dortmund is located.

Kölsch and altbier are often mentioned together since their home cities are nearby and that the beers share a similar production method (cool-fermented ale yeast, followed by lagering). Kölsch is a pale beer, while altbier is a darker beer with a richer malt flavor. The bitterness of altbier increased to match the increased maltiness. That is the only relationship; there really isn't a common history to the styles.

Many people like to discuss the *sticke* (secret) alt variant, which was traditionally a special treat for regular customers. Often advertised with a subtle symbol posted at the pub, it is typically a stronger and hoppier version of the normal product. I think of it like the holiday ales of Belgium, where you find beers that are about 2% ABV stronger and have bolder spicing or other flavors compared to their normal offering. It's the same idea, but the spicing is hops. This variant is outside the definitions of the style guidelines, so brewers that make these versions should enter them as Historical Beers.

ALTBIER

(5 gallons/19 L, all-grain)
OG = 1.051 FG = 1.012
IBU = 51 SRM = 15 ABV = 5.1%

INGREDIENTS

6 lbs. (2.7 kg) Pilsner malt
3.5 lbs. (1.6 kg) Munich malt
8 oz. (227 g) wheat malt
5 oz. (142 g) Caramunich® II malt
3 oz. (85 g) Carafa® Special III malt
11.4 AAU Perle hops (60 min.) (1.25 oz./35g at 9.1% alpha acids)
2.25 AAU Spalt hops (10 min.) (0.5 oz./14 g at 4.5% alpha acids)
0.5 oz. (14 g) Spalt hops (0 min.)
White Labs WLP036 (Düsseldorf Alt Ale) or Wyeast 1007 (German Ale) or Safale K-97 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 ½ tsp each of calcium sulfate and calcium chloride to the mash.

Decoction mash: Mash in Pilsner, Munich, and wheat malts at 144 °F (62 °C). Hold for 20 minutes. Pull a thick decoction (about ⅓ of the mash volume), while continuing to hold the main mash at temperature. Bring the decoction to a boil; boil the decoction for 15 minutes, stirring. Remix the decoction and the main mash, hitting 154 °F (68 °C); hold for 45 minutes. Pull the thin portion of the mash, while continuing to hold the main mash at temperature. Boil the thin portion for 10 minutes. Remix the decoction and main mash, hitting 168 °F (76 °C). Add the Caramunich® and Carafa® malts, hold for 10 minutes, then 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.

Chill the wort to 61 °F (16 °C), pitch the yeast, and hold the temperature for the first three days of fermentation. Allow the temperature to rise to 68 °F (20 °C), and ferment until complete. Rack the beer to a secondary fermenter and lager for two months at 32 °F (0 °C). Rack the beer, prime and bottle condition, or keg and force carbonate.

ALTBIER

(5 gallons/19 L, extract with grains)
OG = 1.051 FG = 1.012
IBU = 51 SRM = 15 ABV = 5.1%

INGREDIENTS

4.3 lbs. (1.9 kg) pale liquid malt extract
2.3 lbs. (1 kg) Munich liquid malt extract
5 oz. (142 g) Caramunich® II malt
3 oz. (85 g) Carafa® Special III malt
11.4 AAU Perle hops (60 min) (1.25 oz./35g at 9.1% alpha acid)
2.25 AAU Spalt hops (10 min.) (0.5 oz./14 g at 4.5% alpha acids)
0.5 oz. (14 g) Spalt hops (0 min.)
White Labs WLP036 (Düsseldorf Alt Ale) or Wyeast 1007 (German Ale) or Safale K-97 yeast
¾ cup corn sugar (if priming)

STEP BY STEP

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

Steep the Caramunich® and Carafa® malts for 30 minutes. Remove then turn off the heat. Add the malt extracts and stir thoroughly to dissolve completely. You do not want to feel extract at the bottom when stirring with your spoon. Turn the heat back on and bring to a boil. Boil the wort for 60 minutes, adding hops at the times indicated.

Chill the wort to 61 °F (16 °C), pitch the yeast, and hold the temperature for the first three days of fermentation. After that time, allow the temperature to rise to 68 °F (20 °C), and ferment until complete. Rack the beer to a secondary fermenter and lager for two months at 32 °F (0 °C). Rack the beer, prime and bottle condition, or keg and force carbonate.

SENSORY PROFILE

Altbier is a moderately colored, well-attenuated, bitter beer. The rich maltiness balances the strong bitterness, while the late hop character is relatively light and spicy. While a dry beer, the style has a firm body and smooth palate. The color is light amber to deep copper, but isn't truly brown. As a lagered beer, the clarity is typically brilliant. The off-white head is thick, creamy, and long-lasting.

The aroma is malty and rich with grainy characteristics that can be likened to baked bread or toasted bread crusts. It should not have darker roasted notes. Hops complement but do not dominate the malt, and often have a spicy, peppery, floral character. The fermentation character is very clean. A hint of esters may be present as can a light sulfur character, although these should not be prominent.

The flavor profile is similar to the aroma, but an assertive hop bitterness balances the rich malty flavors. The beer finishes dry with a bitter-malty aftertaste. Your brain wants to call it bittersweet but the beer itself is mostly dry. The beer is smooth on the palate and the fermentation character is clean and lager-like.

The beer has a medium to medium-full body, which may seem lighter since it is so smooth. Carbonation can be medium to medium-high. Cask versions may be less carbonated and lighter in body. As an average strength (4.3–5.5%) beer, it should not have a warming character, particularly as the malt and hops are so prominent.

The bitterness level of the beer can vary considerably, most notably with the Zum Uerige being assertively bittered and most others moderate. The IBU level is 25 to 50, which is quite broad, although the maltiness tends to increase with the bitterness levels so as to remain balanced.

While it is possible to find some examples in the US, they are often not well kept. The best way to experience the style is to visit Düsseldorf and try them fresh from the cask. Pubs in Düsseldorf brew their beer on site, and serve directly from cask into short cylindrical glasses.

BREWING INGREDIENTS AND METHODS

Since the name of the style mentions the brewing method, a little clarification is needed. Sometimes described as warm-fermented, the yeast used in altbier (and Kölsch) isn't really fermented as warm as most ales (although it is warmer than lagers). Normally the fermentation temperature is between 57–64 °F (14–18 °C).

In my opinion, the most important part about the fermentation regime is that the beer is subsequently lagered. Not cold-crashed, but properly lagered at near-freezing temperatures for between one and two months. Since the yeast is typically powdery and often is sulfur-producing, lagering is an important step in developing the smooth flavor profile of the finished beer. Fermentation byproducts are reduced and the beer becomes very clean and smooth.

The combination of a cool fermentation with an ale yeast followed by a cold lagering phase is why the beer is properly called a top-fermenting lager beer. It used to be called a hybrid style in the style guidelines but people misinterpreted that phrase. Some thought it meant using a combination of ale and lager yeast, but keep in mind that it really referred to both the yeast and the conditioning method that give the style its character.

Any yeast designed for altbier or Kölsch will work in this style, including White Labs WLP036 (Düsseldorf Alt Ale) yeast, Wyeast 1007 (German Ale), White Labs WLP011 (European Ale), Wyeast 2565 (Kölsch), White Labs WLP029 (German Ale/Kölsch) yeast, or Fermentis Safale K-97.

While the grist and mash programs can vary, there are a few essential aspects to the style. To get the dry finish with a fuller body, a more intensive mash program is required. Decoction mashes or step mashes are traditional. The goal is to achieve high attenuation and a dry finish while still retaining sufficient body to make the beer mouth-filling. These mash schedules may have a short protein rest (122–131 °F/50–55 °C), but will include rests in the beta amylase (136–149 °F/58–65 °C) and alpha amylase ranges (149–165 °F/65–74 °C).

Some grists are mostly Pilsner malt with a little color malt (medium crystal type malt) and a little roast malt for color, not flavor. Other grists can feature less Pilsner malt and more Vienna and/or Munich malts. The rich maltiness comes from the base malts and how they are mashed, not from character malt additions. Those other malts are simply for color adjustment. A common mistake is to rely too heavily on character malt additions that provide flavor in addition to color; an altbier should not have a roasted character or other heavily toasted or biscuity notes.

Continental (European) malts have the proper protein content to support more intensive mash schedules. Many American malts do as well, although they don't always have the richer flavor profile as their German cousins. English malts tend to have lower protein and won't work as well in this style, and tend to have more bready and biscuity flavors that are not really typical.

Düsseldorf water is similar to London, Dublin, and Munich, but brewers typically treat their water to remove carbonates. Brewers building their own water profile should shoot for a moderately hard water with balanced chlorides and sulfates. The finished beer does not have a distinctive water character, so as long as the mash pH is in a good range (5.1 to 5.3, measured at room temperature), the beer should be fine.

Hops play an important role in the character of an altbi-

Photo by Gordon Strong

er, especially in the bittering. The hops should have a smooth bitterness, not harsh, and the flavor and aroma should be relatively low but have an elegant noble hop character. The traditional finishing hop is Spalt, but other German noble hops such as Hallertauer and Tettnanger are appropriate. The goal is a hop that is a little peppery and spicy with floral notes. Bittering hops can be the same type, although using a higher alpha variety with a clean character such as Magnum can be more cost effective.

HOMEBREW EXAMPLE

My version of altbier is an aggressive take on the style, with specifications at the upper end of the range. It makes a malty beer with a strong bitterness and a dry finish. I've made other versions of this beer with a higher Munich malt content but it comes out more bock-like. A delicious beer to be sure, but less similar to the commercial examples I've tasted.

The base I used is mostly Pilsner and Munich malt with a little wheat for increased head retention and some Caramunich® and Carafa® for a coppery color. The decoction mash increases the malty impression, body, and color, while producing a highly fermentable beer. My choice for malts are German, such as Weyermann or Best Malz, for authenticity, flavor profile, and protein content.

My hop choice is Perle for bittering and the classic Spalt for flavor and aroma. I don't want a huge late-hop character, so I chose a modest addition. Perle provides clean bitterness, and Spalt has a very pleasant spicy quality.

I'm using the White Labs Düsseldorf yeast, mostly because I like the name. It can be harder to find, but I'll substitute other yeast I mentioned earlier that are available. I ferment cool, and lager it for a full two months. This is a beer I normally make during cold months so I take my time with it.

This is a style that I wish more people appreciated. I think it is a great style to make since it's often hard to find a good, fresh commercial example. It makes a great everyday beer, but you can't really rush it. When you take your time, prepare it in the traditional way,

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THURSDAY, MARCH 21, 2019

INSIDER TOURS OF ASHEVILLE CRAFT BREWERIES - You'll tour – and taste – at four different craft breweries around Asheville during this pre-Boot Camp offering. You'll have the opportunity to meet brewers and ask questions in addition to sampling beers. Includes a meal. A great way to kickoff your Boot Camp experience and check out some of Asheville's booming craft beer scene.

FRIDAY, MARCH 22, 2019 ASHEVILLE BOOT CAMPS

Each Boot Camp will run from 10 a.m. to 5 p.m. and is limited to just 35 people. Your boot camp includes lunch, a lunch keynote with Brian Grossman of Sierra Nevada Brewing, plus a post-Boot Camp Asheville Craft Beer Reception with local craft breweries pouring samples.

ADVANCED HOPPING TECHNIQUES – ***Josh Weikert*** – Join *BYO* Contributing Writer Josh Weikert as he explores when and how to add hops to create awesome hop-forward beers. You'll cover timing and techniques of hop usage including mash hopping, boil hopping, whirlpool/knockout hop stand additions, and dry hopping. You'll cover hop varietal choices, hop pairing/blending, evaluating hops including hop rubbing and sensory training, water adjustments and much more to get the most out of your hops and into your glass. *Please note this workshop will also be offered on Saturday as well.*

TROUBLESHOOTING HOMEBREW FAULTS & FIXES – ***Ashton Lewis*** – Join *Brew Your Own*'s Mr. Wizard and Technical Editor Ashton Lewis as he walks you through the potential minefield of beer flaws and faults homebrewers can face. You'll learn how to troubleshoot – and fix! – your own homebrews with Ashton who has helped thousands of homebrewers over the last 20 years as *BYO*'s Mr. Wizard. You'll have the chance to experience many faults first-hand to better recognize them later.

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

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

BARRELS & WOOD-AGING – ***Michael Tonsmeire*** – Learn how to choose, use, and maintain oak barrels – and oak alternatives – for your brewing. Barrels are a significant investment in money, time, and beer so understanding how to properly select and use them is essential. Learn hands-on from *Brew Your Own* Columnist and *American Sour Beers* book author Michael Tonsmeire. Michael will also cover options for barrel alternatives and how to best use the broad variety of available products such as chips, staves, and spirals including both oak and non-oak alternatives. This full-day workshop will also cover special brewing and recipe considerations to making beers to complement the flavors of woods, spirits, and wines to take your wood-aged beers to a new level.

HOMEBREW EXPERIMENTS – ***Denny Conn and Marshall Schott*** – Developing your own recipes, refining your own brewing techniques, and tweaking your equipment set-up all require the know-how to conduct your own homebrew experiments. Without reliable results you rely on guesswork instead of facts to improve your brewing. Join two of the true leaders in experimenting with homebrews – podcaster/book author Denny Conn from Experimental Brewing and blogger/podcaster Marshall Schott from Brülosophy – as they first walk you through how to properly conduct your own experiments at home including structured blind evaluation techniques, and then walk you through some real life homebrew case studies to show how these experiments can play out. Get ready to roll up your sleeves and get your science on! *Please note this workshop will also be offered on Saturday as well.*

ADVANCED RECIPE FORMULATION – ***Brad Smith*** – Create your own signature recipes and learn the keys to developing the specific grain bill, hop schedule, and ingredient proportions to meet your homebrewing goals. Brad Smith, *BYO* Contributor and BeerSmith software owner, has helped thousands of homebrewers design their own beer recipes and now you'll learn first-hand from this recipe building expert how to use both artistic and scientific approaches to beer design to end up with the beer you envisioned in your glass. You'll also explore ingredients, techniques, and understanding your own brewing system. *Please note this workshop will also be offered on Saturday as well.*

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

TWO-DAY BOOTCAMP: COMMERCIAL BREWERY START-UP – ***Steve Parkes*** – When you register for this Boot Camp you will attend it for both Friday and Saturday unlike our other offerings to better cover more material in greater depth. Opening a commercial craft brewery is a far cry from just ramping up the amount of beer you brew. Over Friday and Saturday you'll walk through the steps, planning decisions, and keys you need to know on both the brewing and management side to successfully open a commercial craft brewery with the Lead Instructor and Owner of the American Brewers Guild Steve Parkes, who has trained hundreds of professional brewers. Learn from Steve's decades of expertise and wide range of experience to help you better achieve your goals. Over two full days you'll be guided through all the various elements you'll have to know for the next big step toward starting a craft brewery.

SATURDAY, MARCH 23, 2019 ASHEVILLE BOOT CAMPS

Each Boot Camp will run from 10 a.m. to 5 p.m. and is limited to 35 people. Your Boot Camp includes lunch, a *BYO* Columnist Q&A lunch keynote, plus a post-Boot Camp Asheville Craft Beer Reception with local craft breweries pouring samples to wrap up your full day.

SOUR BEER TECHNIQUES – ***Michael Tonsmeire*** – Learn hands-on traditional European as well as newer American methods to produce sour and funky beers from Michael Tonsmeire, the *Brew Your Own* Columnist who literally wrote the book on the subject with *American Sour Beers*. Michael will demonstrate the unique skills needed to create your own delicious sour beers including wort production (extract and all-grain), growing alternative microbes, blending, aging on fruit, and sanitation. The focus will be on practical topics difficult to convey by words alone, so no biology or chemistry degree required. You'll leave with a clear understanding of the processes to reliably produce sour beers suited to your palate and desired time frame.

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

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

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

Due to many requests we are repeating four of our most popular Boot Camp topics from Friday again on Saturday to give more people the opportunity to register for the following workshops that have all sold out at prior locations.

ADVANCED HOPPING TECHNIQUES – ***Josh Weikert*** – Join *BYO* Contributor Writer Josh Weikert as he explores when and how to add hops to create awesome hop-forward beers. You'll cover timing and techniques of hop usage including mash hopping, boil hopping, whirlpool/knockout hop stand additions, and dry hopping. You'll cover hop varietal choices, hop pairing/blending, evaluating hops including hop rubbing and sensory training, water adjustments and much more to get the most out of your hops and into your glass. *Please note this workshop will also be offered on Friday as well.*

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SUNDAY, MARCH 24, 2019

INSIDER TOURS OF ASHEVILLE CRAFT BREWERIES

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

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Friday, March 22, 2019

- ❑ Advanced Recipe Formulation
- ❑ Barrels & Wood-Aging
- ❑ Advanced Hopping Techniques
- ❑ Troubleshooting Homebrew Faults & Fixes
- ❑ Advanced All-Grain Techniques
- ❑ Homebrew Experiments
- ❑ All-Grain Brewing Essentials
- ❑ Advanced Yeast Techniques

Saturday, March 23, 2019

- ❑ Hands-On Homebrew Science
- ❑ Sour Beer Techniques
- ❑ Brewing Water Adjustments
- ❑ Advanced Yeast Lab

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AVOID BREWER'S BLOCK

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RECIPE INSPIRATION IS ALL AROUND US

by Jason Simmons

There are endless ways to brew a tasty beer, but sometimes we all get writer's block — or in this case, brewer's block — and are not sure what to brew next. When the tried and true recipes and ingredients are starting to become mundane and you can't seem to think of a recipe that excites you, it's amazing how often ideas strike if you just keep your eyes and ears open to possible influences that we encounter daily. When I have any issues coming up with a new recipe idea I will go over the following list of topics in search of brewing inspiration.

WATER SOURCE

Whether you are an amateur brewer or a water guru, having a basic understanding of your water source and profile will be a great deal of help by telling you where your starting point is with writing a recipe. This is true even if you plan on leaving the water untreated with salts. I have three separate 5-gallon (19-L) water jugs that I specifically use for collecting water from outside my home for my homebrew batches. Some of my alternative water sources come from tap water from a travel destination, a particular brewery, mountain spring run off, mountain streams, unique well water, rain, and snow.

I have been blessed with living in some secluded areas of the Appalachian region, and have always been able to find a clean source of water. My advice to sourcing water is to pay attention to your surroundings. Where are you located, and what is up stream? Even snow and rain in the cleanest of areas collects dirt and smog from the atmosphere. Once collected (and melted if snow) you will notice the dirt settling and oils, if any, floating on top. I always take the middle clean section and run it through a carbon filter before brewery use, discarding the wastewater. It is amazing how your beer's final taste will differ when using different water sources. If collecting water is not an option for you, you can always use distilled water and build to style.

STYLE & HISTORICAL PROCEDURES

We all have our favorite styles that we have brewed time and time again. Once your taste buds are ready for a change we can look at the endless styles of beer that are out there. As a professional brewer, I have found joy in brewing my lesser favorite beer styles just to see if I can do it well. A beer style is not just a flavor of beer, rather a historical picture of time, location, and procedures of the time period showcased in a glass. Each region of the world has spent thousands of years perfecting and refining their brewing techniques to produce the best beer they could with what was available to them. Many of these variables include water, climate, and agriculture issues that will bring about many styles of mashing, lautering, boiling, airborne yeast, cellaring practices, and serving methods.

The ingredients will vary from region to region, along with the brewing practices, as they are unique to that location. Most brewing methods are similar with a few minor differences. Brewing a style in the way it would historically have been brewed can be a fun change of pace and may incorporate things like: Cereal mashes, step mashes, turbid mashes, decoction mashes, caramelized wort with removing crystal malts, kettle reductions/extended boils, open fermentation, and the use of coolships, just to name a few.

When you get into beers with specific requirements such as the German Reinheitsgebot or the Campaign for Real Ale (CAMRA), you end up building your recipes based on those requirements.

Another fun way I have found to brew a batch of beer is to build a fire pit, and brew over a campfire like they did many moons ago. It adds a few more hours to your brew day, but the journey is definitely worth it.

NEW INGREDIENTS

Amarillo®, Huell Melon, Black Prinz®, Golden Naked Oats, and honey malt. I remember when these products first hit the market, and we all wanted to try them in our upcoming beers. We are lucky to be in an age where our farmers, maltsters, and yeast biologists are always coming up with new products quicker than we can try them. Pick your favorite new ingredient, or even a random one you haven't brewed with before, and build a recipe around it to showcase that ingredient. You may just find a favorite you'll add to your regular brewing schedule.

SHOP FOR LOCAL INGREDIENTS

Supporting local businesses is always a great thing to do to help your community. Do you have a favorite coffee shop, produce stand, or corner mom and pop store that offers fresh or organic local products? Or you can go the more traditional route with brewing ingredients — in the past few years there have been a number of hop and barley farms, as well as malting companies popping up in many states to choose from. Look around and see what is available to you.

By going to the farmers markets you are not only supporting your local farmers, but you will have access to some of the finest and freshest produce that you can get. The majority of the time you will be able to talk directly to the farmers who grew and cared for the produce, which can help in formulating a proper recipe. The farmers and staff usually enjoy hearing about how their products are being used, especially when it's for something as awesome and unique as brewing beer. There are various ingredients that you can find at your farmers market depending on your location, and from my experience, they are reasonably priced. When looking at ingredients you can choose either simple sugars like fruit and honeys, or starches like pumpkins, sweet potatoes, and grains. I have also seen a wide range of spices that could be used for brewing, and some places you can even buy herb plants from which you can pick and dry ingredients for beers.

Photo by Jason Simmons

I used cherry wood to smoke malts at home, offering a unique flavor to a recipe.

HOME PROJECTS

For me this is where I like to get many of my brewing ideas. Most of these home projects are single projects that each take a great deal of time to do, or even master over the years. Gardening and growing brewing ingredients is a hobby into itself, which is why it will get its own section later. Even on a professional level I enjoy putting in the extra effort by doing special unique techniques like home toasting malts (even if it is 200 lbs./90 kg), smoking malts in a pan on the grill, or French pressing a barrel's worth of espresso 8 oz./237 mL at a time. Doing home projects that add to the beer flavor, or spirit of the beer, not only makes for a great beer and story, but it also expands your knowledge in topics that you normally might not have gotten involved with.

Other home projects could include home malting, beekeeping for honey, home coffee roasting, making homemade candi sugar using your favorite sugar source, using your favorite wood (like cherry, apple, peach, hickory) to smoke your favorite base malt, building new equipment and gadgets, or even building a yeast library. Any project that you undertake will no doubt take a bit of your time, giving you plenty of time to plan a beer recipe around your project goals.

Many beer ingredients can be grown at home, with hops likely being the most popular.

Photo courtesy of Shutterstock.com

Spruce tips can be foraged in the spring and then used to brew a variety of beer styles. Recipes can be planned around harvest dates for foraged ingredients if you know when to harvest.

GARDENING

I have fond memories as a child helping family members in the garden, and have found agriculture to be fun. As I got older and took an interest in brewing beer, I began to pay more attention to the soil and nutrient needs of what I was growing. Gardening takes a bit of dedication, knowledge, and trial and error to fully master the craft, however the feeling of pride you get when you reap a great harvest is amazing. Right now I have a 12-year-old Cascade hop plant that keeps getting ridiculously bigger each year, and I have been doing small trial and error barley plots for three years. There are plenty of brewing ingredients that you can grow to use in your recipes. Things such as: Barley, wheat, oats, rye, berries, stone fruits, melons, corn, sweet potatoes, yams, pumpkins and other gourds, or even hot peppers if you're brave enough. Remember that gardening is not just growing something, it is also harvesting and properly packaging it. It took me three years of hop harvests to fully get down home drying and packaging techniques.

FORAGING

I love to hike the forests with my family, and we have learned that nature provides many snacks for us if we know what to look for. Because of this, I have picked up the hobby of understanding local plants and foraging for nature's treats. I once had massive blackberry and raspberry bushes that I was able to harvest enough berries to dose into a few kegs of a Buffalo Trace Bourbon barrel aged Belgian blond. There are endless styles that you can choose from, however the most adaptable style for foraging would be gruits.

Start at the beginning of the year by keeping notes on what times each plant starts to sprout, grow, bloom, and is ready for harvest. Some of my favorite plants to keep an eye on for brewing purposes are dandelions, chicory roots (which I roast), yarrow, raspberries, wild cherries, wild blueberries, brambles, blackberries, wineberries, mulberries, a variety of nuts, blue spruce tips, rose hips and petals, thistle, and wild apples, pears, and peaches for ciders. Some of the more extreme versions of foraging that I

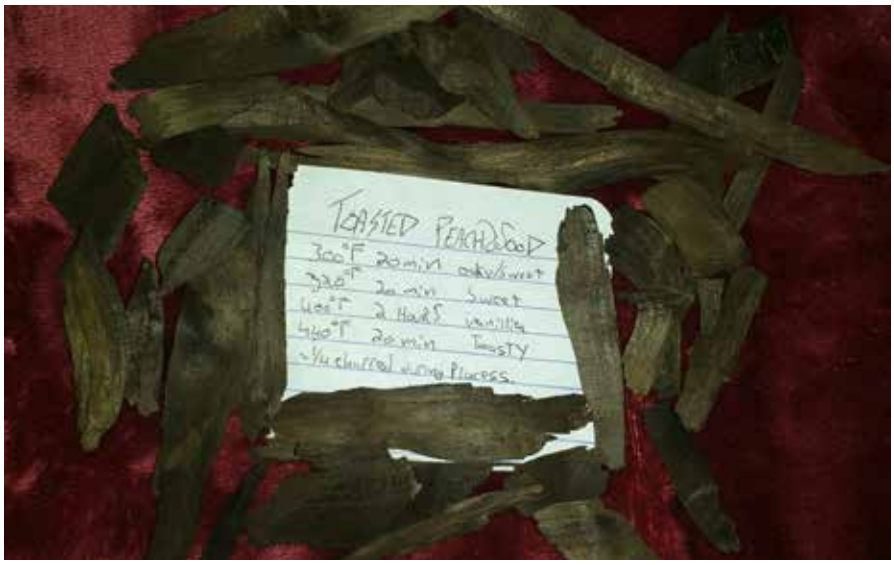

Photo by Jason Simmons

Peachwood is a personal favorite of mine to age beer on, and toasting my own makes it even more unique of an experience and final beer.

have done for beer was collecting red seaweed and kelp from the ocean to use as my Irish moss additions, hiked two miles off a mountain side with a hand truck and jugs to collect mountain spring water, located a cherry tree in the woods then chopped a portion off for smoking Munich malt, and went into the rainforest in the Dominican Republic to get fresh vanilla bean that was pressed into an extract.

Before you start foraging, a word of warning: Always know 100% the identity of the plant that you are working with. Some mistaken plant identities can prove to be a fatal choice. I would also advise against foraging for honey and mushrooms due to the hazard risk involved. Leave those to trained professionals, assuming that you are not one.

WOOD

Smoking Grains:

We have already discussed foraging for wood for smoking grains. If you can't forage for your wood, you can call your local lumberyard and ask for fresh or untreated rejected pieces of your choice of variety. Tree services and many online marketplaces are also a great place to source fresh wood.

Toasting Wood For Aging:

Instead of using it to smoke grains, you can also toast wood and use it to age beer on. In the past year I have been doing research with toasting wood for aging purposes and, with the help of the famous wood toasting chart floating around on the internet, came up with my favorite toasting schedule outlined below (note: while this procedure has never caused the wood to catch fire for me, it is a good idea to closely monitor what is happening in case of a fire):

1. Preheat the oven to 300 °F (149 °C). Spread the wood chips over a cooking tray, then place in the oven once it reaches temperature.

2. Bake the wood at 300 °F (149 °C) for 20 minutes as this temperature promotes an oaky/sweet character.

3. Raise the oven temperature to 320 °F (160 °C) and once at temperature, bake for 20 minutes. This temperature promotes a full sweetness character in the wood.

4. Raise the oven temperature to 400 °F (204 °C) and once at temperature bake for two hours to promote a rich vanilla character.

5. Raise the oven temperature to 440°F (227 °C) for 20 minutes to promote a toasty character.

6. Turn off the oven, then take out the baking tray to set aside on the stove top to let cool. Roughly a quarter of

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the toasted wood will have a light char (charcoal) to it, and might have red hot embers in some spots. The char should be similar to the char of a commercial oak whiskey barrel.

Once the wood has cooled down it is ready to be used, or it can be packaged in a sealable sandwich bag for later use. You can use this process as a guide and play around with the temperatures, times, and char level to meet your liking. You can also use many different wood varieties, however the oak varieties are the most common. (That said, I highly suggest trying peachwood). You can take this process a step further by soaking the toasted wood in your favorite spirits before adding it to your beer for aging.

Barrels:

Wooden cask barrels are fun to work with, but can be tricky. The classic barrel size is a 53-gallon (200-L) oak barrel freshly emptied from the distillery, leaving much essence inside, however smaller sizes are also available. Depending on styles and storage conditions, you can usually get a couple uses out of a barrel before the flavor contributions from the barrel are minimalized. After your second use, if the staves are still intact, you can get more uses if aging sours. Keep in mind that different sizes, storing temperatures, humidities, and other atmospheric factors will play a major factor on when it is time it rack the beer out of the barrel.

YEAST

Base your recipes off of new yeast strains that you haven't used. Along with new strains from the companies homebrewers are most familiar with, there are a handful of smaller yeast manufacturers out there selling unique strains — you might be surprised by the new selection if you haven't searched in a while. Another fun thing to do is to blend yeast strains, especially lager and ale strains. If you are ready for more advanced practices you can do bottle yeast harvest or wild yeast isolations (for more on how to harvest your own yeast, here's an article on the subject: https://byo.com/article/harvesting-yeast-techniques). Or, instead of trying new strains, you can designate a "house strain" and see how many generations you can take it by making a lineage chart.

CLONES

We all have that one beer that we absolutely love. Some professional brewers have no problem helping you out with a clone recipe or just flat out give you their brewing notes with all the brewing specs. However, other brewers may be contracted by their employers to not give out any information. No matter what path you choose, making clones and doing side by side taste testing is always a fun experience. Learn more about formulating clone recipes here: https://byo.com/article/improving-cloning-skills.

TYPE OF BUBBLES

Most people find their favorite way to carbonate their beers and stick to that process. Usually it is force carbonation for kegs or adding priming sugar for bottles. There are many ways to create bubbles to help enhance your recipe. If you have a way of using a spunding valve (building instructions can be found in this article: https://byo.com/project/build-your-own-spunding-valve-to-carbonate-in-the-keg/) then you can cap off your fermenter using natural carbonation for your beer.

There are plenty of other sugars that you can use to prime a beer, such as: Table sugar, beet sugar, brown sugar, molasses, honey (many unique varieties), and maple syrups. I once made an Oreo cream porter carbonating it with the vanilla cream center fillings (it worked well, but there was a lot of wax to deal with).

Once you feel like going the extra step, take a look into the CAMRA requirements. Working with pins, firkins, and casks are one of my favorite things to play with. A well-made cask ale is a glass full of joy in my opinion. Choose a style that goes well with lower carbonation levels for these types of beer.

AGING/VINTAGE BATCHES

Another idea you may want to try is brewing a beer with the purpose of long-term aging. Designing a beer that will age well, one that will blend and mature into one harmonious beer over time, can be a rewarding exercise. You can either age in a keg, or packaged in bottles. The neat thing about kegs is that you can age a hoppy beer and redose it with dry hops before packaging. If you grow your own hops, or have your favorite recipe with one thing changed each year, then you can brew a vintage series.

CONCLUSION

The more you know about beer styles, their cultural history, brewing practices, and ingredients of that area or time period, the greater the list of ideas to produce a unique (to you) beer becomes. As with most brewing habits around the world, use what is local and easily available to you. There are plenty of great brewing opportunities as long as you keep a watchful eye out.

While looking at pictures to choose from for this write up, it brought back many great memories. My family and children have always been there to participate in these brewing projects. Gardening lessons, harvesting hops and barley, long hikes to collect berries and water for projects, and eating lots of Oreos. Beer is much more than a beverage if you look at it from a different perspective. This way of thinking should give you endless recipe and beer style ideas for your next batch. BYO

RELATED LINKS:

• There was a long time when nature was humanity's supermarket, pharmacy, and even homebrewing store. When our ancestors wanted a beer they first had to gather and process grain to provide sugar, capture wild yeast to convert that sugar into alcohol, and forage seasonings to balance both the residual sweetness and questionable fermentation character. *BYO* digital members can read more about foraging ingredients for your homebrewing here: https://byo.com/article/foraging-brewing-ingredients

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BEER TO GLASS

WHY GLASS STYLES MATTER

by Jadon Flores

There's nothing quite as satisfying as going to your local brewery and getting a glass of beautiful brew to enjoy. Most of us don't think too much about the glassware our beer is served in, but we should. A world-class beer's best characteristics that make it stand out from lesser beers can be ruined with the wrong glass. You might be thinking, "well that seems a little extreme . . ." but consider this for a moment, in Belgium, nearly every brewery has their own specific glassware for the beer to be served in. Many places will not serve you until the proper glass becomes available should they all currently be in use. Why in the world do they take their beer service so seriously? While some of the bias and tradition may be thanks to marketing, the style of glassware can make the experience of the beer better!

Let's start with some background on how glassware became such an iconic part of beer service and why the "right" type of glass, meaning a glass that allows the consumer the best experience from a beer, can make the difference. Before the industrial revolution in Europe, most beverages were consumed out of earthenware mugs and steins. Only the rich were able to drink out of expensive, hand-blown glassware. Starting in the 1840s though, technology became available for mass production of not only glass bottles but glassware as well. With the addition of the growth of better industrial filtration methods for beer, the popularity of glassware over earthenware grew rapidly as patrons were able to gaze at the beauty of their beers' color and clarity. From the popularity grew the creativity of different styles, faceted and dimpled, with and without stems, along with flared tulip-styled rims.

Conducting an experiment with other brewers, we poured the same beer in a (left to right) shaker pint, Spiegelau IPA, Belgian tulip, Teku, Glencairn scotch, and Samuel Adams glass to assess the different aromas each glass accentuated.

As much of tasting is not only orthonasal (what we detect by sniffing, far up the nasal cavities), what we might refer to as "true smell" — but also retronasal (what we detect when aroma molecules move onto our nasal bulb from inside of the mouth). That being said, aroma can impact the flavor of the beer immensely! (If you don't believe it, try eating with your nose closed.) Neurogastronomy comes into effect from here. Simply put, this is how the brain interprets chemical compounds taken in by our nose and mouth and translates it into recognizable flavors and aromas. At varying temperatures, certain aromas and flavors become much more pronounced while others fade away. These chemical compounds may also wildly change in our minds by the shape of the glass.

Beer glassware is important for another reason too — carbonation. In a can or bottle, the beer holds onto its dissolved CO_2, which means later on, you might be a little gassier or bloated from drinking straight out of the bottle. Pouring a beer into a glass allows for the release of excessive CO_2 and carbonation and opens up the beer to a better variety of flavors and aromas. To pour a proper beer with the right amount of head that will release a good amount of excessive CO_2 is simple — hold the glass at a 45 degree angle, slowly pouring the beer down the side of the glass until you are around two-thirds full, then tilt the glass straight up to a 90 degree angle, allowing the head to form to around a half inch to an inch (1–2.5 cm) depending on beer style.

There are three main factors as to why each glass is different and why some are better suited for certain styles: Aroma, taste, and appearance. Let's start with aroma.

AROMA

In a recent demonstration I held with a few other homebrewers and pro brewers, we took classic styles and put the beers in various glasses to show the difference in not only serving style and head retention, but specifically the impact of glassware on aromatics. Fairly consistent factors for all styles were head retention based on the type of glass. The smaller circumference of glassware such as a footed Pilsner glass, weissbier glass, and Champagne flute all allowed the head to stay for a much longer time but stifled the aromatics as they don't leave enough room for you to swirl your beer. In larger circumference glassware such as a standard tulip, red wine glass, and snifter, the head would dissipate fairly quickly but because of the large bowl surface, allowed the aromatics to be brought out much better.

In this same demonstration, we used a commercially available IPA to represent the West Coast IPA style with various glassware. We compared the IPA in a shaker pint, a Belgian tulip, a Teku, a Spiegelau IPA glass, a Glencairn scotch glass, and a Samuel Adams proprietary glass. Our collective pre-pour opinions leaned away from the pint glass, and towards the Teku, Spiegelau, and tulip glassware. As we smelled each glass, compared and discussed, what we found surprised us. We all hated the tulip, as it

brought to the forefront a vegetal and astringent bitterness on the nose. The Teku left us underwhelmed, but much more fruit-forward and dank, while the Spiegelau left the beer slightly more sweet smelling with citrus and lemon, and even a slight reminiscence of peach rings candy. The Glencairn shot forth vegetal and carrot notes that were less than pleasing. The shaker pint was, no surprise, boring and muted on all fronts.

The winner by a long shot was the Samuel Adams proprietary glass designed by Jim Koch himself for Boston Lager. The glass lent itself to an uncanny ability to swirl your beer, mixed with the internal laser etching at the base, releasing aromatics of orange, tropical fruits, a distinct hop palate, brown sugar, and cotton candy, and our favorite part — no vegetal notes.

An interesting result of this test showed that the two glasses that most funnel aromas into the nose — the Belgian tulip and Glencairn glasses — were the two in which a vegetal character was detected. This led us to believe the beer wasn't the best for taste and aroma but that the Glencairn and the tulip were actually *better* for sensory panels. It should be pointed out, that tulip glasses are one of the most common for aroma tests because of how the design funnels aromas to the nose.

While the Samuel Adams glass resulted in the most enjoyable experience, it may not be the best glass from a sensory panel view as far as expressing the full aroma including flaws. This brought up an interesting debate when it came to the amount of other aromas and flavors we were able to perceive using this glass. Still, after that particular beer panel, our hats went off to Jim — his two years of hard work paid off to create an excellent beer glass resulting an a great beer drinking experience.

TASTE

A classic beer to taste, partially due to its naturally ever-evolving flavor and aroma from batch to batch, is the Belgian monolith, Orval. If we were focused on our orthonasal senses before with the IPA, gathering and analyzing the aromas contributed or relinquished with different shaped glassware, we honed in on the retronasal this time. For Orval, we experimented using a traditional Orval branded chalice, a shaker pint, a red wine glass, a Teku, a brandy snifter, and a Glencairn scotch glass. Using the aromatic qualities, be they good or bad, of each glass, we noticed a significant difference in flavor between blind tastings.

From our least favorite, the red wine glass, we noticed a stark minerality, especially limestone, with a hint of noble hop spice, followed by the shaker pint, which although having good head retention, lacked the *Brettanomyces* character, and lent itself to more of a dry, catty grape juice flavor rather than the beautiful Belgian pale ale it is. Next was the brandy snifter, which had low carbonation and all our

palates saw differently, ranging from skunky with high minerality, to bright and citrusy with a hint of soapiness, to a great hop character with muted Belgian esters. From there we all loved the classic style of the Orval chalice and noted how it emphasized the beer's *Brett* and hoppy character, but we were split on what we thought was the best glass between the Teku and the Glencairn. Both glasses brought Orval to a floral, earthy front with a nice hop profile and spicy Belgian esters.

As far as taste was concerned, the best glasses were the Teku and Glencairn, however we all agreed as far as presentation and nostalgia, regardless of taste, the magnificently branded Orval chalice was the pick, which brings us to our final reason for glassware.

APPEARANCE

Appearance has been a main driving force for glassware for over a century and a half. New glassware for the masses is one of the reasons that drove Pilsner's popularity, as consumers saw the crystal brightness, how the yellow color kissed the light. Beer's color and appearance is the reason dimpled glass steins run from Munich, Germany to Los Angeles, California during Oktoberfest season, red-hued Märzens and amber-yellow Vienna lagers sparkling against the facets as the top inch (2.5 cm) and lip hold in a dense but soft head. Aesthetics can make any product sell better, ask anyone in marketing, and beer is no different. (Orval had our hearts over our minds in the aroma section because of this!) A glass with an interesting shape, maybe some sexy curves, throw in a stem and you have the makings of an attractive beer glass, depending on the beer.

A short stubby stem has the potential to give a glass a sense of sophistication while allowing the owner to firmly grasp their hand around the basin, gently warming it with their hand, releasing dark and rich tones of the beer, or adversely opposite, allowing the drinker to keep their hand away from the basin, keeping the beer colder. A great example of this is an imperial stout served in a snifter or brandy glass. Right out of the fridge, this beer will provide a soft, dark roast and milk chocolate, but this same beer when warmed from 40 to 50 °F (4 to 10 °C), suddenly turns from a quaint quartet to a full symphony. The crescendo of chocolate and dried fruits like raisins and prunes, hints of Sherry, tiramisu-like savoriness, all combine, churning around in a glorious fishbowl on a pedestal.

In some cases of our little tasting experiment, we were pleasantly surprised by how the glassware affected the experience of the beer. The best beer to use for this subject was Consecration from Russian River Brewing, using a pint glass — the horror to Vinnie Cilurzo — a Teku, a tulip, a Glencairn, a Pilsner glass, and a Cham-

Photo by Shutterstock.com

In Belgium, Orval's beers are always served in the brewery's specially designed chalices.

pagne flute. As far as aesthetics, the shaker pint fell far away. Although the Pilsner glass maintained a slight head retention, it did not complement the ruby red color like the flute, which was definitely lacking in aroma and taste but looked gorgeous when poured. Very untraditional, but based on the color, very fitting, the Glencairn showed a rich eminence of red tint and complemented the beer, giving it a rich and decadent quality. Then we had the very classic tulip, which makes any beer look timeless, but shockingly did not do any justice to Consecration, making it almost taste dusty and vegetal in comparison to the other glasses. On a more modern take and with growing popularity, the Teku made a far standing in all three categories, looking refined and elegant while being utilitarian and enhancing the aromatics as well as the flavor.

BEER GLASS DESIGN

Regardless of how a glass might look at first glance, many glasses are designed to be beneficial for every aspect of the enhancement of certain styles of beer. But, based on the lip of the glass, they also control the amount of liquid that is physically able to be released at one time. Shaker pints (oddly misnamed as they rarely hold a "pint" of liquid) grew in popularity around the 1980s and not only were they used by the bartender to obviously shake up your whiskey drink, but they allowed patrons to guzzle sessionable beers at a faster rate, allowing bars to sell more beer in a faster time. They were also cheap, durable, stackable, and utilitarian for bars and microbreweries. In comparison to the shaker pint, a Pokal, with its inward tapering, only allows the mouth to take in approximately an ounce (30 mL) at a time instead of multiple ounces at once. The amount of liquid naturally restricted by the glass is an important factor in terms of consumption speed when it comes to higher ABV beers such as double IPAs, scotch ales, and barleywines, so the consumer doesn't go "too hard, too fast."

Stems are usually incorporated into glassware as a way to either make holding the glass easier, to maintain minimum hand contact with the base of the vessel for liquid temperature, or to increase the ease of swirling the liquid in the glass for the beverages' aromatic qualities. In many cases it's a bit of all three. A commonality you gather from many, specifically Belgian, glasses is the outward tapering to what we perceive as the classic tulip shape. This outward shooting lip, nicknamed for its flower-like appearance, serves a twofold purpose, the first of which is head retention as the shape allows for the beer head to be cradled in the half inch to inch of glass (1 to 2.5 cm), and the second of which is to allow the aroma of the beer to float to the nose better. The ease at which you can swish your beer in a tulip style glass is tenaciously designed for aromatic beers such as Belgians, sours, and noble hop-forward beers.

Height of glassware can be another factor brought to the table, such as in Pilsner and weissbier glasses. Pilsner "flutes" came pretty early and became quickly the most varied in 19th century Europe, with the thin, tall walls of the glass showcasing the light-yellow color with brilliant lager clarity, and a steady stream of bubbles stemming from the bottom nucleation to an effervescent, white head. Meanwhile the sturdy, slightly chunky weissbier glass, meant to reflect the light against

COMMON GLASSES/BEER STYLE PAIRINGS

Shaker pint: Commonly used for American pale ales, ambers, IPAs, but were never designed for beer and it shows in flavor, aroma, and overall appearance.

Snifter: Imperial stouts, barleywines, and other rich, dark, and high-ABV beverages.

Stein and Bavarian Seidel: Imperial stouts, barleywines, and other rich, dark, and high-ABV beverages.

Stemmed (Belgian) Tulip: Belgian and aromatic beers. Usually a very versatile vessel for most beers as it allows room for supporting the head and holds in aromas wonderfully.

Chalice/goblet: Indicative of classic abbey and Trappist ales.

English Tulip: Most commonly used for Irish stouts such as Guinness.

Nonic Pint (or imperial pint): Used for most English ales, the bump allows for glass stability and ease of holding while standing.

Tapered Pilsner: The base allows for stability while the height gives free form of the pale colored beers and thin tapering holds in dense but effervescent head.

Weissbier: Designed for wheat beers, especially to hold the thick, dense, and creamy head.

Pokal: Most commonly has a slight inward taper to concentrate head, with a stubby stem to keep the beer from being warmed by the hands. Most commonly used for bocks, imperial stouts, imperial IPAs, tripels, and other strong ABV beers because of the small serving size.

the hazy grandeur of hefeweizens and other wheat beers, while allowing the wide mouth for a solid three fingers of head.

GLASSWARE CARE

Proper glass cleaning, maintenance, and storage is fairly simple, as most glasses can be rinsed with normal dish soap so long as rinsed thoroughly to prevent the soap from interfering with head retention, then dried upside down in a rack with allowance for plenty of airflow to naturally dry the glass. There are more complicated ways of cleaning your glasses such as the three stage method applied at restaurants and breweries, which is hot soapy water, a thorough rinse with cold water and then a 30-second sanitizer, which may vary by chemical manufacturers. But, in most cases without excessive hard water, rinsing the glass after use and rinsing once more before pouring tends to do the trick pretty well I've found, except in cases where lipstick or oils and fats from food have gotten in the way. Before pouring your beer, you may try a quick test by sprinkling salt inside the glass to test for proper cleaning methods. If the salt sticks around the glass uniformly, the glass is "beer clean," while oils will prevent the salt from sticking in areas. The best ways to tell if a glass is "beer clean" is first and foremost, are there bubbles on the walls of the glass? Does the foam from the head lace the beer in concentric circles as your drink? If you answer yes to both, then your glass is beer-clean.

As far as storage goes, the most common practice is to keep glasses in a closed area such as a cabinet to prevent dust build up in and outside of the glass. For my personal preference, I like to keep my glasses stored upside down to prevent dust build up. Never leave your glasses/mugs in the freezer, as ice crystals form and will water down your beer, not to mention, beer should on average be served around 39–42 °F (4–6 °C) for the best flavor and aromatics, depending on the beer style. So if you store your beer in your fridge, there is really no benefit to pouring beer into a cold glass. BYO

RELATED LINKS:

• Learn more about each of the most popular beer glasses in this story available to BYO digital members: https://byo.com/article/choosing-glassware-to-showcase-your-brew

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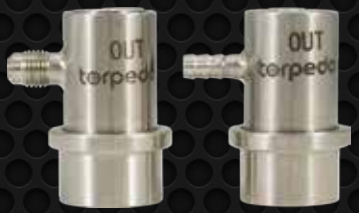

TORPEDO™ QUICK DISCONNECTS

Vienna Lager

Brewing the Austrian beer style rescued by Mexico

by Dave Clark & Mike Habrat

Who knew a Vienna-style lager would change my life? The year was 1990 and a friend and I were on a weekend getaway to ride roller coasters at Kings Island amusement park outside Cincinnati, Ohio. On the drive there, the skies opened and rain came crashing down, effectively eliminating the amusement park from that day's plans. Instead, we spotted a highway sign pointing us to a brewery called Oldenberg, just across the Ohio border in the small town of Ft. Mitchell, Kentucky. Making mostly German-style beers, Oldenberg offered a brewery tour followed by a sampling of the beers. One sip of their flagship offering, a Vienna-style lager named OPV (Oldenberg Premium Verum), turned out to be a life-changing experience.

From that day forward, I was hooked on this thing then called "microbrew." After my initial introduction to OPV, I began to seek out new beers anywhere and everywhere. My interest became a passion — almost an obsession. Today, I write this article as a former professional brewer, a Beer Judge Certification Program master judge, and Certified Cicerone who is currently authoring a beer book about the Phoenix, Arizona beer scene. My extensive beer journey started with that accidental encounter with a Vienna lager. If you've never had the pleasure of experiencing the style, I suggest you try one. It may change your life too.

- Dave Clark

Photo courtesy of Shutterstock.com

WHAT IS A VIENNA LAGER?

Reddish-amber in color, the bottom-fermented Vienna lager was founded in 1841 near the city bearing its name. Created by Anton Dreher, Brewmaster/Owner of The Schwechat Brewery, Dreher's new approach to brewing changed the way people thought about beer — but more on that later.

Constructed with a depth of malt flavor, subtle hopping, and a clean, crisp finish, Vienna lager is a style that virtually died out in its land of origin, then found a rebirth halfway around the world with a whole new interpretation of the style.

Mild bitterness and subtle flavor from Bavarian noble hops balance the developed malt profile. A lager beer, free of esters and other fermentation characteristics, this medium-bodied and moderately carbonated beer is packed with flavor, yet easy drinking and a fantastic complement to many dishes.

CREATION OF A NEW STYLE

Klein Schwechat, a town located southeast of Austria's capital city of Vienna, was the home of Schwechat Brewery since 1796. Owned and operated by Franz Anton Dreher, this unassuming brewery produced traditional beers for the locals. Upon Franz Dreher's untimely death in 1820, ownership of the brewery was passed along to his young son, Anton Dreher.

It was years before Anton came of age and learned the skills needed to take over control of the brewery, but when he eventually did in 1836, he maximized his opportunity. Fully immersing himself in his brewing studies, Dreher had a passion for learning and was always looking for new ways to improve through innovation.

Just as brewers interact with each other today to learn new techniques and best practices, it was no different in Dreher's day. At his relatively young age, Dreher was more than willing to strike up relationships with others in the field to hone his craft. A kinship was struck with Gabriel Sedlmayr, Brewmaster/Owner of the Munich-based Spaten Brewery. The two became fast friends and often traveled together to learn what they could in other brewing centers around Europe.

News spread regarding groundbreaking malt-kilning techniques happening in England that produced malts that resulted in paler beer styles with entirely new flavors. Prior to the kilning discovery, beers of this time were typically dark colored, often made in the dunkel style. Since most kilning was done over direct fire, the resulting malt was usually dark and often smoky.

It's been speculated in various texts that the two young brewmasters performed "covert reconnaissance" traveling to England to see what they could learn about this new malt-kilning technique. Whether it was a secret mission or simply a case of brewers sharing information as they do today, the two brewers came away with new knowledge that gave them the ability to create beers unlike any created in their respective homelands previously.

Armed with his new knowledge, Dreher and Sedlmayr returned to their native lands and learned to kiln Vienna and Munich malt, respectively.

Certain historical time periods have seen explosions of progress in various fields. The early 1900s were known for huge advancements in the automobile industry, just as the 1960s were notorious for space exploration. It was the early 1840s that changed the beer landscape forever.

Vienna lager created quite a following at home and abroad. Making an immediate impact with its lighter color, bready, rich maltiness (and lack of smoky character), Vienna lager quickly became an overnight sensation in the region.

Around the same time, Gabriel Sedlmayr's Märzen was making waves nearby in Bavaria. Named after the month in which it was brewed (March), Märzen was Sedlmayr's interpretation of what he learned from his trip to Britain. Like Dreher's Vienna lager, Sedlmayr's Märzen was an instant hit. These new styles opened the minds and palates of European beer drinkers, which ushered in the industry-changing Pilsner beer style that debuted in 1842 when German Brewmaster Josef Groll introduced the beer named after the city in which it was created, Plzen.

In about one year's time, innovating brewmasters in three neighboring countries created three very non-traditional beer styles that left a lasting impact on the brewing world that still resonates to this day.

As the world's original pale lager, Pilsner was substantially and significantly different from all other beer styles of the time. However, Vienna and Märzen lagers shared many similarities. Both styles were malt-dominant, brewed from kilned grains that produced melanoidin-rich flavors. Both employed locally-grown noble hops. Similar in body, carbonation, and color, both styles also worked well with traditional European cuisine.

The Märzens of Munich were brewed to pack a little bit of a punch, with an ABV often falling in the 5.5–6% range, upwards of a full percentage point stronger than the Viennas that ranged from 4.7%–5.5%. Brewers of Vienna had a slightly heavier hand when it came to flavor hop additions with bitterness levels approaching 30 IBU. Märzens often landed around 20 IBUs and peaked at 25. The slightly drier Vienna malt and extra 5 IBUs created a beer with a crisper finish compared to some lingering sweetness in the Märzen.

Many modern day examples of Vienna lagers, especially those brewed in Mexico, are not decocted and employ adjuncts, usually corn, resulting in an entirely different character than the rich, malt-derived flavors originally intended by Anton Dreher. Relying on the adjuncts for much of the flavor profile, these beers are typically sweeter and lighter in body, with much less developed malt flavor.

VIENNA LAGER IN THE NEW WORLD

Vienna lager was like a shooting star in its home country. Instantly becoming the drink of choice for locals, it would soon thereafter defer to the much more popular Pilsner, and to a lesser degree Märzen, before essentially disappearing in its homeland about 60 years after its creation.

Photo by Shutterstock

The Vienna lager was created near Vienna, Austria by Anton Dreher, Brewmaster at The Schwechat Brewery in 1841.

The rise of popular pale styles such as Pilsner, helles, and Dortmunder began to de-emphasize the preference for the toasted malt character found in Vienna lagers in favor of a lighter, grainy flavor.

Besides beer drinkers' shifting palates, changes in brewing practice also contributed to the decline of Vienna lagers. Anton Dreher maintained high standards for the ingredients used in his beers. At the time, it was quite common to use lower quality barley in the production of colored malts like Vienna. Dreher refused to accept this practice in his brewery, resulting in higher quality beer and continued popularity.

After Dreher's death, sourcing quality malts became more of a luxury rather than a requirement, resulting in Austrian brewers adopting lower quality malts in favor of higher profit margins. This practice can also be attributed to the decline of consumer interest in Vienna lagers.

Destined to become an extinct style, it took some political upheaval halfway across the world to serendipitously revive the Vienna style in a newly-imagined, adjunct-laden take on the style commonly known as Mexican lager.

By the late 19th century, immigration to the United States had grown significantly with Europeans drawn by the freedoms and opportunities offered in the New World. The decline of the Austrian empire and its rebirth as a dual monarchy consisting of co-equal Austrian and Hungarian states in 1867 contributed to an exodus of people from the region. The French Intervention in Mexico resulted in the Archduke of Austria, Ferdinand Maximilian Josef Habsburg, being installed as emperor and opened a second front of Austrian immigrants to Central America.

Some of those leaving Austria were the very brewers that contributed to the history of Vienna-style beers. Many settled in the American Southwest and Mexico looking to employ their brewing traditions in an area devoid of an established brewing culture as found in the more developed areas of the United States East Coast. These immigrant brewers attempted to recreate their beloved beer styles in this new, warmer climate but without much success. Lacking an abundance of natural ice, especially in the Southwest United States, lager beer quality suffered until refrigeration became more widespread in the 1880s.

Santiago Graf, an immigrant brewer, founded a brewery in the hills of Toluca, Mexico. Realizing the futility of employing lager brewing practices, he settled on creating beers with top fermenting ale yeast. This process resulted in the first quality beers produced in the southwest. Eventually, Graf invested in an absorption ice machine that he imported from Germany to focus on creating lagers, including a reinterpretation of the Vienna style, in the New World.

Much like Anton Dreher, Graf believed in using the finest quality ingredients in the production of his beers. Forgoing American hops due to their reputation for harsh flavors, he imported his hops and malts from Europe. His use of high-quality ingredients coupled with modern refrigeration yielded lagers that Mexico had not experienced before and they quickly became popular.

Graf is credited with incorporating a small amount of black malt in his Vienna lagers, resulting in a version on the darker end of the style's spectrum. Modern day Mexican versions have become lighter and sweeter due to the increased use of adjuncts in the grist. It is likely adjunct usage was incorporated into these modern

DEVILS BACKBONE BREWING CO.'S VIENNA LAGER CLONE

(5 gallons/19 L, all-grain)
OG = 1.050 FG = 1.011
IBU = 18 SRM = 10 ABV = 5.1%

The gold standard for Vienna lagers in North America, known for its smooth, malty finish and drinkability. This beer from Devils Backbone (Roseland, Virginia) has won gold at the Great American Beer Festival three times since 2012, plus numerous other accolades.

INGREDIENTS

4.1 lbs. (1.9 kg) Pilsner malt
4.1 lbs. (1.9 kg) Vienna malt
1.25 lbs. (0.57 kg) dark Munich malt
1.25 lbs. (0.57 kg) Weyermann Caraamber® malt (26 °L)
3.75 AAU German Northern Brewer hops (60 min.) (0.5 oz./14 g at 7.5% alpha acids)
1.75 AAU Czech Saaz hops (20 min.) (0.5 oz./14g at 3.5% alpha acids)
Imperial L17 (Harvest) or Omega Yeast OLY-114 (Bayern Lager) or Mangrove Jack's M76 (Bavarian Lager) yeast
¾ cup corn sugar (if priming)

STEP BY STEP

With a loose 3-to-1 water-to-grist ratio (~1.5 qts./lb.), conduct a protein rest at 125 °F (52 °C), holding for 30 minutes. Raise temperature to 147 °F (64 °C) and hold for 30 minutes for beta amylase rest. Raise temperature to 162 °F (72 °C) for 30 more minutes to convert alpha amylase. Mash out for ten minutes at 170 °F (77 °C). Recirculate until clear, then sparge until you collect about 7 gallons (26.5 L) of wort. Boil for 90 minutes, adding hops as indicated. If you choose to add clarifiers such as Whirlfloc or Irish moss, do so with 15 minutes remaining in the boil.

Chill to 52 °F (11 °C) then pitch ample amount of healthy yeast. Oxygenate thoroughly. Allow temperatures to rise to 54–54.5 °F (12 °C) during the main fermentation period. When fermentation is about two-thirds complete, raise temperatures to 56 °F (13 °C) to finish fermenting remaining sugars. At end of fermentation, let rise to 57 °F (14 °C) for diacetyl rest. Seven to 10 days after pitching. Start cooling 2 °F (1 °C) per day until you reach a temperature between 42–44 °F (6–7 °C). Rack off the yeast and transfer to a secondary for aging. Crash cool to lagering temperatures between 28–34 °F (-2 °C to 1 °C). Lager for a minimum of two weeks, but the beer will benefit from a lagering period of four weeks or more. Force carbonate to 2.5 volumes or prime and bottle condition.

DEVILS BACKBONE BREWING CO.'S VIENNA LAGER CLONE

(5 gallons/19 L, partial mash)
OG = 1.050 FG = 1.011
IBU = 18 SRM = 10 ABV = 5.1%

INGREDIENTS

2 lbs. (0.9 kg) Vienna malt
1.25 lbs. (0.51 kg) dark Munich malt
1.25 lbs. (0.51 kg) Weyermann Caraamber® malt (26 °L)
2.3 lbs. (1 kg) Briess Pilsen dried malt extract
1 lb. (0.45 kg) Briess Goldpils® Vienna dried malt extract
3.75 AAU German Northern Brewer hops (60 min.) (0.5 oz./14 g at 7.5% alpha acids)
1.75 AAU Czech Saaz hops (20 min.) (0.5 oz./14g at 3.5% alpha acids)
Imperial L17 (Harvest) or Omega Yeast OLY-114 (Bayern Lager) or Mangrove Jack's M76 (Bavarian Lager) yeast
¾ cup corn sugar (if priming)

STEP BY STEP

Heat 2 gallons (7.6 L) of water to 157 °F (69 °C) and place large steeping bag containing the crushed grains into a 5-gallon (19-L) pot. Submerge the bag and stir grains to ensure sufficient hydration. Mash for 45 minutes targeting a mash temperature of 149 °F (65 °C). Remove bag from pot and wash grains with enough 170 °F (77 °C) water to collect 2.5 gallons (9.5 L) of wort.

Top off kettle with water to make 3 gallons (11 L) and add 1 lb. (0.45 kg) of Pilsen dried malt extract to improve hop isomerization. Boil wort for 60 minutes, adding hops according to the schedule. Add remaining malt extract in the last 15 minutes of the boil. If you choose to add clarifiers such as Whirlfloc or Irish moss, do so with 15 minutes remaining in the boil.

Chill to 52 °F (11 °C) then top off wort with pre-chilled water to bring volume up to 5 gallons (19 L). Pitch ample amount of healthy yeast. Oxygenate thoroughly. Allow temperatures to rise to 54–54.5 °F (12 °C) during the main fermentation period. When fermentation is about two-thirds complete, raise temperatures to 56 °F (13 °C) to finish fermenting remaining sugars. At end of fermentation, let rise to 57 °F (14 °C) for diacetyl rest.

Follow the lagering and packaging instructions outlined in the all-grain version of this recipe.

MARKET GARDEN BREWERY'S BOSS AMBER LAGER CLONE

(5 gallons/19 L, all-grain)
OG = 1.054 FG = 1.014
IBU = 30 SRM = 11 ABV = 5.2%

A traditional Vienna-style lager that has a semi-dry, toasted malt finish. A great session beer and a menu mainstay since Market Garden Brewery's opening in Cleveland, Ohio in 2011.

INGREDIENTS

8 lbs. (3.6 kg) Vienna malt
2.5 lbs. (1.1 kg) dark Munich malt (20 °L)
1 lb. (0.45 kg) biscuit malt
0.5 lb. (0.22 kg) acidulated malt
5 AAU Hallertau Tradition hops (60 min.) (1 oz./28g at 5% alpha acids)
2.5 AAU Hallertau Tradition hops (20 min.) (0.5 oz./14 g at 5% alpha acids)
3.25 AAU Hallertau Tradition hops (10 min.) (0.65 oz./18 g at 5% alpha acids)
1 oz. (28 g) Hallertau Tradition hops (0 min.)
White Labs WLP830 (German Lager) or Wyeast 2124 (Bohemian Lager) or Saflager W-34/70 yeast
¾ cup corn sugar (if priming)

STEP BY STEP

Using high-quality malts and a grist of 3-to-1 water-to-grain weight ratio (~1.5 qts/lb), perform a step mash beginning with a 131 °F (55 °C) protein rest. Each step should be about 20 minutes. Raise temperature to 145° F (63 °C) to convert beta amylase before raising to 158 °F (70 °C) for alpha amylase conversion. Finally, mash out at 170 °F (77 °C). Sparge with 5 gallons (19 L) of water at 170 °F (77 °C) and collect 6.75 gallons (25.5 L) of wort.

Boil for 75 minutes. If you choose to add any fining agents such as Whirlfloc or Irish moss, do so with 10 minutes remaining in the boil. At flameout, whirlpool the beer and add the final hop addition. Give the wort a long stir and let settle for 10 minutes. Chill rapidly to 52 °F (11 °C). Pitch the yeast and oxygenate thoroughly.

Ferment at 52 °F (11 °C) for seven days before raising temperature to 56–60 °F for a 2-day diacetyl rest. Once complete, slowly drop the temperature a few degrees per day until reaching 40 °F (4 °C) over the course of a week. Once 40 °F (4 °C) is achieved, drop the temperature to 30 °F (-1 °C) for cold conditioning. Lager the beer for four weeks. Force carbonate to 2.5 volumes or prime and bottle condition. If bottle conditioning, leave the beer at 70–75 °F (21–24 °C) for about two weeks.

MARKET GARDEN BREWERY'S BOSS AMBER LAGER CLONE

(5 gallons/19 L, partial mash)
OG = 1.054 FG = 1.014
IBU = 30 SRM = 11 ABV = 5.2%

INGREDIENTS

1 lb. (0.45 kg) Vienna malt
2 lbs. (0.91 kg) dark Munich malt (20 °L)
1 lb. (0.45 kg) biscuit malt
4 lbs. (1.8 kg) Briess Goldpils® Vienna dried malt extract
5 AAU Hallertau Tradition hops (60 min.) (1 oz./28g at 5% alpha acids)
2.5 AAU Hallertau Tradition hops (20 min.) (0.5 oz./14 g at 5% alpha acids)
3.25 AAU Hallertau Tradition hops (10 min.) (0.65 oz./18 g at 5% alpha acids)
1 oz. (28 g) Hallertau Tradition hops (0 min.)
White Labs WLP830 (German Lager) or Wyeast 2124 (Bohemian Lager) or Saflager W-34/70 yeast
¾ cup corn sugar (if priming)

STEP BY STEP

Heat 2 gallons (7.6 L) of water to 161 °F (72 °C) and place large steeping bag containing the crushed grains into a 5-gallon (19-L) pot. Submerge the bag and stir grains to ensure sufficient hydration. Mash for 45 minutes targeting a mash temperature of 149 °F (65 °C). Remove bag from pot and sparge with 170 °F (77 °C) water to collect 2.25 gallons (9.5 L) of wort.

Top off kettle with water to make 3 gallons (11 L) and stir in 2 lbs. (0.91 kg) of the Vienna malt extract. Adding this amount of extract here will improve the isomerization of the bittering hops. When the extract is dissolved, bring to a boil for 60 minutes, adding hops according to the schedule. If you choose to add any fining agents such as Whirlfloc or Irish moss, do so with 10 minutes remaining in the boil. Add remaining malt extract in the last 15 minutes of the boil.

At flameout, add the final hop addition, then give the wort a long stir and let settle for 10 minutes.. Cool wort to 52 °F (11 °C) and rack to fermenter. Top off wort with pre-chilled water to bring volume up to 5 gallons (19 L). Oxygenate thoroughly and pitch yeast.

Follow the fermentation, lagering, and packaging instructions outlined in the all-grain version of this recipe.

MCFATE BREWING CO.'S VIENNA LAGER CLONE

(5 gallons/19 L, all-grain)
OG = 1.052 FG = 1.011
IBU = 27 SRM = 7.5 ABV = 5.5%

A lighter, Mexican amber interpretation of the traditional Vienna-style lager from McFate Brewing Co. in Scottsdale, Arizona.

INGREDIENTS

6.4 lbs. (2.9 kg) Weyermann Pilsner malt
3.5 lbs. (1.6 kg) Weyermann Vienna malt
2.25 oz. (64 g) acidulated malt
6 oz. (172 g) dextrose corn sugar
1 oz. (28 g) Weyermann Carafa® Special III (600 °L)
6.4 AAU Warrior hops (60 min.) (0.4 oz./11 g at 16% alpha acids)
1 oz. (28 g) Czech Saaz hops (0 min.)
½ tsp. Irish moss or Whirlfloc (15 min.)
White Labs WLP830 (German Lager) or Wyeast 2124 (Bohemian Lager) or Saflager W-34/70 yeast
¾ cup corn sugar (if priming)

STEP BY STEP

Using a very loose mash with a 4-to-1 water to grain weight ratio (~1.9 qts./lb.), target a mash temperature of 150 °F (66 °C) and perform a single-infusion mash for 30 minutes or until proper conversion has occurred. Recirculate your wort through the grain bed until clear then sparge with a maximum of 3 gallons (11 L) of sparge water. The loose mash should provide a majority of the water needed. If your runoff goes above a pH of 5.5, add water to top off instead of running the risk of pulling any astringency from the spent grain bed.

Boil for 90 minutes, adding hops and fining agents as indicated. At flameout, rapidly chill the wort to 48 °F (9 °C) and pitch plenty of healthy yeast. Oxygenate thoroughly. Keep at 48 °F (9 °C) for 4 days, then raise to 54 °F (12 °C) for a diacetyl rest for about 6 days. Not only will this take care of any diacetyl issues, the elevated temperatures will help ferment some remaining sugars, giving the beer a slightly drier character. Starting on day 11, lower the temperature 2 °F (1 °C) per day until reaching 40 °F (4 °C). Hold it at this temperature for 7 days then drop it to 32 °F (0 °C) for transfer to keg to drop out any additional yeast still in suspension.

Force carbonate to 2.5 volumes or prime and bottle condition leaving the bottles at 70–75 °F (21–24 °C) for two weeks to properly condition. Serve in a Pilsner glass at approximately 45–48 °F (7–9 °C).

MCFATE BREWING CO.'S VIENNA LAGER CLONE

(5 gallons/19 L,
extract with grains)
OG = 1.052 FG = 1.011
IBU = 27 SRM = 7.5 ABV = 5.5%

INGREDIENTS

3.5 lbs. (1.6 kg) Briess Pilsen dried malt extract
2 lbs. (0.9 kg) Briess Vienna dried malt extract
6 oz. (172 g) dextrose corn sugar
1 oz. (28 g) Weyermann Carafa® Special III
6.4 AAU Warrior hops (60 min.) (0.4 oz./11 g at 16% alpha acids)
1 oz. (28 g) Czech Saaz hops (0 min.)
½ tsp. Irish moss or Whirlfloc (15 min.)
White Labs WLP830 (German Lager) or Wyeast 2124 (Bohemian Lager) or Saflager W-34/70 yeast
¾ cup corn sugar (if priming)

STEP BY STEP

Place crushed de-bittered Carafa® III malt into a steeping bag and submerge in 2.5 gallons (9.5 L) of water as the water heats up. Remove steeping grains when water temperature reaches 155 °F (68 °C). Remove pot from heat and add 3 lbs. (1.4 kg) of the Pilsen malt extract, stirring well. Add water to boil kettle to bring volume up to 3.5 gallons (13.2 L). Resume heating brew kettle and boil for 60 minutes, adding hops and fining agents according to the ingredient list. Add remaining malt extract and corn sugar in the last 15 minutes of the boil. Cool wort to 48 °F (9 °C) and rack to fermenter. Top off wort with pre-chilled water to bring volume up to 5 gallons (19 L). Oxygenate thoroughly and pitch yeast.

Keep at 48 °F (9 °C) for 4 days, then raise to 54 °F (12 °C) for a diacetyl rest for about 6 days. Not only will this take care of any diacetyl issues, the elevated temperatures will help ferment some remaining sugars, giving the beer a slightly drier character. Starting on day 11, lower the temperature 2 °F (1 °C) per day until reaching 40 °F (4 °C). Hold it at this temperature for 7 days then drop it to 32 °F (0 °C) for transfer to keg to drop out any additional yeast still in suspension.

Force carbonate to 2.5 volumes or prime and bottle condition leaving the bottles at 70–75 °F (21–24 °C) for two weeks to properly condition. Serve in a Pilsner glass at approximately 45–48 °F (7–9 °C).

PEDAL HAUS BREWERY'S MEXICAN AMBER LAGER CLONE

(5 gallons/19 L, all-grain)
OG = 1.048 FG = 1.008
IBU = 17 SRM = 6 ABV = 5.2%

A traditional Vienna-style lager with a delicate malt balance from Pedal Haus Brewery in Tempe, Arizona.

INGREDIENTS

5.25 lbs. (2.4 kg) Weyermann Vienna malt
4.5 lbs. (2 kg) Weyermann Pilsner malt
3 oz. (85 g) Weyermann Caramunich® III malt (56 °L)
1 oz. (28 g) Weyermann Carafoam® malt
0.15 oz. (4.25 g) Weyermann Carafa® III malt
3 AAU German Hallertau Tradition (70 min.) (0.5 oz./14 g at 6% alpha acids)
3 AAU German Hallertau Tradition (20 min.) (0.5 oz./14 g. at 6% alpha acids)
½ tsp. Irish moss (15 min.)
White Labs WLP830 (German Lager) or Wyeast 2124 (Bohemian Lager) or Saflager W-34/70 yeast
¾ cup corn sugar (if priming)

STEP BY STEP

If possible, use soft or reverse osmosis water. Target a protein rest at 121 °F (49 °C) for 20 min., raise to 147 °F (64 °C) for 20 min., then 154 °F (68 °C) for 20 min., then 170 °F (77 °C). Target 4.5 to 5 gallons (17 to 19 L) of water in the mash. Collect ~5.6 gallons (21 L) in the kettle and boil for 70 minutes. Conduct a vigorous boil to maximize evaporation. Add kettle finings at 15 minutes. At flameout, allow to rest and whirlpool gently for 20 minutes. If you have an immersion chiller, it's good to drop the temperature to limit the Dimethyl Sulfide (DMS) production and coagulate the proteins but don't go below 180 °F (82 °C) if the kettle is open to the environment. Cool to 48 °F (9 °C), aerate, and pitch yeast.

Allow temperature to rise to 52 °F (11 °C) during fermentation. After gravity has been terminal for over a week and has no diacetyl detectable using a forced diacetyl test, gradually drop the temperature to 43 °F (6 °C) and lager 3–4 weeks. Drop the temperatures slowly so the yeast is not stressed or put to sleep. Force carbonate or bottle condition to 2.5 volumes.

PEDAL HAUS BREWERY'S MEXICAN AMBER LAGER CLONE

(5 gallons/19 L, partial mash)
OG = 1.048 FG = 1.008
IBU = 17 SRM = 6 ABV = 5.2%

INGREDIENTS

2 lbs. (0.91 kg) Weyermann Vienna malt
1 lb. (0.45 kg) Weyermann Pilsner malt
3 oz. (85 g) Weyermann Caramunich® III malt (56 °L)
1 oz. (28 g) Weyermann Carafoam® malt
0.15 oz. (4.25 g) Weyermann Carafa® III malt
1.5 lbs. (0.68 kg) Briess Pilsen dried malt extract
1.2 lbs. (0.54kg) Briess Goldpils® Vienna dried malt extract
3 AAU German Hallertau Tradition (70 min.) (0.5 oz./14 g at 6% alpha acids)
3 AAU German Hallertau Tradition (20 min.) (0.5 oz./14 g. at 6% alpha acids)
½ tsp. Irish moss (15 min.)
White Labs WLP830 (German Lager) or Wyeast 2124 (Bohemian Lager) or Saflager W-34/70 yeast
¾ cup corn sugar (if priming)

STEP BY STEP

Heat 2 gallons (7.6 L) of water to 157 °F (69 °C) and submerge large steeping bag with the crushed grains. Mash for 45 minutes at 149 °F (65 °C). Remove bag and sparge with 170 °F (77 °C) water to collect 2.5 gallons (9.5 L) of wort.

Top off kettle with water to make 3 gallons (11 L) and add the Pilsen dried malt extract. Boil wort for 60 minutes adding hops according to the schedule. Add Goldpils® malt extract in the last 15 minutes of the boil. Follow the remaining all-grain instructions with an exception to top off fermenter with pre-chilled water after cooling and transferring wort to bring volume up to 5 gallons (19 L).

TIPS FOR SUCCESS:

"There is some debate to the value of a protein rest and a great beer can be made either way. We do it and we found pleasant benefits that the wort gained through the heating process while ramping. If your mash tun doesn't have a heat source, consider decocting to ramp up as it will add a color and aroma that is outstanding for the style."

"During the 3–4 week lagering period, the acetaldehyde and the sulfur will reduce. The acetaldehyde will come back up a little during packaging due to oxygen so lager longer than you think you need to. We force carbonate post-filtration but you can bottle during the beginning of the lager phase using some priming sugar and some fresh lager yeast allowing the beer to mature and carbonate in the bottles on their side at a controlled temperature."

- Pedal Haus Beer Director Derek "Doc" Osborne

versions as both a cost savings and method to increase drinkability.

In the burgeoning American craft beer movement begun in the 1980s, brewers revived classic Old World beer styles, including Vienna lager, in an attempt to diversify the bland macro lager landscape that existed at the time. One of the most popular and prolific Vienna lagers to come out of this revival is Samuel Adams Boston Lager.

New craft breweries continue to find inspiration in traditional lagers with many producing Vienna styles. Many "classic examples" of Vienna lagers known today are of American or Mexican origin. Popular American examples include Great Lakes Brewing Eliot Ness, Devil's Backbone Vienna Lager, and Sierra Nevada Vienna. Popular Mexican examples include Negra Modelo Lager, Victoria, and Dos Equis Amber.

BREWING VIENNA LAGER

The malt bill is based around Vienna malt, first and foremost. At the brewer's discretion, the base of Vienna can be augmented with the use of Pilsner malts and smaller percentages of character malts such as Caravienne®, Caramunich®, Caraamber®, Carafa®, dark Munich, or even small amounts of wheat.

The hops are meant to complement the complex character of the Vienna malt, giving the beer a crisp dryness that is refreshing on the palate. Low alpha German or Czech noble hops suffice. A moderate hop bitterness addition and a lighter flavor hop addition creates the necessary character.

The key to a good Vienna is balance between the flavorful malt character and a palate-friendly, medium body that produces an ease of drinkability. Decoction will produce a desired, deep malt character for brewers willing to go through the time and trouble. Otherwise, additions of Caravienne, Caramunich, or Melanoidin malts can replicate that character to some degree.

Employing a double decoction makes sense starting in the lower beta-amylase range of about 144 °F (62 °C). Take about a third of the thickest part of the mash and boil it for 20 minutes, then reintroduce into the main mash, effectively raising the temperature to 154 °F (68 °C) for alpha amylase conversion. Perform a second decoction for another 20 minutes. Reintroducing the second decoction should help you achieve a 168 °F (76 °C) mash out temperature.

For those who may only have the ability to work with a single infusion mash, attain a temperature on the lower side of the mash range to ensure significant beta-amylase conversion to enhance full fermentability, 149–150 °F (65 C) will work just fine. Mash for at least 30 minutes, or until you've confirmed that all starches have been converted through an iodine test. Raise to 168 °F (76 C) for mash out, collect wort, and finish by sparging. Sparge with water that has a lower pH to avoid any possibility of tannin extraction.

This style of beer benefits from a very loose mash, with a water-to-grain ratio of about 3-to-1. This way, most of your wort comes from the initial mash and requires a much shorter sparge period.

Fresh, viable German lager yeast is the clear choice at a pitching rate at least double that of an ale. Chill the wort quickly to 48–50 °F (9–10 °C), pitch yeast, and oxygenate thoroughly. It's acceptable to let temperatures rise a few degrees during primary fermentation. Once activity slows, let the beer free rise to 56 °F (13 °C) to begin a diacetyl rest. After about two weeks of total fermentation time, slowly lower the temperatures about 2 °F (1 °C) per day until you reach 40 °F (4 °C). At this time, transfer into a lagering vessel and lower to a good lagering temperature of about 34 °F (1 °C) or lower. Giving the beer a solid four weeks of lagering time will help develop the complex flavors of the beer while providing a very clear, reddish-amber beer.

Carbonation for Vienna lagers should be about 2.5 volumes to accentuate the crispness and drinkability of the beer. Vienna lagers are best served at 45 °F (7 °C) in nonic pints or Pilsner glasses, which accentuate the best characteristics of the beer. A wonderful complement to many different cuisines, the style pairs perfectly with wienerschnitzel, bratwurst, roasted chicken, or even pepperoni pizza. Wearing lederhosen or a dirndl while consuming Vienna lagers is not required, but certainly adds to the experience.

THE PROS WEIGH IN

Arguably the most true-to-style version of a traditional Vienna lager comes from Brewmaster Jason Oliver of Virginia's Devils Backbone Brewing Company. Falling in love with lagers while attending UC-Davis in 1998, the history major revered the way classic lagers were ingrained in the Germanic and Czech cultures. Having brewed at two German-inspired breweries prior to joining Devils Backbone, Oliver's gravitation toward German brews came naturally. Looking to brew a variation on the more common Märzen style, Oliver crafted his award-winning Vienna Lager. "I thought Viennas were a little leaner, crisper and slightly less ABV; they give you a lot but don't take anything from you," Oliver said.

Oliver employs a step mash, beginning at protein-rest mash temperatures, then immediately heating to activate beta amylase. This is followed by raising the temperature again to activate alpha amylase before mashing out.

Oliver carbonates his beer through spunding, a traditional practice of capturing natural carbonation by trapping escaping CO_2 during fermentation. Employed in all of Devils Backbone's beers, spunding is activated when fermentation is ⅔ complete. At that point, the escape valve is sealed, capturing remaining CO_2. Allowing the beer to rise another 1–2 °F (0.5–1 °C) after the cap is placed results in the right amount of natural carbonation.

A rule of thumb Oliver employs during fermentation is to maintain 10 days over 50 °F (10 °C). "Fermentation (is) like a bell-shaped curve, ten days over 10 °C (50 °F) is a good marker to go for," he said.

Andy Tveekrem has held the title of Brewmaster throughout his career, getting his start at Great Lakes

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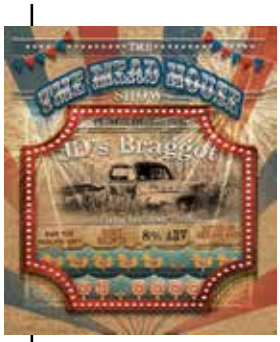

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Photo courtesy of Devils Backbone Brewing Co.

Brewing Company in Cleveland, Ohio before heading to Maryland to run the operations at Frederick Brewing Company and Dogfish Head Brewing Company in Delaware. Andy came back to Cleveland and co-founded Market Garden Brewery, virtually across the street from the brewery where he got his start.

"I love Vienna lagers because they have a beautiful depth of color and flavor. It's one of the best beer styles for pairing with food since it is balanced between malt and hop flavor, and the malt flavors are rich in toasty, biscuity character. For our Boss Amber Lager, I wanted to create a beer that would be distinct from our neighbor across the street (The Eliot Ness Amber at Great Lakes Brewing Company). Boss Amber is lower in alcohol and has a drier, more toasted malt finish. It's a great session beer," said Tveekrem.

Andy has a few preferential ingredients that give his beer its unique quality, including adding 9.5% biscuit malt to the grist. "Biscuit malt is a highly flavorful malt that needs to be used judiciously to avoid taking over the malt profile. But when used properly, it lends a nice . . . drum roll . . . biscuity note," he said.

He has a very specific preference for hops, as well. "Originally, we used Saaz hops but now we use Hallertau Tradition sourced from the Euringer family hop farm in the Hallertau region. The target is 30 IBU for bitterness and these hops provide a nice residual hop flavor and aroma that perfectly complements the malt flavor," said Tveekrem.

It's an interesting contrast comparing the 30 IBUs in Tveekrem's recipe with Oliver's malt-forward 18 IBU — two numbers that fall on each end of the acceptable range for the style.

On the other side of the country, two Phoenix, Arizona area breweries compete regularly for local supremacy. McFate Brewing of Scottsdale and Pedal Haus Brewery of Tempe both make outstanding interpretations of the style.

Using Weyermann products, namely a combination of Pilsner and Vienna malts, McFate's Head Brewer Adam Schmeichel produces a light, easy-drinking Vienna in the modern Mexican style. Schmeichel believes the beauty of a Mexican-style Vienna lager is that it's "way less of everything" compared to a traditional Vienna. "The beers have similar coloring, but quite a bit less of the toasty/caramel malt background. In Arizona, a Mexican-version is the better option since it's lighter in body compared to a traditional Vienna lager," he said.

The style, he says, takes careful attention during fermentation. "Controlling temperature is key . . . Keeping it between 48–50 °F (9–10 °C) is the sweet spot. Once you get past 52 °F (11 °C) you start to introduce fruity character into the beer," he said.

Arguably the Phoenix area's most revered brewer, Derek "Doc" Osborne, crafts a masterful Vienna lager at Tempe's Pedal Haus Brewery, a popular brewpub located in the heart of Arizona State Sun Devil country. Marketed as a Mexican lager but brewed more like a traditional Vienna, Osborne starts with a soft-water profile and employs a step-mash starting with a protein rest before steps for beta and alpha-amylase conversion.

"There is some debate to the value of a protein rest and a great beer can be made either way. We do it and we found pleasant benefits that the wort gained through the heating process while ramping. If your mash tun doesn't have a heat source, consider decocting to ramp up as it will add a color and aroma that is outstanding for the style. If you do a single infusion, plan to use a little more Carafa® III and Caramunich® III," Osborne said. BYO

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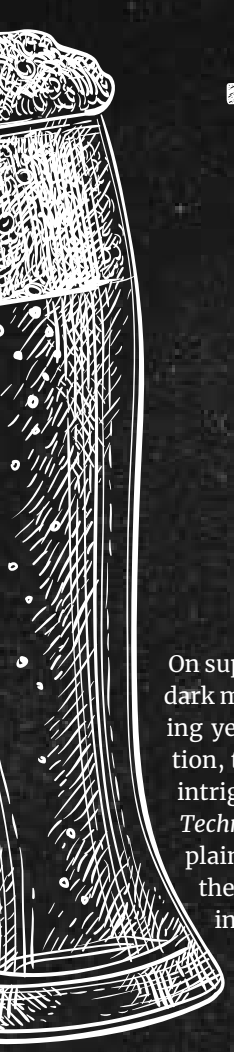
The Mysteries of DARK LAGERS

by Thomas Kraus-Weyermann & Horst Dornbusch

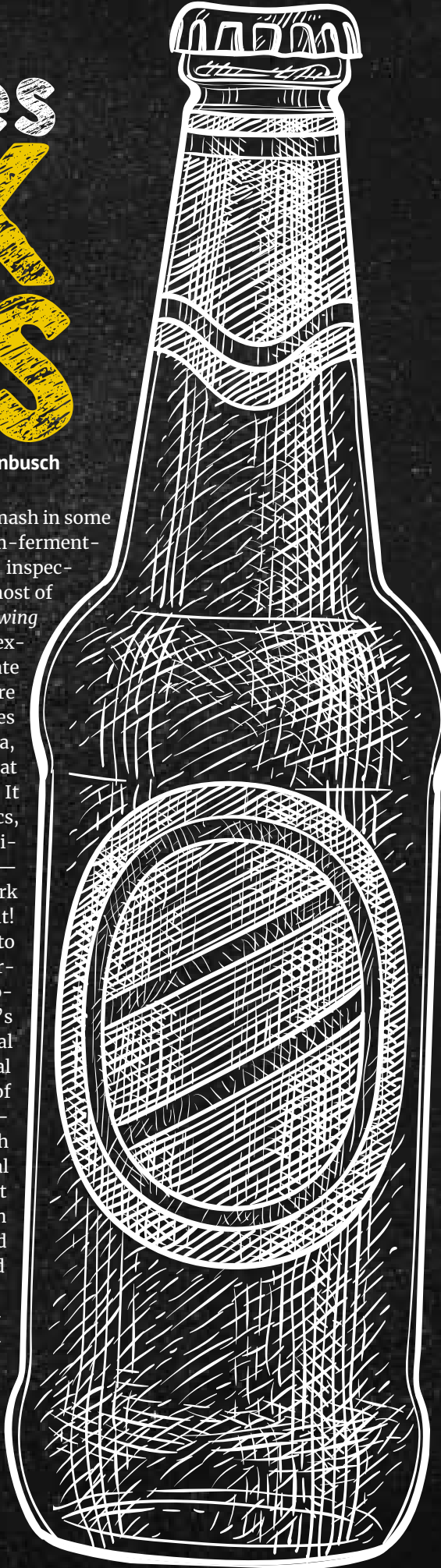


On superficial inspection, the story of dark lagers seems very simple: Just mash in some dark malt with your base malt, extract the wort, and ferment it with bottom-fermenting yeast. The reality, however, is much more complicated. Upon closer inspection, the dark lager story reveals itself to be surprisingly riveting, with a host of intriguing subplots. As the new book *DARK LAGERS: History, Mystery, Brewing Techniques, Recipes* by Thomas Kraus-Weyermann and Horst Dornbusch explains, to understand how dark lagers came to be, we must first investigate the peculiar emergence of darkness in beer. After all, brewing grains are inherently blonde, not dark. Then, we must bring to light the causes behind the rise of bottom fermentation at a particular place, Bavaria, at a particular point in time, the late Renaissance. The book tells that story in ways that have never been attempted, in any language. It shows how an extremely improbable intersection between politics, climate change, and a still-unexplained case of transcontinental, microbiological hybridization — well before the age of jet travel — forced all Bavarian barley-based beers to become dark lagers . . . without the brewers even knowing about it!

The book also provides 41 recipes grouped into three categories: Classic, Innovative, and Experimental. Two recipes of each category are reproduced at the end of this story. Some of the book's recipes challenge the boundaries of conventional brewing. There is, for instance, an imperial oatmeal schwarzbier, which combines the characteristics of a regular schwarzbier with those of a Russian imperial stout and an oatmeal stout. Some recipes push the envelope of a single style, such as an imperial dark lager brewed with half a dozen Pacific Northwest hops. Other recipes call for unusual ingredients such as organic cacao powder in the mash and the kettle and organic all-natural vanilla extract in the whirlpool and the fermenter.

All of the recipes in the book — from the reconstruction of the classics to the most outlandish experimental brews — were designed by the authors and their collaborators. They were test-brewed in host breweries both large and small, both simple and fully automated, in three countries, on two continents.

The following are excerpts from the book reproduced verbatim, with transitions written for this article marked by [square brackets]. Gaps are indicated by . . . ellipses.



THE DAWN OF DARKNESS IN BEER

Malt — and thus beer — became dark only after humans started to use direct-fired kilns, probably to speed up the slower, more labor-intensive, and invariably more expensive air-drying of malt, which would produce only pale malt. In air-drying, the moist, sprouted kernels are spread out in a layer, in the open or in a well-aired attic. They then have to be shoveled by hand for days, until they are dry. The constant manual turning of the malt is necessary to accelerate the drying process, to dissipate heat, and to keep the malt from spoiling or becoming moldy . . .

We do not know exactly who came up with the idea of a fire-heated malt kiln, nor do we know where and when it happened. We do know, however, that such kilns must have been commonplace in the most advanced monastic breweries, at least by the 9th century . . . [T]he basic construction of such a kiln included perforated slabs holding the grain over open flames underneath. These kilns were fast and effective, but all malts made by this method were relatively inhomogeneous with some kernels underdone and pale but others almost certainly scorched and black. The beer flavor, therefore, was often acrid and partially reflected the fuel used in the kiln — from soft and hard wood, to charcoal, to straw, to peat, or, in later years, to coal and coke . . .

THE RETURN OF MALT WITHOUT SMOKINESS

[I]n 1713, a British iron master named Abraham Darby developed and patented a procedure for heating coal in the absence of air to gasify and drive off the coal's volatile compounds, like sulfur. This left behind almost nothing but clean-burning carbon. Darby's objective was to produce pure carbon that would let him improve the quality of carbon steel. In other words, Darby had figured out how to turn coal into coke. Though Darby was not thinking of the malting and brewing industries in his time, it turned out that coke produced by his method was also a highly suitable fuel for malt kilns, because it burned evenly in slow-glowing embers without shooting flames or phenolic smoke as do straw, peat, wood, or coal. Instead, it burned clean. This allowed British maltsters to produce relatively paler and more homogeneous malt — at a higher cost than malt kilned over other fuels, of course. Such coke-dried malt was ideal for the finest of British pale ales and other specialty beers of the time. Regular, cheaper malt dried over smoky fuels, however, remained popular as it was still being used in beers for the unwashed masses . . .

Another revolution in malting technology occurred in 1817, when the British engineer Daniel Wheeler patented "A New or Improved Method of Drying and Preparation of Malt," an invention that eliminated smokiness in dark malts regardless of the fuel source. This device was a roasting drum for malt that was inspired by Wheeler's observation of coffee roasters. The "improved method" consisted of an enclosed drum that was heated externally by fire. As the rotating drum heated up, the moist kernels inside dried slowly and evenly, but because the flames could not reach the drum's content, they could not impart any smokiness . . . Because Wheeler had patented his invention, the malt produced by his drum acquired the name "black patent malt."

THE RETURN OF MALT WITHOUT DARKNESS

Next came the 1842 patent by Patrick Stead, a Scottish maltster. He invented a so-called pneumatic malting process . . . [in which] the germinated grain is being dried with force-blown air. To push such air, of course, requires mechanical power, which had become available in Stead's time thanks to the invention of a practical steam engine by James Watt, who patented his device in 1781. Pneumatic malting was a great step forward, because it allowed the maltster to control the malting process and turn it into a reproducible, standardized, seven-day rhythm. In other words, Steade's methods replaced both floor malting by using mechanical ventilation in the germination chamber, as well as direct-fired kilns by using "steam-produced heat." These principles are simple and variations of them are still being used today in just about every modern malting plant . . .

As the 19th century progressed, especially malt color and malt flavor were no longer dictated by the limited means at the maltster's disposal, but they became primarily a matter of choice by the brewer. Beers, both ales and lagers, no longer had to be dark and smoky, unless a brewer wanted them to be so. This, in turn, spawned a vast array of new beer styles, which turned the 19th century into a veritable *La Belle Époque* of beer style innovations. Not only could brewers now reliably make pale to straw-blond ales and lagers, they could also deliberately compose dark ales and lagers with pale base malts plus an overlay of many different caramel, chocolate, and roasted malts, for a large variation of tastes. Essentially, it spelled the re-birth of the dunkel and its dark lager cousins as a product of brewing creativity instead of necessity . . .

THE ORIGIN OF DARK BEERS AS A STYLE IN BAVARIA

[H]umans have been making beer, that is, they have initiated fermentations, probably for the past 10,000 years, or even earlier. For almost all this time, however, they have known just about nothing about yeast as the all-important agent of alcoholic fermentation . . . [nor of the microbial causes of beer spoilage. Even in Bavaria, in the Renaissance, bad] brewing outcomes often tempted brewers to solve their conundrum by simply covering up any off-flavors. They "improved" their spoiled libations with all sorts of additives, which included such strong-tasting botanicals as tree bark, rushes, or poisonous mushrooms, as well as alkaloid hallucinogens such as mandrake root. They even added pith, soot, chalk, chicken blood, and oxen bile to make their ferments almost palatable . . .

[All this stopped in 1516, when the Bavarian Duke Wilhelm IV pro-

claimed a beer regulation, which is now considered the genesis of the modern German Beer Purity Law, the *Reinheitsgebot*, which stipulates that brewers could use only water, barley, and hops in their beers. Wilhelm's now-famous ingredients prescription, however, failed to prevent further beer infections, which led to a second ducal prescription, in 1553, by Wilhelm's son and successor, Duke Albrecht V, the so-called summer brewing prohibition, in effect between April 23 and September 29.]

Albrecht had realized one important fact that had perhaps escaped his father's attention. In the continental climate of Bavaria, in the foothills of the Alps, where summers were very hot and winters very cold, beers brewed during the hot season were more likely to taste bad than did those brewed during the cold season. Today, we understand, of course, that many beer-spoilage microbes thrive well in temperate temperatures, whereas they may die off in freezing temperatures, or, at the very least, enter a state of dormancy . . . [Albrecht's] far-reaching regulation not only had the effect of actually improving beer quality in Bavaria, it also contributed to a gradual change in the type of beer that was made there. This is because winter temperatures not only slow down the activities of beer spoilers, which was Albrecht's ostensible but misunderstood objective, they also make it harder [if not impossible] for the warmth-loving, ale-making *Saccharomyces cerevisiae* to do its work.

[Instead, another microbe, the cold-tolerant, lager-making *Saccharomyces pastorianus*, became the dominant agent of fermentation in 16th-century Bavarian vats. *S. pastorianus* prefers a working temperature of perhaps 50 to 60 °F (roughly 10 to 15 °C). In a pinch, it may even ferment — albeit very slowly — at temperatures as low as 38 °F (3.5 °C). At this temperature, *S. cerevisiae* is decidedly dormant. Another change favoring the dominance of a cold-fermenting yeast] was a sudden climate change which we now call the Little Ice Age . . . [which many climatologists agree] started no later than the year 1550 — which is coincidentally only three years before Albrecht's summer brewing prohibition . . .

[T]he uncanny combination of the onset of the Little Ice Age and the summer brewing prohibition created an ideal, perhaps even unique, condition for most of Bavaria's beers to become lagers. Most importantly, because these environmental conditions turned out to be lasting and because yeast cells replicate themselves primarily by budding, lager yeasts could develop their own chromosomal stability. In addition, because most beers in Bavaria in the late Renaissance were dark, it is a valid historical inference that — drum roll, please! — Bavaria was the most likely place — and the second half of the 16th century the most likely point in time — for dark lagers to have emerged, and thus for the overall Bavarian lager beer culture to become firmly established.

WHEN *CEREVISIAE* MET *EUBAYANUS*

[However, where did *S. pastorianus* come from? Was it] simply a mutant of *S. cerevisiae* that fit better into the new conditions? Or has *S. pastorianus* always been in Bavaria as an indigenous yeast, just waiting for its chance to replace *S. cerevisiae* in most beers — not only in Bavaria but eventually, indeed, in the entire world? . . . Enter the science of genetics, which suddenly opened up an entirely new Pandora's Box of puzzles . . .

[C]hromosome mapping of [*S. cerevisiae* and *S. pastorianus* showed] that roughly half the genes of *S. pastorianus* is identical to a set of genes found in *S. cerevisiae*, while the other half comes from another organism. Scientists further determined that the unknown portion of the *S. pastorianus* genome was responsible for its lager making characteristics, that is, for its capacity to ferment at cold temperatures . . . In terms of evolutionary development and domestication, this hybridization must also have been a relatively recent occurrence, because the *S. pastorianus* genome contained multiple copies of its parental gene sets, whereas long-established organisms tend to lose superfluous genes over time . . . Once scientists understood that *S. cerevisiae* was one of the genetic donor microbes in the hybridization of *S. pastorianus*, the search for the other donor or donors [with special focus on cold climate zones, including in Patagonia, in the high Andes between Argentina and Chile] was obviously on.

[It was] in 2011, when microbiologists involved in the search for the illusive *S. pastorianus* antecedent finally hit pay dirt — and propelled zymurgy a giant leap forward . . . At the intersection of latitude 41 and longitude 71, [on a beech tree that is native to South America, they collected a yeast that had hitherto not been identified.] . . . They rushed it off for genome sequencing to the University of Colorado School of Medicine, [where it was determined] that 99.56 percent of that yeast's genome was identical to the non-ale-yeast portion of the genome of *S. pastorianus*. In other words, the scientists had . . . found the missing progenitor of Bavarian lager yeast . . . and that progenitor hailed, unlikely as that may be, from the wilds of Patagonia. [They named that wild lager yeast *Saccharomyces eubayanus*.]

THE MYSTERY OF A MICROBIAL PEREGRINATION

[But how did the Andean microbe get to Bavaria in the 16th century, when there was virtually no contact — human or otherwise — between that part of South America and Bavaria? To date, nobody has solved that riddle. The book speculates that, perhaps, "the answer is blowing in the wind." There are convection air movements called Hadley Cells] in both the northern and the southern hemispheres . . . that rise up some six to nine miles near the equator [and then] move some distance towards their respective poles. They typically descend about 30° north or south. On the earth's surface, these air masses then move gradually back to the equator to start the cycle all over again . . .

A second global air current pattern is the system of jet streams.

These are upper-level strong winds blowing from west to east, high off the ground . . . In both hemispheres, there are two jet streams, the polar ones that hover around latitudes 60° north and south, and the subtropical ones that hover around latitudes 30° north and south. These jets tend to flow latitudinally along the Hadley Cell boundaries . . . Thus, is it not conceivable that *S. eubayanus* could have traveled thousands of miles on global winds to just about anywhere, including to the beer vats of Bavaria . . . [where it hybridized with *S. cerevisiae* and started the world's first lager culture]?

RECIPES

The six recipes selected here from the book have been edited for length and been adjusted for homebrew batch sizes of 5 gallons (19 L). Because these recipes were test-brewed in commercial breweries in Germany, Canada, and the United States, they are for all-grain mashing only.

For homebrewers wishing to rely for all or part of their wort on extracts, the unhopped, sweet, and malt-aromatic Weyermann Bavarian Dunkel Malt Extract is an authentic choice. Produced from a two-step decoction of Weyermann Munich Malt I, Weyermann Caramunich®, and Weyermann Pilsner Malt, it contains 72 to 79 percent extract and has a gravity of OG 1.350 to 1.400. If liquored down to an OG 1.052 (13°P), it produces a liquid with a color of 25 to 28.7 SRM (65 to 75 EBC). The extract is shipped in 8.8 lbs. (4 kg) canisters. If stored unopened at 32 °F to 86 °F (0 °C to 30 °C), it has a shelf life of up to 18 months.

Select your all-grain brew house process depending on your equipment capabilities and your inclination. All of these lagers can be brewed by either a single-step or multi-step infusion or by a multi-step decoction, and the outcomes may taste slightly differently, but the beers will all be dark lagers.

Traditionally, all dark lagers were multi-step decocted — originally from a thin mash-in with well water at whatever its temperature happened to be. The liquor-to-grist ratio was perhaps 3.5/1, which means a mixture of 1.68 quarts of liquor per 1 lb. of malt (3.5 L per kg). To replicate the old decoction method, mash-in at about 104 °F (45 °C) for proper grist hydration, followed by a decoction of about one-third of the main mash to raise the overall temperature to about 122 °F (50 °C). The next decoction raises the main mash temperature to about 149 °F (65 °C). The third decoction raises it to the mash-out temperature of about 172 °F (78 °C). According to Stephen R. Holle in his *A Handbook of Basic Brewing Calculations*, the precise decoction volume is best calculated in the metric system in liters and °C as: Decoction Volume = Mash Volume x (Target Temp – Initial Temp) / (Decoction Temp – Initial Temp), whereby the boiled decoction is, of course, at 100 °C (212 °F). While heating the decoction to the boil, allow it to rest as applicable for 15 minutes each at 122 °F (50 °C); 149 °F (65°C); and 162 °F (72 °C).

A multi-step infusion brewer can take the mash through the same temperature paces as the decoction brewer, with 15-minute rests at each temperature step. For more on decoction mashing, see the BYO article "Decoction Mashing Techniques": **https://byo.com/article/decoction-mashing-techniques/**

For brewers who prefer a single-step infusion, mash in at roughly 152 °F (67 °C) for a one-hour rest and raise the mash temperature through sparging with 180 °F (82 °C) to the mash-out temperature.

Boil the wort for at least 60 minutes. In the old days, Bavarian brewers with their direct-fired kettles used boil lengths of up to 2 hours or longer to activate the melanoidin-producing Maillard reaction.

Ferment all brews at the lower end of the selected yeast's temperature interval as stated by the manufacturer. Rack the brew after about 14 days and lager it for about 4 weeks at a temperature as close to the freezing point as your equipment allows. Finally, prime/condition and package the brew. For brewers with the equipment to measure the CO_2 content, carbonate the beer to about 2.2 to 2.7 volumes (4.4 to 5.4 g/L).

A "CLASSIC" BAVARIAN/ MUNICH DUNKEL

Recipe design: Thomas Kraus-Weyermann and Horst Dornbusch
Test brew location: Weyermann Pilot Brewery, Bamberg, Bavaria

(5 gallons/19 L, all-grain, 85% extract efficiency)
OG = 1.052 FG = 1.013
IBU = 22 SRM = 18 ABV = 5.2%

The dominant malt backbone of this beer emphasizes classic, Munich–type notes of caramel. The hop character is complex, but subdued. The finish is long with a hint of residual sweetness that blends well with the lingering maltiness.

INGREDIENTS

3.7 lbs. (1.7 kg) Weyermann Munich I malt (6 °L)
3.2 lbs. (1.45 kg) Weyermann Munich II malt (9 °L)
1.3 lbs. (0.6 kg) Weyermann Caramunich® III malt (57 °L)
0.44 lb. (0.2 kg) Weyermann Carafoam® malt (2 °L)
0.18 lb. (0.08 kg) Weyermann Carafa® Special I malt (337 °L)
4 AAU Magnum hops (60 min.) (0.3 oz./11 g at 13.5% alpha acids
0.4 AAU Hallertauer Mittelfrüh hops (15 min.) (0.1 oz./4 g at 4.25% alpha acids)
0.1 oz. (4 g) Hallertauer Mittelfrüh hops (5 min.)
Fermentis W-34/70 or similar yeast

A "CLASSIC" BAMBERGER HOFBRÄU® EXQUISATOR DUNKELDOPPELBOCK

Recipe design: Thomas Kraus-Weyermann and Horst Dornbusch
Test brew location: Weyermann Pilot Brewery, Bamberg, Bavaria

(5 gallons/19 L, all-grain, 80% extract efficiency)
OG = 1.078 FG = 1.021
IBU = 37 SRM = 19 ABV = 7.6%

This lager has a rich, deep chestnut color; a creamy head of foam; and an aromatic bouquet with hints of bread, earthy cacao, hazelnut, caramel, spice, and some roastiness. On the palate, the flavors lean towards nuts, a mild sweetness, and soft floral hop notes. The body is light to medium; and the finish is gently warming.

INGREDIENTS

6.75 lbs. (3.08 kg) Weyermann Barke® Munich I malt (8 °L)
4.85 lbs. (2.22 kg) Weyermann Pilsner malt (2 °L)
1.35 lbs. (0.62 kg) Weyermann Caramunich® I malt (34 °L)
0.4 lb. (0.19 kg) Weyermann Special W® malt (113.5 °L)
0.15 lb. (0.06 kg) Weyermann Carafa® Special I malt (337 °L)
2.3 AAU Herkules hops (60 min.) (0.13 oz./3.6 g at 17.9% alpha acids)
2.7 AAU Tradition hops (30 min.) (0.7 oz./20 g at 3.9% alpha acids
2.3 AAU Perle hops (30 min.) (0.3 oz./8.7 g at 7.7% alpha acids
0.32 oz. (9 g) Spalter Select hops (5 min.)
0.42 oz. (12.2 g) Spalter Select hops (0 min.)
Fermentis W-34/70 or the alcohol-tolerant Fermentis S-189 yeast

Photo courtesy of Thomas Kraus-Weyermann & Horst Dornbusch

AN "INNOVATIVE" DARK FARMHOUSE LAGER

Recipe design: Thomas Kraus-Weyermann, Horst Dornbusch, and Tod Mott (Brewer/Owner of Tributary Brewing Company)
Test brew location: Tributary Brewing Company, Kittery, Maine

(5 gallons/19 L, all-grain, 80% extract efficiency)
OG = 1.066 FG = 1.014
IBU = 25 SRM = 18.2 ABV = 7.4%*

* ABV is calculated after the addition of candi sugar, OG is calculated prior to sugar addition.

This recipe was conceived with a Belgian/French Bière de saison/Bière de

Photo courtesy of Thomas Kraus-Weyermann & Horst Dornbusch

The winter view from Schilling Beer Company in Littleton, New Hampshire, which sits beside the Ammonoosuc River.

garde accent in mind. The malt selection plus the dark Belgian brewing sugar give this lager a very deep reddish hue, while the British Target for bitterness plus the Slovenian Celeia produce rich flavors and aromas, which last well into the lingering finish, where they serve as counterpoints to the slight residual sweetness from the sugar. The Swiss-origin Fermentis S-23 is very alcohol-tolerant and dries out the finish.

INGREDIENTS

7.9 lbs. (3.6 kg) Weyermann Pilsner malt (2 °L)
1.35 lbs. (0.62 kg) Weyermann Special W® malt (114 °L)
0.9 lb. (0.41 kg) Weyermann Munich II malt (9 °L)
0.56 lb. (0.26 kg) Weyermann Vienna malt (3.6 °L)
0.56 lb. (0.26 kg) Weyermann Caramunich® II malt (46 °L)
0.4 lb. (190 g) Belgian dark candi sugar (5 min.)
5.1 AAU Target hops (60 min.) (0.6 oz./17 g at 8.5% alpha acids)
0.3 AAU Celeia hops (15 min.) (0.1 oz./3g at 3% alpha acids)
0.1 oz. (3 g) Celeia hops (0 min.)
Fermentis S-189 yeast
Fermentis S-23 yeast

AN "INNOVATIVE" DARK "NEGRA" VIENNA LAGER

Recipe design: Evan Semiao (Brewer at Schilling Beer Company)
Test brew location: Schilling Beer Company, Littleton, New Hampshire

(5 gallons/19 L, all-grain, 85% extract efficiency)
OG = 1.052 FG = 1.011
IBU = 24 SRM = 15 ABV = 5.5%

This recipe is for a Mexican-style Dark Vienna Lager. The flaked corn adjunct is pre-gelatinized and de-germed so it can be added directly to the mash. Flakes tend to give a higher yield than other corn adjuncts and are less likely to cause a stuck mash. The finish of this beer is quite dry.

INGREDIENTS

5.9 lbs. (2.68 kg) Weyermann Munich II malt (9 °L)
2.35 lbs. (1.07 kg) Crisp flaked maize (1°L)
0.3 lb. (140 g) Weyermann Carafoam® malt (2 °L)
0.25 lb. (0.12 kg) unmilled Weyermann chocolate wheat malt (395 °L)
5.6 AAU Magnum hops (60 min.) (0.4 oz./10 g at 14.1% alpha acids
0.2 oz. (6 g) Northern Brewer hops (5 min.)
Fermentis W-34/70 yeast

Note: *Mill the entire grain bill except for the chocolate wheat malt and mash in at a liquor-to-grist ratio of 2:1. Then fold the unmilled chocolate wheat malt into the mash. Thin out the mash before lautering.*

AN "EXPERIMENTAL" DARK LAGER WITH ROASTED BARLEY, CACAO POWDER, AND VANILLA EXTRACT

Recipe design: Thomas Kraus-Weyermann, Horst Dornbusch, and Jean Gadoua (Brewer/Owner of Microbrasserie Farnham Ale & Lager)
Test brew location: Microbrasserie Farnham Ale & Lager, Québec, Canada

(5 gallons/19 L, all-grain, 85% extract efficiency)
OG = 1.057 FG = 1.017
IBU = 22 SRM = 42 ABV = 5.5%*

The malts give this beer a rich background against which the roastiness of the unmalted barley and the chocolate and vanilla flavors come to the fore.

Photo courtesy of Thomas Kraus-Weyermann & Horst Dornbusch

Use cacao powder, not cocoa powder, because the former is pressed from a paste of cacao nibs, which removes the cacao fat. Cacao powder is much more beer foam–friendly and deepens both the cacao taste and beer color.

INGREDIENTS

6.2 lbs. (2.82 kg) Weyermann Vienna malt (3.6 °L)
2.1 lbs. (1 kg) Weyermann Caramunich® II malt (46 °L)
0.5 lb. (0.25 kg) Weyermann roasted barley (433 °L)
0.3 lb. (0.14 kg) Weyermann Special W® malt (114 °L)
0.3 lb. (0.14 kg) Weyermann Carafa® Special I malt (338 °L)
0.3 lb. (0.14 kg) Weyermann Caraaroma® malt (150 °L)
4.2 AAU Mandarina Bavaria hops (60 min.) (0.5 oz./14 g at 8.3% alpha acids)
0.3 oz. (44 g) Mandarina Bavaria hops (0 min.)
2 oz. (55 g) organic cacao power
0.125 cup (38 mL) natural vanilla extract
Fermentis W-34/70 yeast

Note: *Half the total amount of cacao powder and one-fifth of the total amount of vanilla extract go into the mash. The second half of the cacao powder goes into the wort near the end of the kettle boil. Roughly 40% of the vanilla extract goes into the whirlpool. The final 40% of the vanilla extract goes into the cold beer at the end of primary fermentation.*

AN "EXPERIMENTAL" ALE/LAGER HYBRID: "HILDEGARD VON BINGEN" HEIRLOOM BEER

Recipe design: Thomas Kraus-Weyermann and Horst Dornbusch in collaboration with the Samuel Adams Boston Brewery
Test brew location: Samuel Adams Boston Brewery, Boston, Massachusetts

(5 gallons/19 L, all-grain, 80% extract efficiency)
OG = 1.064 FG = 1.016
IBU = 13* SRM = 18 ABV = 6.4%

*IBU calculation is from hops only; gruit addition not considered for bitterness calculations

This beer is named for the 12th-century abbess, physician, brewster, naturalist, and composer Hildegard von Bingen, who also served as an advisor to the Holy Roman Emperor, Frederick I Barbarossa. She was the one who christened the hop bine "hoppo," from which our modern terms "hop" in English, and "Hopfen" in German, derive. On the palate, this brew tastes very much like an artisanal gin or an herb liqueur, but without any syrupy sweetness. The beer is pleasant and refreshing with a tea-like, piney, and woody tang in the foreground and with hop and lavender aromas in the background. There is also an earthy hint of mint and citrus rind. The two yeasts together make for a very attenuative combination, which causes the finish to be very clean and surprisingly dry, with a slight touch of liquorice.

INGREDIENTS

4.6 lbs. (2.2 kg) Weyermann Floor-Malted Bohemian Pilsner malt (2 °L)
2.95 lbs. (1.42 kg) Weyermann Floor-Malted Bohemian Wheat malt (2 °L)
1.65 lbs. (0.8 kg) Weyermann Floor-Malted Bohemian Dark malt (6.5 °L)
0.87 lb. (0.42) Weyermann Beech-Smoked barley malt (2.9 °L)
0.33 lb. (0.16 kg) Weyermann chocolate spelt malt (275 °L)
0.33 lb. (0.16 kg) Weyermann Cararye® malt (66 °L)
0.22 lb. (0.1 kg) Weyermann Carafa® I (338 °L)
2.1 AAU Hallertauer Mittelfrüh hops (60 min.) (0.5 oz./13 g at 4.25% alpha acids)
0.16 oz. (5 g) lavender (5 min.)
0.16 oz. (5 g) wormwood (vermouth flavor; 5 min.)
0.1 oz. (3 g) marjoram (5 min.)
0.03 oz. (1 g) rosemary (5 min.)
Yeast (This recipe was conceived as a free-style transition beer from the time when both top- and bottom-fermenting yeasts were likely to have been present in many German vats and when brewers still used both hops and gruit in their kettles. The lager yeast was the Samuel Adams house lager yeast; the ale yeast was Fermentis BE-256).

Note: *Add the rosemary with caution, because its flavor can become dominant very quickly. Make sure the needle-like rosemary leaves are whole; if they are in powder form, use only half the amount specified. For a more gentle rosemary flavor, use even less. Reducing the rosemary component in this brew brings out more of the floral-perfume-like aspects of the lavender and wormwood.* BYO

Photo by Charles A. Parker/Images Plus

Beyond the Barrel

Using oak alternatives

by Andrew Reudink

We have a love affair with the barrel. For thousands of years people have used barrels for a practical means of transferring and storing goods. Only within the last couple of centuries has their general use given way to lighter, less expensive, and more durable materials, leaving the remaining oak barrels for the beverage makers. Ask a homebrewer about the next big purchase they would like to make for their brew and many will put an oak barrel on the short list. It's easy to see why, visit your local craft distillery, winery, or brewery and there they are stacked high in neat rows, annotated for when memory fails. Stainless fermenters usually out number them in breweries, but the barrels are where the *really* special products are being tucked away until they are just right. Who wouldn't want to add an oak barrel to sit amongst their carboys?

The interest in barrels has never been higher as the number of craft breweries, wineries, and distilleries reach all time highs year after year. With all the demand, prices are steadily increasing, making the cost of a new barrel quite a pricy investment. Even the smaller sizes ideal for homebrewers are still a decent investment. Not only are many people trying to brew on a budget but there is also a movement to decrease the overall footprint of homebreweries as is evidenced

Photo by Daniel Pambianchi

There are numerous varieties of oak powders, pellets, and oak chips available. Depending on the origin and toast level, these products can impart drastically different characteristics in a beer.

by the plethora of all-in-one systems that seem to have exploded into the market. Even a 5- or 10-gallon (19- or 38-L) barrel can take up a considerable amount of space in your brewing area. Add to that, smaller barrels can have a tendency to leak more than their larger counterparts. Most importantly, smaller oak barrels offer a surface area-to-volume ratio that far exceeds that of the 53-gallon (200-L) and 59-gallon (225-L) barrels the pros use. Oak character can become excessive if not monitored very closely, and oxygen ingress can ruin your beer before you know it.

What do we do the rest of the time we want to add oak flavor to our beer? Luckily, the modern homebrewer has a variety of options for adding oaky character to their brew without having to store and maintain a barrel at home, all of which are feasible, practical, and cost effective. Let's run through the various products — what they are, how and when they should be used, and their costs so we can get a better idea of which may be the best fit for your next wood-aged homebrew.

LIQUID OAK/WHISKEY FLAVORINGS

Products designed for flavoring vodka or neutral spirits can add specific regional flavor profiles such as Bourbons, scotches, brandies, or liqueurs instantly at relatively low cost (Manufacturers like StillSpirits and LiquorKwik provide "cloned" essences, additionally producers of natural fruit flavoring make liquid oak in increasing varieties.) Flavors tend to be more stable over time yet less nuanced and can be added at bottling/kegging because these flavorings do not contain fermentables. Results are highly repeatable especially when using a pipette or syringe to measure the dosage, but a little goes a long way so start with a small amount and add more to taste. Even better, remove a small measured sample that you can dose incrementally until you are happy with the flavor, then scale up the quantity into the full batch volume. Whenever time is a constraint, using liquid flavorings are an excellent option. *(Average cost for a 5-gallon/19-L batch: $5–$15)*

OAK POWDER, PELLETS

Somewhat like sawdust in texture, oak powder or pellets offers the fastest extraction of flavors over time (besides the liquid additives). Country of origin may be labeled (i.e. French or American) but toast level is usually not, rather offering recommended flavor profiles. Given the short contact time — one to two weeks is usually sufficient — oak powders are more easily used in the primary fermenter than thicker oak pieces but can still be used at any stage of your brew. Similar to dry hopping, powders add a lot of fine particulates that can clog transfers. Once added, pellets quickly break apart, so using a bag, canister, or steeping ball may aid in fining later.

Weigh out powders on a kitchen scale for consistent flavor from batch to batch. Pellets available in carboy-

ready sleeves eliminate the mess associated with transferring, however they lack the ability to change the quantity added to a given batch of beer. With the exception of the sleeves, oak powders or pellets are difficult to re-use in another batch later, given that they tend to offer maximum extraction on the first use. *(Average cost for a 5-gallon/19-L batch: $4–$8 powder, $8–10 sleeve)*

OAK CHIPS

Oak chips are one of the most highly used and least expensive forms of oak available to the homebrewer. Chips are easy to toast at home in the oven to desired levels if you can't find the toast you want (or just because it's fun!). Similar quantities can have varied flavor impact on the beer due to the inconsistent shape and size of the individual chips. Moreover, if you are used to very fine chips and find yourself using some that are considerable larger or vice versa, the flavor profile may vary wildly. The smallest chips can clog transferring equipment, so you may consider using a bag or filter screen on your siphoning equipment.

Some complain of a perceived bitterness or harshness where oak chips have been added due to the increased proportion of end cut to the long grain of the wood. That can work in your favor if first soaking them in a wine or spirit before adding to beer. Chips will easily piggyback their character because they act like a sponge. You can even find chips on the market that are already soaked in various spirits. Within one or two weeks of use chips will be spent, rendering them a poor candidate for multiple re-uses. Considering the short contact time, they are often added during primary fermentation or in the conditioning phase. *(Average cost for a 5-gallon/19-L batch: $4–$10)*

OAK CUBES

Roughly half an inch (1.25 cm) to a side, cubes are typically available in either French or American oak and are often blended from various toasts, however they can be found in individual levels. They are easy to scale up or down to accommodate desired oak character by simply counting the number of cubes and are highly consistent from batch-to-batch. It can take up to two months to achieve the full depth of flavor from cubes, but the resulting profile is worth the wait. However, this time constraint makes them difficult to use in the primary fermenter. They are best saved for secondary or beyond.

Much like a barrel that is toasted or charred on the inside while remaining "raw" outside, cubes offer lighter toasts the deeper the beer penetrates the wood, imparting subtleties not found in smaller sized oak alternatives. Whether bagged or loose, there is little chance oak cubes will interfere with racking. Even if added directly to a keg, oak cubes are large enough that they are unlikely to clog a dip tube. Many will even fit into the opening of bottles and therefore are suitable for cellaring. Note, they may expand slightly in the bottle and become impossible to remove.

Cubes are easy to repurpose into another batch, just place them in an airtight container (mason jars and vacuum seal bags work great) until the next batch is ready to be infused. In an airtight container, soaked wine or liquor cubes will last for months at room temperature, but consider freezing oak from a previous batch of beer if you won't be using it right away. *(Average cost for a 5-gallon/19-L batch: $6–$10)*

OAK SPHERES

Similar to cubes, oak spheres (or oak balls) offer a thickness that increases the depth of character in your beer. By eliminating the corners found on cubes, oak spheres are able to offer a superior level of consistency between lots, ensuring that your favorite specialty beer is on point time and again. They were originally designed and milled to be as large as possible for use in neutral wine barrels where other oak treatments were difficult to remove. These little balls just roll right out after you rack, making clean up a breeze.

Since they were designed for commercial winemakers, both French and American oak is available in all toasts, but it may prove hard to find smaller quantities of all but the most popular varieties. If you desire a char you will have to do it yourself — get out the kitchen torch and place the spheres on a non-flammable surface.

At an inch (2.5 cm) in diameter, spheres still squeeze into the narrow opening of a glass carboy and are easy to measure. Typically added at the rate of one sphere per gallon (4 L), but that can be changed as desired. To ensure the broadest flavor possible, allow up to four months of soak time. These are wonderful for additional uses, offering up to a year of total contact time with your beers. *(Average cost for a 5-gallon/19-L batch: $7– $13)*

OAK SPIRALS

Available in a wide variety of oaks, toasts, and chars, the precise milling against the grain allows spirals to extract flavor quickly and consistently. They are cut to expose more end in proportion to the long grain of the wood than other staves. The high manufacturing cost makes spirals one of the priciest oak alternative choices for the homebrewer, but it can be a cost that is well worth the regularity. Spirals offer infusion times as short as three to six weeks. To change the overall intensity, just measure in length and break off the desired size.

Smaller 750-mL bottle-sized spirals can be added directly to bomber bottles and are an excellent choice for setting aside something special worth aging if you didn't want to oak the entire batch. Spirals, like other staves, will not hamper the normal use of a corny keg so can also be added directly to the keg. The milling leaves the oak relatively thin so multiple re-uses should be avoided. *(Average cost for a 5-gallon/19-L batch: $7–$20, or single-bottle size packages can be bought for $4–$7)*

STAVES

Planed smooth, oak staves have the closest relationship to a barrel in the proportion of the long grain to capillary exposure (end cut). Shy of only barrels themselves, staves take the longest to impart their full oak char-

acter. Staves made for homebrewers are typically sized for a 5- to 6-gallon (19- to 23-L) batch. Lowering that ratio will require the use of a saw to cut the stave down to the required size. It is ill advised to try and snap a piece off of the stave like you might do with a spiral as splitting the stave can lead to characters more closely resembling chips and increase the intensity (not in a good way).

Staves are available in every conceivable toast and char, much like spirals, manufacturers are engineering the shape and thickness of staves to decrease extraction time while providing fuller flavor. Different patterns in the wood change the overall flavor profile and are designed for beer, wine, or spirits respectively. Ultimately, follow the producers' guidelines for time, but account for at least two months. Many offer a hole drilled in one end or both to attach a string for easy removal or to tie several staves together in sequence. Staves are possibly the best choice for both long-term storage and re-use from beer to beer.

Making staves at home from American white oak can be rewarding especially if you have the opportunity to harvest the wood. It typically takes two seasons at least to properly dry the wood before it is suitable for use. So if you do not have access and have patience, try the local lumberyard but be sure not to purchase any treated wood. Kiln drying is acceptable, but they must contain no chemical desiccants, which can be poisonous. *(Average cost for a 5-gallon/19-L batch: $10–$15)*

CHOOSING THE "RIGHT" OAK FOR YOUR BEER

Coopers and producers of other oak products both overseas and domestically use very similar seasoning conditions to ensure the highest quality. Around the world, cooperages source their oak from three primary types — French, Hungarian, and American. Few oak alternatives are available in the Hungarian variety by name, though it may be used in certain products that are not identified as such. Hungarian oak is considered to impart a flavor somewhere in between French and American types. Using some of each of the former can result in a flavor that mimics Hungarian. When deciding on French versus American oak treatment, you need to understand and consider the differences between the two flavor profiles. They are not only from different countries but different species of oak altogether. French oak has a tighter grain imparting flavors more slowly with subtle notes of spice and a perceived silky tannic texture. While American white oak has more flavors associated with baking characteristics; caramel notes, vanilla, and an overall creamy mouthfeel. The loose grain of the wood may take less time than its French counterpart given a similar style of treatment, though seems to be less stable over time.

Matching a beer style to an oak profile can feel overwhelming considering the variety of options. It is always best if possible to choose based on tasting notes. If the resulting beer doesn't taste better, then what is the point? Don't let anyone else's "rules" dictate your creativity, but if you are new to oak products then you can certainly see what oak/beer style combinations pros or other experienced homebrewers are doing.

What you need to consider after the flavor, which is paramount, are the practical aspects of using oak in your beers. Do you have time for the treatment you prefer? Is it going to require additional racking or fining? Is it available in the time I need it? Does my chainsaw need to be sharped before trimming this branch?

RE-RE-USE

Oak trees grow slowly. It takes a lifetime before an oak can be harvested, with some coopers preferring trees centuries old. It is no wonder then that barrels are constantly repurposed, likely only out of necessity at first. Then someone realized the potential of reusing oak. Sours in old wine barrels. Stouts in old Bourbon barrels. Why stop? IPA in a red wine barrel that had a course of gin run through it in between? Yes, please. When you see the largest breweries, wineries, and distilleries in the world aging their wares in several barrel types, you have to think perhaps there is more to it than marketing. The three recipes on pages 75–76 are a few of my favorite homebrew recipes in which I've used oak alternatives, and you'll see from the list that the styles vary dramatically. Just because oak in beer is often associated with imperial stouts and sours, the flavors that oak contributes can enhance (and even significantly change for the better) numerous beer styles!

When trying to add a used barrel flavor to beer, soaking your oak alternative in spirits or wine prior to adding will reduce the overall intensity while contributing flavors closer to one that has been freshly dumped. To do this, cover the oak with wine or liquor and let sit in a sealed container at cellar or room temperature for a week or more. As the contact time increases the flavor the oak product will release will shift from straight oak towards the infusion. Keeping air out is more important for wine than liquor as it oxidizes more quickly and can lead to undesirable flavors. When the oak has soaked up as much of the flavors as you desire, pour off the liquid and add your oak to your beer. Or alternatively, start a second infusion to further reduce the oakiness and add another depth of flavor. There are no strict rules here; if it tastes good in the beer then you've done it right! The leftover oaked wine/spirit is a type of flavoring not so different from the ones above and can be added with the oak or later used to quickly intensify those characteristics. If you don't want to add it to your homebrew, it's usually quite tasty as a cocktail mixer if there is no other use for it.

Just because you don't own a barrel doesn't mean you can't recreate the finest oak flavors available. And you never have to worry about oak alternatives drying out or leaking. Even when you don't have a specific project in mind, save those chips, cubes, spirals, spheres, and staves from your last batch in an airtight container. They might just make that next brew even better. BYO

OAK ALTERNATIVE RECIPES

ABYSMAL STOUT (BOURBON "BARREL" AGED)

(5 gallons/19 L, all-grain)
OG = 1.096 FG = 1.020
IBU = 40 SRM = 66 ABV = 11.5%

INGREDIENTS

15 lbs. (6.8 kg) Golden Promise™ malt
1.5 lbs. (0.68 kg) kiln coffee malt (150 °L)
1 lb. (0.45 kg) Briess Midnight Wheat malt
1 lb. (0.45 kg) crystal rye malt (75 °L)
0.75 lb. (0.34 kg) crystal malt (60 °L)
0.5 lb. (0.23 kg) Victory® malt
2 lbs. (0.9 kg) extra dark candi syrup (primary)
6.5 AAU Nugget hops (60 min.) (0.5 oz./14 g at 13% alpha acids)
6.5 AAU Nugget hops (30 min.) (0.5 oz./14 g at 13% alpha acids)
1 oz. (28 g) licorice root (15 min.)
1 vanilla bean (primary)
2 oz. (57 g) Bourbon-soaked American white oak cubes
Imperial A10 (Darkness) or Wyeast 1084 (Irish Ale) or Lallemand Nottingham yeast
¾ cup corn sugar (if priming)

STEP BY STEP

Soak the charred cubes starting on brew day in Bourbon or rye of your choosing (mid-shelf). Mash in the grains with 6.2 gallons (23.4 L) of 164 °F (73 °C) strike water to achieve a mash temperature of 150 °F (66 °C). Hold this temperature for at least 60 minutes, then begin mashout process. Collect 7.5 gallons (28 L) of wort. Total boil time is 2 hours. Add hops and licorice root as indicated. You may want to add a yeast nutrient as well to give the yeast an extra boost to help finish fermentation.

Chill the wort, aerate, and pitch the yeast. Try to hold fermentation at around 68 °F (20 °C) but be careful that internal fermentation temperatures may be quite a bit higher than ambient temperature. Once fermentation begins to die down, add the candi syrup and chopped vanilla bean.

When your beer is ready for transferring into secondary (about 3–4 weeks), pour the liquor off the oak cubes (*reserving for cocktails!*) and place cubes into the vessel. Rack the beer on top of the cubes. Big stouts like this are often best with considerable age, after many months (minimum of 2 months) of aging to allow the oak and intense flavors to meld together, while the sometimes hot alcohol character of a fresh beer smooths out. Consider a January brew day for a Christmas beer release. If time does not allow for such a long aging, decrease the quantity of oak used or switch to an oak alternative with a shorter extraction time.

ABYSMAL STOUT (BOURBON "BARREL" AGED)

(5 gallons/19 L, partial mash)
OG = 1.096 FG = 1.020
IBU = 40 SRM = 66 ABV = 11.5%

INGREDIENTS

Replace the Golden Promise™ malt from the all-grain recipe with 6.6 lbs. (3 kg) Maris Otter liquid malt extract, 2 lbs. (0.9 kg) extra light dried malt extract, and 2 lbs. (0.9 kg) Golden Promise™ malt. The remainder of the ingredients remain the same as the all-grain version.

STEP BY STEP

Soak the charred cubes starting on brew day in Bourbon or rye of your choosing (mid-shelf). Starting with 2 gallons (8 L) of water, bring temperature to 160 °F (71 °C). In a large grain bag, submerge the crushed Golden Promise™, the kiln coffee and Victory® malts into the water. Hold the mash temperature at 150 °F (66 °C) for 45 minutes, then stir in the remaining crushed grains while bringing the temperature back to 150 °F (66 °C). Hold this temperature for at least 15 minutes, then wash grains with 1.5 gallons (5.7 L) of hot water.

Top off the kettle to 6.5 gallons (24.6 L) and stir in malt extracts while off heat until fully dissolved. Return to heat and bring wort to a boil for 60 minutes. Follow the remainder of the all-grain recipe.

FLANDERS RED ALE

(5 gallons/19 L, all-grain)
OG = 1.061 FG = ~1.008
IBU = 5 SRM = 22 ABV = ~7%

INGREDIENTS

3 lbs. (1.4 kg) Pilsner malt
3 lbs. (1.4 kg) Vienna malt
3 lbs. (1.4 kg) Best Malz Red X® malt
1 lb. (0.45 kg) German Munich malt (6 °L)
0.5 lb. (0.23 kg) aromatic malt
0.5 lb. (0.23 kg) Caramunich® II malt
0.5 lb. (0.23 kg) Special B malt
0.5 lb. (0.23 kg) red wheat malt
1 lb. (0.45 kg) amber candi syrup (0 min.)
2 AAU Hallertau hops (30 min.) (0.5 oz./14 g at 4% alpha acids)
1 French heavy toast oak stave soaked in red wine
Imperial Yeast G02 (Kaiser) or White Labs WLP036 (Düsseldorf Alt Ale) or SafAle K-97 yeast
Imperial Yeast F08 (Sour Batch Kidz) or White Labs WLP665 (Flemish Ale) blend
¾ cup corn sugar (if priming)

STEP BY STEP

This is a single infusion mash. Heat 3.75 gallons (14.2 L) of strike water to 169 °F (76 °C). Mash at 155 °F (68 °C) to 60 minutes before beginning mashout process. Collect 6.5 gallons (24.6 L) of wort and bring to a boil. Boil for 60 minutes, adding hops and candi syrup as indicated.

Chill wort, aerate, and pitch the

OAK ALTERNATIVE RECIPES

German ale yeast (don't pitch the blend at this time). Ferment at 62 °F (17 °C) for about 10–14 days.

When final gravity is reached and beer has settled, transfer to secondary and inoculate with the yeast/bacteria blend. Give the bugs several weeks to get their funk on before dumping the wine and adding the stave to your beer. Within as little as a few months the beer will be ready to keg or bottle!

FLANDERS RED ALE

(5 gallons/19 L, partial mash)
OG = 1.061 FG = ~1.008
IBU = 5 SRM = 22 ABV = ~7%

INGREDIENTS

Replace the Pilsner, Vienna, Red X®, and Munich malts in the all-grain version with 1.5 lbs. (0.68 kg) Pilsen dried malt extract, 1.5 lbs. (0.68 kg) Vienna dried malt extract, 1 lb. (0.45 kg) Munich dried malt extract, and 2 lbs. (0.9 kg) Best Malz Red X® malt. The rest of the ingredients are the same as the all-grain recipe.

STEP BY STEP

Starting with 1.5 gallons (6 L) of water, bring temperature to 160 °F (71 °C). In a large grain bag, submerge the crushed Red X®, aromatic, and red wheat malts into the water. Hold the mash temperature at 155 °F (68 °C) for 45 minutes, then stir in the remaining crushed grains while bringing the temperature back to 155 °F (68 °C). Hold this temperature for at least 15 minutes, then wash all the grains with 1.5 gallons (5.7 L) of hot water.

Top off the kettle to 6.5 gallons (24.6 L) and stir in malt extracts while off heat until fully dissolved. Return to heat and bring wort to a boil for 60 minutes, adding hops and candi syrup according to the ingredients list. Follow the remainder of the all-grain recipe.

TIPS FOR SUCCESS:

If you haven't saved an oak stave from a batch of wine you made, don't fret, but you may have to start soaking it 2–3 months prior to brew day to achieve the right balance and that freshly dumped barrel taste. Place your stave in a Ziplock or vacuum seal bag and pour in about 8 oz. (235 mL) of your favorite full-bodied and tannic red wine (like a Cabernet Sauvignon). Moving it in and out of the freezer daily will help speed up the rate of extraction.

Sour beers and mixed culture fermentation are worthy of many articles and books unto themselves. This is a very simple explanation for making a sour beer. Though it consistently works well, the time to achieve your desired flavor profile may vary based on factors that are outside the scope of this article.

VIN BLANC IPA

(5 gallons/19 L, all-grain)
OG = 1.064 FG = 1.014
IBU = 58 SRM = 5 ABV = 6.4%

INGREDIENTS

9 lbs. (4.1 kg) Pure Idaho Pilsner malt
3 lbs. (1.4 kg) white wheat malt
0.5 lb. (0.23 kg) Vienna malt
0.33 lb. (0.15 kg) crystal malt (15 °L)
14 AAU Nugget hops (60 min.) (1 oz./28 g at 14% alpha acids)
12 AAU Hallertau Blanc hops (5 min.) (1.25 oz./35 g at 10% alpha acids)
0.75 oz. (21 g) Nelson Sauvin hops (1 min.)
0.5 oz. (14 g) Cashmere hops (1 min.)
1.25 oz. (35 g) Nelson Sauvin hops (dry hop)
0.75 oz. (21 g) Hallertau Blanc hops (dry hop)
0.5 oz. (14 g) Cashmere hops (dry hop)
1 oz. (28 g) gin-soaked American oak chips (medium toast)
Imperial Yeast A24 (Dry Hop) or Omega Yeast OLY-052 (DIPA) or LalBrew New England
¾ cup corn sugar (if priming)

STEP BY STEP

Starting on brew day, in a sealed container cover 1 oz. (28 g) of oak chips in your favorite gin. Heat 4 gallons (15.2 L) of strike water to 162 °F (72 °C). Mash all the grains at 148 °F (64 °C) for 75 minutes before beginning the mashout process. Collect 6.5 gallons (24.6 L) of wort and bring to a boil for 60 minutes, adding hops as indicated. After flameout, give the wort a long stir to create a whirlpool and let settle for several minutes.

Chill wort to yeast-pitching temperature, aerate, then pitch the yeast. Ferment at 68 °F (20 °C) for roughly one week, then add the dry hops. At this time, pour the gin off the oak and replace with a dry white wine like Sauvignon Blanc. When the beer is ready for transfer, rack into an appropriate fermenter or keg and add the chips with the wine to the beer. Package the beer as you would a normal IPA.

VIN BLANC IPA

(5 gallons/19 L, extract with grains)
OG = 1.064 FG = 1.014
IBU = 58 SRM = 5 ABV = 6.4%

INGREDIENTS

Replace the Pilsner, wheat, and Vienna malts with 5 lbs. (2.3 kg) Pilsen dried malt extract and 2 lbs. (0.91 kg) wheat dried malt extract. The remainder of the ingredients remain the same as the all-grain recipe.

STEP BY STEP

Starting with 6.5 gallons (24.6 L) of water, submerge the crushed grains in a muslin bag into the water. Heat the water up to 170 °F (77 °C) then remove the grains. Stir in all the malt extracts while off heat. Stir until malt extracts are fully dissolved, then bring wort to a boil. Boil for 60 minutes, adding hops according to the ingredients list.

Follow the remainder of the all-grain instructions.

from HOBBY to startup

by Jason Phelps

Steps to make your passion a business

So, you want to take your beer/mead/cider-making hobby to the commercial level? Good for you, and you've accomplished the first step, which is to start thinking about the idea! You will want to keep doing this. Advice abounds, and if you ask around long enough you'll hear cautionary tales as often as you'll hear good, usable advice. That is alright though, the warnings are a reminder of the risky choices inherent in this type of project. The straight story is that you must REALLY want to make, market, and sell beer (or mead, cider, etc.) professionally in order to get it right. The key to success will be how you react and how you use the resources you have when things change, because things will always change.

In April of 2016 my wife and I began the planning for launch of Ancient Fire Mead & Cider, a boutique producer of meads and ciders that would be based in southern New Hampshire. By the fall of 2016 we were immersed in the business planning and had begun scouting for locations. We worked with our local SCORE Association chapter (a network of volunteer, expert business mentors) to get advice and counseling, something that helped us stay on track building out our financials and refining our pitch for the loan we were seeking. We found a location in early 2017 and by July 2017 had secured it and begun our permitting process with the Alcohol and Tobacco Tax and Trade Bureau (TTB). Financing fell into place in the fall of 2017, including a loan through a local economic development corporation associated with the city we situated our business in. For the remainder of 2017 we were in construction mode working with a local contractor as well as doing some of the work ourselves. After nearly two years of planning and preparing, we finally opened the doors to our business on March 1, 2018 with the first of three product lines for sale. We still have a lot more work to do on the market-

ing and sales front, but every bit of planning we have done can be seen in the tap room we opened last summer and the production facility that sits behind it.

In this article I intend to raise lots of questions and provide some tips in a whole bunch of areas that you'll ultimately need to spend time working on in order for you to successfully plan a project to go pro. I won't be taking you through the entire process of opening a complete and operating business, but rather get you to the point where you can get moving to build a solid foundation for your vision. A lot of this is common to non-beverage businesses as well, but the specifics will keep you in the beverage mindset.

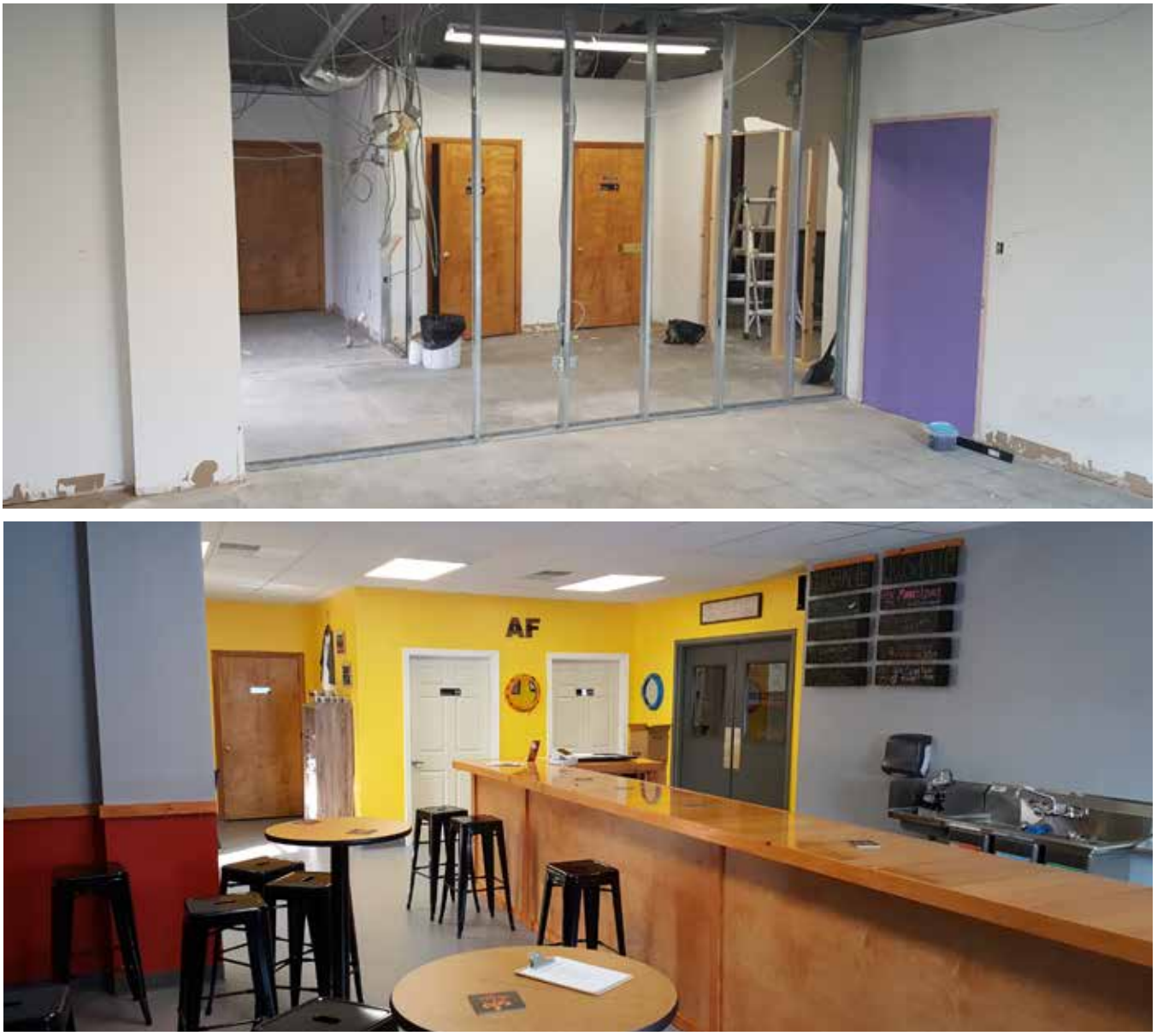
ASSEMBLE THE TEAM

Bring together owners, primary investors (if you have them), and any other decision makers. Make sure everyone knows each other. Initially ask them to work as a group to discuss the strengths and weaknesses of the idea/project and how to turn that information into useful business plan components. Take good notes.

Every successful ownership team also retains trustworthy business partners to help them with legal, insurance, real estate, financial, and compliance matters. Get out and find them. Build your team to include people who can help you by planning and researching "in-house," but also those that can provide value-added and advisory services as you explore your goals. Once again, hire those who are engaged.

HAVE A PLAN

Create a business plan. The plan should describe your vision, your mission to execute that, who is behind the company, how it will get launched, who you are competing with, and where you expect it to go a couple years out into the future. This is a great exercise for an ownership team to go through. You learn about



Photos courtesy of Jason Phelps

A before and after look at what is now the Ancient Fire Mead & Cider tasting room, located in Manchester, New Hampshire.

your plans, learn about each other, as well as find so many things to discuss, make more specific, and of course meaningful to you as the founders. To familiarize yourself with the ins and outs of a plan, find templates or completed plans to review so that you have an idea of what you need to include as well as how to phrase it. There are also a number of resources out there to help understand the different aspects of the beverage business. Entrepreneur Magazine has published some, and college or graduate school textbooks are always a good place to start.

Talk to competitors, retailers, bars, restaurants, similar area businesses, and other new local businesses owners about the local beverage industry. Find out what starting a business has been like in your area. Find out what other beverages like yours sell for in all the different venues where you expect to compete with them.

Be sure to identify early on what parts of your plan are absolutely required for the project. Tap into local economic development organizations, the Small Business Association (SBA), the nonprofit SCORE Association, and other available resources to help you understand aspects of the business planning process with which you are not already familiar. You need to know your plan and craft your pitch as you evangelize for your project. These resources can help you do this.

DON'T FEAR THE FINANCIAL ANALYSIS

Before we speed past the new business plan you've created, it makes sense to reinforce that spending time on the financials of your business plan will absolutely help you. You may need help with it — we did — but going and getting that help will take you farther than you can imagine.

Grab hold of something, but here is a mouthful of concepts you will need to get your head around. Cash flow statements, fixed expenses, variable expenses, cost of goods sold (COGS), seasonal sales forecasts, weighted gross margin (WGM), calculating breakeven, a production calendar, staffing forecasts, and so on, all including components like insurance and taxes! Just look all this stuff up, and then find someone (like the previously mentioned SCORE, SBA, and local economic development resources) to help with the parts you don't immediately get. You will eventually get it, and you'll appreciate knowing how to understand the impact of your decisions when you do.

Please see page 91 for more discussion on COGS.

FINANCING YOUR PROJECT

Every project needs resources, and financial ones are never in great enough supply. You will need to know what funding you already have and what additional types you are interested in seeking. Make sure you have a realistic understanding of what funding sources actually net you versus what they will cost you.

Develop a startup budget that includes categories like owner equity, loans, crowdfunding, equipment, construction/upgrades to the facility, and startup costs like marketing, six months of COGS, and operating expenses, etc. Net it all out so you can get a good idea of how much money you need.

Talk with local economic development authorities about revolving loan programs and startup services. Get involved in the local chamber of commerce and/or other professional networking groups. You will meet lots of great people who can help you reach out and find leads to chase down. Be ready to explain a summary of your business plan (your "elevator pitch") including highlights from your financials. Network your way into partnering with others who can loan you money based on your planning and ability to speak to how you are going to grow your initial success. Keep in mind that while you may simply love the beverages you make, business investors will expect a financial return on their investments. You need to make a profit to remain in business.

GET HANDS ON

Do you have any friends who work at (or own) a brewery? Ever worked with them there before? You should.

There are definitely some equipment differences between home and commercial production, and scale alone can make translating the experience working in a local brewery for a day to your project challenging. The understanding of the processes and what modern industrialization can do for you is well worth any time spent. Learn how to break down and clean a tank. That next beer that goes through it will be sold to the public and because you made sure the tank was clean, it will be the best it can be! The networking opportunities through hands-on volunteering are invaluable.

COMPANY BRANDING, MARKETING, & SALES

What is your brand all about? How does your vision translate to something tangible that can be demonstrated to business partners, investors, or customers? How do you plan to represent your brand visually? Will you be engaging a branding designer that will develop a branding package that represents your brand online, in print, on gear and signage, and ultimately labels?

As the owner of a startup meadery I coined a twist on a phrase my brother-in-law once said to me about being a sales guy. "Always be(e) hustling" is what I say I am doing when I am making mead, marketing Ancient Fire or even taking out the Ancient Fire trash bin.

You have to sell the product you make, which means someone from your team will need to spend time marketing it, and actually doing all the work to educate, share samples, answer questions, and ultimately take and fulfill orders. More time will be spent here than in making the product. Or at least, you will want this to be the case soon.

Are you selling to retail customers? Can you direct distribute? What kinds of accounts are you looking for? What formats will your product come in? What kind of promotions can you do? How do your marketing expenses return on investment? You'll need to work answers to these questions out as part of your plan, and you will soon

be ready to get out there and make some sales.

How you market your new business from the first day you want to go public with the vision is something you will want to work out early. You won't be selling product on day one of your planning, but you are already marketing your brand, so working this out before a lot of other aspects of the project, including many of those physical ones, will ultimately set the tone for how customers engage with your brand.

LOOKING FOR A LOCATION

Leasing or buying a location for your brewery is going to be a complicated equation for your project, and so much of what needs to be put into the details is going to come from you. But, here are some general tips to make vetting locations productive: Pick a few towns, and get a feel for their zoning, permitting, and other processes. Talk to someone who opened a similar business in these same areas if you can. A real estate agent will be a huge asset — they know the local market, but they also know so many helpful people! Work out how they get paid in a contract up front and work it out in terms commonly used in your area so other agents and potential landlords won't be met with something they aren't used to.

I leased a space for my business so I can provide tips on that process. Buying a property will be different up front, but many of the concerns around usage will be the same, and you'll want to get all of that worked out in advance.

When you see a promising space, pull its property and land use information and ask the local zoning/planning officials if the type of business you want to run is permitted there. If it is, you need to look more closely at the space for what is necessary for your business. If not, you'll need to wade into land use and zoning variances, the process for which is going to vary from locale to locale.

Once you've identified one or more spaces that might be a fit, talk

Photo courtesy of Jason Phelps

Jason and Margot Phelps at Ancient Fire Mead & Cider.

to plumbers, electricians, contractors, and the landlord about what you want to do and how it might be accomplished in the space. You'll also need to consider local health codes, local fire and safety codes, parking, and handicap requirements.

Typically, to get a landlord to take your interest in a space seriously, you would draft a letter of intent (LOI) that outlines the terms you would like them to entertain for a lease. Just like the real estate agent contract, and a agent should help with the LOI, you'll need to draft the LOI in terms consistent with local and state law, as well as in terms that the market typically works within for the best outcome.

There are several different commercial lease types out there and understanding how they work can help with expectations of how your costs will break down, and this is something your real estate agent can help you with. You'll also want to get a feel for annual increase and lease renewal terms as well as any sublet/escape clauses that will apply to a potential lease you may want to enter into.

You will definitely want to have a local real estate attorney review a lease for you and help coordinate any changes to be negotiated with the landlord. This section may read somewhat simple, but it is a complex and important aspect, one you should give appropriate time to.

FEDERAL PERMITTING

Working with the Alcohol and Tobacco Tax and Trade Bureau (TTB) and the Permits Online system is recommended, but is not entirely a straightforward exercise. The paper forms are the older way to go, and are definitely no longer efficient.

What to review first? You'll need a location and a signed lease to get the process started; the federal alcohol production bond is site-specific. You'll also want to have a diagram of how your space will be laid out. You are essentially making yourself known as an alcohol producer to the federal government so they want all sorts of information, including the sources and uses of any money the company has or is expecting commitments to. They will also ask for background information on all owners (more than 5%) so it makes sense to consider the ownership structure before you get here.

You do not necessarily need to engage an attorney for this process — we didn't — but that is done with some frequency based on this question coming up in trade circles.

STATE & LOCAL LICENSING

You'll need to understand the applications, fees, and purposes of all sorts of things, including business licenses and permits of assembly. It varies town-to-town, and state-to-state, so you'll need to explore this topic independently. Identify the regulatory agencies and give them a call. Most will have resources on their websites or will send them to you upon request.

WHERE DO YOU GO FROM HERE?

Head spinning yet?

At this point if you've done the aforementioned, then you have informed yourself across an array of topics for the project you hope to take on. You should have a vision and a team energized to take it public. With the exception of the costs associated with building out and working in a specific location, the production equipment, labor, lots of miscellanea, and any unique aspects of your business, you should have the core of a startup budget in view. You'll want to fill in the rest as you further refine your vision and make decisions about where and how you will be operating.

With the above foundation, you are ready to dive into securing a location, finalizing the build out costs, entering into permitting/licensing, and getting your new space ready to go.

There is much work ahead of you, but it will be worth it when you get to serve the first customer in your new facility. BYO

RELATED LINK:

Dreaming of taking your hobby pro, but not interested in running the business? Here's what you need to know before you get started: https://byo.com/article/go-pro/

BY JOSH WEIKERT

MASTER THE SPICE

Options and approaches to additions

One of the best things about being a homebrewer is that you get to make the kinds of choices that beer drinkers that only *buy* their beer never get to make. Homebrewing, generally, gives us control over what styles to brew and subsequently drink. For example, I love altbier, but they can be a tough style to find and/or identify. Also, you get to control when to drink your homebrew — if I want a fresh Oktoberfest in May, I can have one. And finally, homebrewing allows adjustments to a beer's specs. For example, I love New England IPA, but I can't find one with five percent ABV . . . but I can brew one. It also includes making beers that a brewery won't make, doesn't want to make, or maybe even can't afford to make. It's with this in mind that we get into today's column on spices in beer. Spiced beer isn't exactly new — in the days before hops became the de facto flavoring agent in beers, any number of flavorful herbs and spices were used in beer. (Most folks know these malt beverages as gruit.) However, homebrewing gives us the chance to spice with whatever we want, not just the usual coriander and orange peels.

With that in mind, this issue's "Techniques" column will be less about which spices to use — honestly, crack open that spice cabinet and build a recipe based on whatever jumps out at you — and more about the approaches to using spice that should be broadly applicable to any number of recipes and beers. We'll start with spices in the brew day, and then go on to address getting your hands on good spices, dialing in your recipes, and upping your spice competence and confidence.

As a rule, I add my spices post-fermentation unless I have a compelling reason not to.

Photo courtesy of iStockphoto

SPICING THE BEER: WHEN

When it comes to spicing beer (or adding any specialty ingredient, actually), I prefer to work from the back of the process to the front. What's the absolute *latest* in the process I can add something? That's when I want to do it. The reasoning behind that approach is that the earlier in the process an ingredient is added, the more change it can undergo in presentation and the less control I have over it from a flavor perspective. My first pumpkin spice beer was a bit of a mess, in large part thanks to an aggressive cinnamon flavor derived from cinnamon added in the boil. It was too much (I later learned), and not only that but the flavor seemed sharp and unpleasant rather than spicy and redolent. If I had only waited and added it, to taste, post-fermentation, I would have gotten a better result.

As a rule, I add my spices post-fermentation unless I have a compelling reason not to. This means no unpredictable reactions from the boil/heating; many spices react to heat, of course, and often in good ways. However, unless I brew a recipe regularly I'm never going to get enough renditions of it made to really test whether I'm getting a better (or worse) expression of that spice thanks to heating it. I don't like that level of variability. Then there's whether the spice flavor (good or bad) survives the fermentation process, and I don't mean (only) potential interactions/transformations in the presence of yeast — an early-added spice could also blow-off during primary, either through off-gassing of developed/extracted compounds or through literal blowing-off via the kräusen.

A more-controllable approach is

to add to taste, post-fermentation. We'll get to the how in a minute, but that's the when in most cases. There are some exceptions. If it's something that is regularly used in brewing and/or boiling adds a known value, then I'll consider adding it in the mash or boil. This could include lemon or orange peel, some herbs (I find that rosemary benefits from a hot-side addition compared to cold), or salt in my Gose. Adding it post-fermentation, though, means that I can taste what I'm adding, taste the beer I'm adding it to, and balance my flavors directly. At that stage the only step in the process remaining is carbonation and conditioning, and if kegging I can even adjust that to get the most out of my spice additions. When an ingredient isn't used often enough to develop a reliable recipe, then control, control, control is the name of the game.

spices will develop flavors quickly, so taste at a reasonable interval (one hour, then a few hours, then a couple of days, etc.) to "track" the changes in flavor. You may also find that your spices are fully-depleted and don't keep adding flavor, even though you're not satisfied yet. If so, good. Add more, and continue the process. Remember, under-shooting at first isn't a problem here, but overshooting is.

I nearly always use a tincture, though. A tincture is simply a liquid extract you create for yourself, and then add *it* to the beer rather than the spices. Soak your spices in a neutral spirit like vodka (bag any ground spices). Pour just enough liquid to cover the spice, and let it sit for 30 to 60 minutes. At that point, remove the bag/spices (or decant the liquid off of the spices). What remains should be an alcoholic extract of spice that you can add directly to your beer. Don't worry about not

> **"This might sound strange, but don't lean too heavily on your own spice cabinet unless you're sure that what you're using is relatively fresh."**

SPICING THE BEER: HOW

This section presumes that you're adding post-fermentation, but parts of it will translate even if you're going in at another stage of the brewing process. In either case, it's a question of spice prep and infusion method.

First, prep your spices — this might be as simple as opening up a bottle or package. For example, brewers who use whole coffee beans or cinnamon sticks, need no prep, but many others do require some form of a crush, grind, or splitting. Most of the time you'll benefit from exposing more of your spice's surface area and/or getting inside of it. Cracked or crushed peppercorns, split vanilla beans, ground coffee, etc. Of those, I prefer cracked/crushed to ground. That might seem a bit counter-intuitive — don't we want maximum exposure for maximum flavor? Possibly . . . but then we're back to control. In many cases we're only using a small amount of spice anyway, which speaks to the cliché: A little goes a long way. Grinding increases the risk of getting too much flavor out of it. Don't believe me? Put a whole or cracked black peppercorn on your tongue — not bad. Now chew it — depending on your tolerance for peppery flavors, you might hang in there for a while, but the heavily-crushed spice is going to be more intense. That's going to matter less if you use the tincture approach I describe below, but even there I tend to use just a cracked/coarsely chopped form. If I get an intensely-flavored tincture, I may overshoot or get gun shy and undershoot. You can always add more. You can't take it out once it's in there.

In terms of addition, you can do a direct-add or make a tincture. If adding directly to the fermenter (or even the keg), get hold of a fine-mesh bag. You probably already have one or two for use with hops, anyway! Steep, then taste. Some

making enough, or making it too weak — just like the steeped spices, you can always add more, though if it's so weak that you can't taste the spice, by all means let it rest a while longer. Try, then trust. You can also use this approach to add combinations of spices, but the more control-freakish among you will want to make individual tinctures for each spice and then blend, or add each in sequence to the beer to build your flavors.

The question of "how much" spice you'll need or want is going to be relative and vary from style to style and recipe to recipe. The wide world of beer publishing and the internet has a number of resources that might provide good reference points (including the vast recipe collection found on www.byo.com/recipe), especially if using a common spice (cinnamon, vanilla, etc.). If, however, you don't trust what you read and/or if you are using an exotic or atypical spice, I can recommend the following approach. This is what I've come to term my "Family of Four" guideline: Find a cooking recipe that uses that spice in a meaningful way (not just as a subtle flavoring or as part of a huge collection of spices or in spice heavy rubs or marinades), and scale it to six servings (what you would make for a family of four people). How much of the spice in question is called for? That's about how much you'll probably need per 5 gallons (19 L) of beer. It's simplistic, not based on any firm science, and entirely anecdotal, but I'll be darned if I need to adjust by more than a few percentage points either way. If it's an especially strong spice I might aim lower, or if it's an especially prominent flavor profile in my beer I might aim higher, but this is a great starting point for whatever the spice is. If nothing else it can give you a little bit of confidence to use that smoked paprika even when you can't find a single brewing recipe that does!

FINDING YOUR SPICE

Last, but not least, good sourcing of your spices can be the difference between the satisfied glow caused by a great beer and a tight-lipped smile followed by hearing the most dreaded words in subjective beer evaluation: "That's interesting!" This might sound strange, but don't lean too heavily on your own spice cabinet unless you're sure that what you're using is relatively fresh. Dried spices (especially if already cracked, crushed, or ground) can oxidize just like any other ingredient. Would you use an open can of two-year oats from your pantry in your oatmeal stout? Good — then don't use that had-it-since-you-moved-in jar of ground cloves. Even if the oxidation doesn't carry through to the flavor in a perceivable way, oxidized spices are simply less-flavorful than fresher spices, on average. If, however, you're a regular cook and you have good "pull-through" in your spice cabinet, it can be a good place to "shop" for your brewing spices.

Otherwise, go visit your local supermarket. Dried spices are plentiful there, and the baking aisle will have a large selection of what you need (and inspiration for what you might only want). If you know that you'll be using these spices in the future, you can also take care to store them in vacuum-sealed, CO_2-flushed, or even just generally air-absent containers or bags to help preserve them for future batches of beer. Bag, force the air out as best you can, and store in a freezer.

You can also secure fresh herbs and spices from the produce aisle, preserving a lot of secondary flavors that won't be present in the dried varieties. It can take a bit of effort and research to work out how best to get at the spice/compounds in question, but the results are usually worth it. Black limes, ginger, peppers, and other seeds and roots can be processed at home to get the freshest product available, and they often come with the unexpected benefit of a lot of secondary flavors as well! If, however, you definitely want only a single spice flavor, then maybe stick to the pre-processed options.

SPICE UP YOUR LIFE

If you've read this far then the final recommendation is probably wasted on you, but here it goes, anyway: Experiment. And I don't mean that in the "throw something in and hope for the best" sense. I mean, keep good records, add spices to only part of a batch (or, even better, split it into five mini-batches and dose each differently), and learn from your results. For more on this topic read the December 2018 "Tips From the Pros" on spicing concepts.

Brewing with spices can be a remarkably rewarding effort, but it can also be maddeningly variable. Your best defense against that frustration is to know what goes in, when, how, and from where. Be conscientious in your spice beer brewing, and you'll be spice-confident in no time.

BY COLIN KAMINSKI

LOX-LESS MALTS

Their impact on staling and head retention

Staling is the general term we use for undesirable flavors that occur during the aging of beer. Why should a homebrewer care? You may respond with, "My beer never gets old enough to stale." Or, "I never brew light beers and I have not noticed this." Or, "I never let beer out of my control." While there may be some merit to this, this column is geared to highlight a new pedigree of barley that has been shown to not only help limit certain staling effects, but also increase head retention in beer brewed with it.

Staling is of both quality and economic importance. Most, if not all, large breweries invest considerable resources into improving the shelf life of beer. The R&D program at Sierra Nevada has always maintained a strong focus on increasing the quality of both their fresh and their aged beers for example. It is very challenging for a brewer to release beer into the wild and lose control of its storage conditions and serving date. Brewers have approached the problem from many directions, making beers that last longer, educating distributors on how to keep beers fresh and educating consumers on the importance of fresh beer. Despite all these efforts, it is still common to find stale beer in the trade. As a homebrewer, if you want to enter a competition, the beer will be out of your control. In fact shipping beer is likely to accelerate the staling process. Also, it is common for homebrewers to give beer as gifts. You wouldn't want your gift to go stale before it was appreciated. Or perhaps you want to make a beer specifically to age.

Let's start with considering how artificial staling is done. The two common methods are to store the beer warm or alternate warm and cold cycles. Sierra Nevada claims to be able to replicate 3 months of staling time in 7 days in its artificial aging chamber. Once a beer is brewed its quality will change over time. Some qualities can improve while others degrade. The malt, hops, and yeast character can change dramatically over timeframes as short as a few weeks. Oxygen is particularly harmful to beer and steps are taken at most breweries to lower the oxygen uptake at all phases of beer production with the exception of right after wort is cooled and yeast is added. But even at this phase of the process; there are brewers who have found novel ways to lower oxygen during wort aeration as well. Here we will describe one of the ways oxygen contributes to the most common staling flavor; wet paper.

T2N BACKGROUND

Among the most studied beer staling molecules in pale lagers is trans-2-nonenal (T2N). It has the aroma/flavor that is often perceived as wet paper or wet cardboard. If this flavor is not familiar to you, there are spiking kits available to simulate this flavor or you can wrap a beer in a wet paper bag and drink it. Another way, albeit slow, is to take a light flavor beer and leave it warm for 6 months.

T2N has a flavor threshold of 100 parts per trillion making its control very important. To put that number into perspective, one gram of T2N will render over 26 million gallons of beer stale tasting! While this is not the only factor we need to worry about during aging, we will focus this issue's column to T2N and its sources. Because this flavor is so dominate in the staling of pale lager beers we don't have much data on it for big craft beers. I propose that the large hop additions currently

To put that number into perspective, one gram of T2N will render over 26 million gallons of beer stale tasting!

Photo courtesy of Shutterstock

in vogue supply reductones to help limit this reaction and as the market returns to balance craft brewers too will have to consider this important molecule.

T2N is formed as the degradation product of poly-unsaturated fatty acids oxygenated by the lipoxygenase (LOX) enzyme. Let's slow that last sentence down and pick it apart so everyone can understand. Fatty acids are oxygenated in a catalytic reaction by the LOX enzyme to form a conjugated hydroperoxide. Once this reaction is complete the LOX is unchanged and free to catalyze another fatty acid. This hydroperoxide product is subsequently degraded later in the process but most importantly in the package into T2N.

LOX BACKGROUND

LOX-enzymes are created while the plant is growing. During malting, the germination step activates the LOX enzymes causing them to create T2N. Since enzymes work more quickly as they warm up, as long as not denatured by extreme heat, lowering germination temperatures are effective in lowering LOX activity. LOX is denatured at low heats and kilning malt at a higher temperature and/or a longer time will denature most of the LOX at the expense of making slightly darker base malt. If LOX survives malting it will be activated further in the mash. LOX enzymes are almost entirely denatured by the boil. In addition hydroperoxides and T2N created before boil will be volatized in the boil.

For the last 60 years there has been a steady decline in the levels of LOX in malting barleys. It is likely that selective breeding for flavor has worked to lower this problematic enzyme. LOX comes in two varieties named LOX-1 and LOX-2. LOX-1 is been shown to be the most important pathway to T2N. Gamma-nonalactone is also formed from lipid degradation and has been shown to increase the degree of staling flavor when combined with T2N. It should be noted there is also a non-oxidative pathway to T2N formation from a nitrogenous (Schiff) base that is activated in boil and continues into the finished beer. Research is divided as to the importance of these two paths but the available research into LOX shows a reduction in T2N levels in the packaged beer.

While LOX is very thermolabile (is easily destroyed by heat) and is largely destroyed during mashout and completely destroyed by boil, the conversion to hydroperoxide has already been done. Brewers can further reduce the LOX activity by increasing boil evaporation to remove the hydroperoxide precursor and by decreasing the pH of wort. Homebrewers already have a fairly high boil-off rate compared to professional brewers, so homebrewers have had an advantage there. Since LOX requires oxygen to make T2N it is logical to assume that lowering oxygen or increasing reductones would help to lower T2N levels in finished beer. Lowering hot-side aeration is also beneficial in limiting oxidized fatty acids. Not only do the LOX enzymes create the T2N molecule but LOX also seems to play a part in the production of trihydroxyoctadecenoic acid (THOD). THOD has been implicated in the staling process and is also a known foam-negative compound.

REMOVE THE LOX

LOX-less (also called Zero-LOX or LOX-Null) barley lacks the LOX enzymes that create the T2N compound. So let's delve into the genetics of LOX-less barley. LOX-1-less barley was first bred from an existing recessive gene collected by the Institute of Plant Sciences and Resources, Okayama University, Japan from an Indian landrace (pre-hybridized) barley (OUI003, Code Number SBOU2) crossed with Canadian CDC Kendall with marker assisted backcrossing in 2001. This barley was named CDC PolarStar. PolarStar was the first commercial barley variety to eliminate LOX from the barley grain, this work was repeated by University of Adelaide using the Australian malting barley variety Flagship. Both programs were sponsored by Sapporo Breweries Ltd, Japan. Carlsberg and Heineken also bred barley without Lox-1 (2001) and later entirely without LOX-1 and LOX-2 (LOX-less) (2010). Interestingly six LOX-less landrace barleys have been identified and further work in producing LOX-less barley specifically bred for brewing purposes is underway. There are now many LOX-less varieties available to both the pro and homebrewers (see Chart 1 above).

> **"As a result, the beers have longer shelf life and a much improved head retention thanks to the reduction in these two compounds."**

Chart 1

Partial List of Malt Varieties Available as LOX-Null
Cha-Cha
Chapeau
Charles
Cheerio
Charmay
Chill
New Sachiho Golden
Polar-Star
Propeno
Tipple

These new barley varieties have performed well in the field, malt-house, lab testing, small and large-scale trials and are in use in some of the largest breweries in the world. For the farmer, the yield per acre, time to maturity, kernel size, and kernel qualities match standard varieties. For the

brewer, the levels of extract, nitrogen (FAN levels), beta glucans and diastatic power are within normal brewing ranges. A big surprise in this research has been the low levels of THOD in LOX-less variety produced beers. It is not known if the varieties are genetically predisposed to have lower THOD or if the LOX enzyme participates in some way to the formation of THOD. Further barley lines are being developed specifically to explore the effect breeding can have on foam retention.

THE RESULTS

Why go through all of this effort? Lab analysis has shown a marked decrease in T2N levels in aged beers and much longer head retention for beers brewed with these malts. In fact the LOX-less barley produces 1/50th the T2N compound and ½ to ⅓ of the THOD after storage. As a result, the beers

Chart 2 — Trans-2-Nonenal (T2N) Concentrations of Stored LOX-Normal and LOX-Null Beers

Storage Condition	LOX-Normal	LOX-Null
7 days at 0°C	0.02 ± 0.0024	0.01 ± 0.0007
7 days at 37°C	0.35 ± 0.0023	0.12 ± 0.0026
14 days at 37°C	0.36 ± 0.0115	0.09 ± 0.0053

Averages of three determinations (µg/L) ± one standard deviation.

Chart 3 — Foam Stability and THOD Concentration of LOX-Normal and LOX-Null Beers

	LOX-Normal	LOX-Null
NIBEM foam stability value (seconds)	239	260
THOD concentration (mg/L)	3.6	1.7

Averages of three determinations.

Both charts from: *Brewing Performance of Malted Lipoxygenase 1 Null Barley and Effect on the Flavor Stability of Beer.* N. Hirota

have longer shelf life and a much improved head retention thanks to the reduction in these two compounds (see Charts 2 and 3 above). In fact, there was up to 30 minutes improvement in head retention found in some trials.

There seem to be no drawbacks in other aspects of the resulting beer. In a blind analysis by "very experienced" tasters it has been shown that the stale and papery quality of fresh beers is much lower than control varieties and both forced- and natural-aging studies have shown the T2N levels are lower in beers produced with LOX-less varieties. Qualitatively, these aged beers show a much better score for staling qualities with the LOX-less varieties. So far there are no studies on three-year-old beers to show if there is a benefit in LOX-less varieties but the shorter-term results seem to point towards positive long-term benefits. Also, the levels of Gamma-nonalactone, the synergistic staling compound with T2N, have been lower in Lox-less variety based beers.

Notable in the data from Hirota (Chart 2) is that even with LOX-less varieties the T2N is not zero. Although the numbers are lower and have been repeated by other researchers. This leads one to consider other sources of T2N and that research is continuing. Some pathways have been proposed, and look promising, but, so far, no one has published a specific pathway.

I was able to run several sensory trials on grains and worts as well as batches of beer brewed on homebrew-sized equipment and have found that the flavors and brewhouse performance is equivalent to more traditional brewing varieties. These tests, which included side-by-side trials with many of the popular homebrewing base malts showed that the fresh beer was very similar to traditional malts. (The LOX-less Viking Pale Zero and Pilsner Zero malts were used for these trials.)

FINAL THOUGHTS

Staling is a common problem in beer. Brewing researchers have identified many flavors that are caused by aging that are detrimental to beer. LOX-less barley has given brewers a new tool in controlling staling, specifically by the T2N pathway catalyzed by the LOX enzyme. Its brewhouse performance and cost is unchanged from traditional varieties and is another weapon in a brewer's arsenal.

Mash a liter and give the wort a taste to see how those compare to similar grains. If you like it, give it a brew! You may find it is the base grain that you use for beers that may sit in your kegerator or bottle longer than others.

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BY AUDRA GAIZIUNAS

CRUNCHING THE COGS

When it's not a hobby anymore

When I was hired by Dogfish Head a decade ago, one of the first trips I took was a research vacation to the Pacific Northwest to immerse myself in and learn as much as I could about the business behind craft beer. I had very few beery numbers peers back then, and most worked for breweries the size of New Belgium, Sierra, and Allagash. I recognized the importance of learning from smaller-scale operations, to understand their growth patterns and costing methodologies, but I needed to build a database in order to map those patterns. Over a period of a week I visited 26 breweries and brewpubs, and the results of my findings were astounding. At that point, 25 of the 26 didn't know how to cost out one run of their beer. Very few to none were implementing any cost accounting practices, and most were using averages as estimates. Estimates at *best*. The cash was rolling in, and each was generating enough sales to pay all the bills and payroll, so that was viewed as good enough. Being an accountant, this was a challenging mindset for me to accept. It was also quite eye-opening and provided me the inspiration to eventually launch my own consultancy focused on small-scale operations.

Over the past decade I've had many conversations with aspiring brewers as they've explored the financial and emotional feasibility of running a nanobrewery. "Could one support oneself and/or his or her family with a 1-BBL or 3-BBL operation in 1,500 square foot (140 sq. m) space?" "Could that 1-BBL brewery grow into a 7-BBL or 10-BBL operation pretty easily with unique branding and quirky styles? Others have done it in the past, so could I?" These brewers would hand me their numbers, and I'd poke holes through their assumptions. Where are the production and taproom losses factored in? Why are you using average cost when the most expensive style will be your flagship? Where are your credit card processing fees? Time and time again full cost has been misunderstood as another startup would venture forth undercapitalized. Small-scale brewers need to understand how to cost not only our beers, but our entire operation as well. Let's start with the type of costs that fold into each batch we create.

TYPES OF COSTS

Within our operation we have fixed costs and variable costs. Fixed costs do not change with our level of production, while variable costs do. Some examples of fixed costs would include our monthly lease of our space, liability insurance, and our head brewer's salary (unless he/she is paid hourly). Variable costs would include our raw materials (malt, hops, adjuncts), carbonation, and packaging. Some costs are a mix of fixed and variable, such as certain utilities, where you are charged a fixed monthly account fee and a separate usage fee per kilowatt, gallon, etc.

All our costs can also be labeled as direct or indirect. Direct costs can be traced back to each batch of beer produced, such as raw materials, which are traced by pounds per batch produced or the head brewer's salary, which are traced by hours spent brewing each batch. Indirect costs cannot be easily traced back to each batch of beer produced; thus, they are allocated based on a certain level of activity. In most cases in brewing, that activity is number of gallons produced and include such costs as carbon dioxide, which is used in many processes within the brewery, from carbonating our

Small-scale brewers need to understand how to cost not only our beers, but our entire operation as well.

Photo courtesy of Shutterstock

beer within our fermentation vessels (FVs) to moving beer through the lines in the taproom and through our canning line while packaging via mobile canner. Other indirect costs would include insurance on the brewery equipment, our lease on the production space, and management oversight.

Each cost can be categorized as fixed or variable and direct or indirect, so start your analysis by labeling each of your costs by those two categories, then grouping those categories together. This exercise will help you determine which costs you can and can't control as you launch and grow your operation.

So how does one calculate full cost per batch of beer produced? Create a spreadsheet with tabs for each of your recipes. In these tabs you will capture your direct costs:

> **"The more accurately you calculate your gross margin, the better your chances of charting a financially feasible course for your nano's future."**

Direct materials and direct labor. Then add a tab to capture your total indirect costs, which we numbers nerds call overhead. Overhead is an accounting term that refers to all ongoing brewery expenses not including or related to direct labor, direct materials, or third-party expenses that are billed directly to customers. A brewery must pay overhead on an ongoing basis, regardless of whether it is producing a high or low amount of barrelage. It is important not just for budgeting purposes but for determining how much a brewery must charge for its products or services to make a profit.

Overhead expenses can be fixed, meaning they are the same from month to month, or variable, meaning they increase or decrease depending on the brewery's production level. For example, our rent payment may be fixed while shipping and mailing may be variable. Overhead expenses can also be semi-variable, meaning that the brewery incurs some portion of the expense no matter what, and some portion depends on the level of production activity. Overhead can be general, referred to as company overhead, meaning that it applies to the brewery's operations as a whole. A brewery can allocate overhead to a specific project or department as well (production versus sales or administrative). Your overhead costs can be broken down annually, quarterly, or even monthly, but most start with quarterly to ensure they can keep up with adjustments. From the nano perspective, overhead costs will include marketing, depreciation on production equipment, insurance, and utilities. Estimate the amount of beer you will produce over a defined time period (quarterly, annually, etc.) in gallons, then divide your total overhead costs by number of gallons you're producing to determine your overhead rate per gallon of beer.

DEVELOPING A PRICE POINT

Once you understand the full cost to produce each beer, assign a price to each batch to ensure you're making an adequate margin. Most nanobreweries operate using a taproom-focused model to maximize profitability, so the vessel sold is a 16 oz. pint (473 mL). Each gallon consists of 128 oz., or 8 pints, or 3.8 L, but I've completed enough research to understand that only 65–75% of sellable liquid is actually realized as revenue. The rest is lost due to foaming, taplines, and comps. Therefore, assume each gallon (3.8 L) translates into roughly 6 sellable pints (96 oz. or 2.8 L). Multiply your pint price by 6 to arrive at total revenue. Subtract your per gallon (3.8 L) cost from that revenue and make sure that number is positive. If it isn't, revisit your pricing and cost structure until it is.

Another way to look at cost is by calculating your breakeven point. The breakeven point is the level of sales where your profit is zero. The breakeven formula is sales minus variable cost minus fixed cost. You multiply your sales per unit by units sold. You also multiply the variable cost per unit by the same units sold. The sales level that makes the formula equal to zero is the breakeven point. Illustrated, the breakeven formula looks like this:

P(x) – VC(x) – FC = 0.
FC = fixed cost
P = price per unit
VC = variable cost per unit
x = units

Say that our sales price per case is $20. Rent is $100. Utilities total $50. Barley and hops cost $3 per case. Packaging runs $2 per case and hourly labor runs $1 per case.

First, what's fixed versus variable? Our fixed costs include rent and utilities ($150 total). Our variable costs include our raw materials, hourly labor, and packaging ($6 total). Let's now solve for x.

$20(x) - $6.00(x) - $150 = 0
$14x - $150 = 0
$150 = $14x
x = 10.7 or 11 cases (round up to nearest whole case)

Our operation would have to sell 11 cases to break even.

THE IMPORTANCE OF COGS

What is COGS anyway? COGS is cost of goods sold, or the accumulated total of all costs used to create a product (in our case: Beer), which has been sold. We match the time period we recognize revenue for the beer we have sold with the cost it took to produce those goods in the same period.

For example, say we brewed a beer in May and then sold it in pints in June. During the month of May, the beer is sitting in our inventory on our balance sheet. When we sell the beer in June, we move that cost from the balance sheet to the income statement as cost of goods sold to match up with the sales we have recognized for that same beer. It is only in using this matching principle that we can understand our true profit.

When evaluating your total cost of goods sold (COGS), I highly recommend using a weighted average cost of goods for your pro forma modeling versus a plain (mean) average. In other words, estimate how much sales you anticipate per style, and assign that same percentage of cost. For example, let's say you plan on four flagship styles: An IPA, a Pilsner, a Berliner, and a stout. You expect your sales to be 40% IPA, 25% Pilsner, 20% Berliner, and 15% stout (for a total of 100%). Looking at your recipe costs, apply 40% to your IPA cost, 25% to your Pilsner cost, 20% to your Berliner cost, and 15% to your stout cost, then add those four up. The total will be your weighted average cost of goods. Use that weighted average for your cost projections. What if you don't know your cost per style with any great degree of precision? Then determine your most expensive style and apply that cost to your entire model. In this example, the IPA will cost you the most between those four (just the hops alone), so apply your IPA cost to your entire financial model. The point here is that using a plain average versus weighted average when modeling numbers for the craft beer industry is a dangerous beast. On a nano scale you set yourself up for challenges in cash flow management and production planning that may become too difficult to surmount early on. The more accurately you calculate your gross margin, the better your chances of charting a financially feasible course for your nano's future.

One final point to address here is excise taxes. Excise taxes are a cost of sale versus a cost of production. You do not incur excise tax until the finished beer is removed for consumption or sale. Therefore, it is not included as part of a cost of production, but rather as a part of sales, general, and administrative costs.

FINAL THOUGHTS

Startup breweries, especially nanos, tend to spend too little time planning for the business side of their operation. The equipment costs significantly less compared to a 15-BBL brewhouse with distribution aspirations, so the barrier to entry is quite low. Couple that with aspirations of pint sales profitability, and all of a sudden we are led by romantic aspirations of a lifestyle business versus pragmatic thinking. Make sure you spend enough time planning for all your anticipated fixed and variable expenses, understanding the relationship between the two and calculate your breakeven range before diving right in with your TTB application. Remember that hope is not a strategy. A well-crafted understanding of your COGS is a much better place to start.

BY KURT DRESNER

WHIRLPOOL PORT INSTALL

Punching a hole for a weldless port

During a brew day several years ago, I was lamenting the extremely sluggish process of draining my boil kettle into my fermenters. I have a counterflow chiller, but in order to get pitchable-temperature wort into the fermenter, I had to run the wort at just a trickle even while my chilling water was at full bore. As one familiar with Newton's Law of Cooling, I realized also how much water I was wasting; heat transfers more quickly when the temperature gradient is steeper. This means the wort needs to move faster, so it will be more turbulent and so the hot wort can be chilled by the cold water, not by the slightly-less-hot wort in front of it. As an experiment, I took my output hose out of my fermenter and dropped it back over the edge of my boil kettle, and cranked open the ball valve on my wort pump. Presto: The chilling water was coming out piping hot, meaning it was taking more heat out of the recirculating wort. As an added bonus, the boiling hot wort would sterilize my whole chiller and all of my hose for me, saving me the effort of pre-sanitizing it.

"I should do this every time!," I thought. But I sure would look like a schmuck standing there holding the hose in the boil kettle so that it didn't shoot boiling hot wort all over my brewery. Also, hadn't I heard something out there about the positive effects of whirlpooling in the kettle? Uh-oh … time for another brewery upgrade. A whirlpool port addition to my boil kettle was the solution to my predicament.

My system features a bunch of *weldless fittings*, inspired by the popular Electric Brewery (www.theelectricbrewery.com) build you can find online. Instead of welding a new port, I'd create one by drilling a hole, and then sealing it with a high-temperature silicone O-ring. This has several benefits. Firstly, I don't know how to weld. It looks like fun, but I've just never learned. Secondly, if I want to adjust, remove, or change out this port later, I can do that. The downside to this approach is that you can never fully sanitize it, as it involves pipe threads. A properly welded, tri-clover port could be sanitized at room temperature, if that's a requirement for you. That said, it's going to be in the boil kettle, and I'm going to run boiling wort through it on every brew, meaning I don't really have to worry about unwanted microbes taking up residence (and living to spoil my beer). This weldless approach has proven popular on the hot side of the brewing process and has been used on every Blichmann Boilermaker kettle for years.

The perfectionist in me loves the idea of a fully welded, tri-clover setup, and those can be had for a reasonable amount of money these days (relatively speaking), complete with whirlpool ports. However, if you are like me and have already dropped a fair amount on your system and you're looking to step up your end-of-boil capabilities without shelling out for a whole new system or replace all of your hoses, this approach could work well for you.

Instead of welding a new port, I'd create one by drilling a hole, and then sealing it with a high-temperature silicone O-ring.

Photos by Kurt Dresner

Tools and Materials

- Step bit (e.g. Greenlee 36414 Multi Hole Step Bit, 1⅜ in.)
- Greenlee 730BB- 13⁄16-in. Standard Round Knockout Punch)
- 5 in. (13 cm) of ½-in. OD stainless tubing
- 90 degree ½-in. MPT to ½-in. compression
- ½-in. NPT coupler
- ⅞-in. ID, 1⅜-in. OD washer
- ½-in. NPT nipple close
- 1⅛-in. ID, 1⅝-in. OD washer
- 211 Silicone O-Ring 70A Durometer: 13⁄16-in. ID, 1 1⁄16-in. OD, ⅛-in. width
- ½-in. NPT locknut
- 3-piece ball valve, ½-in. FPT.
- ½-in. MPT quick disconnect (or whatever connect you use)
- PTFE (Teflon®) tape

1. DRILL A PILOT HOLE

The first thing you need to do is put a hole in your perfectly good boil kettle. I had debated extensively with myself where to place the port, in terms of height. After doing some reading, I decided to put it right about at the 5-gallon (19-L) level. I wanted to be able to use it if I was only doing a 5-gallon (19-L) batch, but I didn't want it too low, to ensure that the wort would mix enough during cooling. In retrospect, unless you really think you'll be doing a lot of 5-gallon (19-L) batches, put this reasonably high up, otherwise chilling won't be as efficient.

It's a good idea to make a small dimple if you can with a nail or other tool so that the step bit won't wander around. I didn't have a nail, so I just went to town with the step bit, pushing the kettle up against the wall so I could use a lot of force. You will want to be careful with the step bit. Cutting oil will help keep things lubricated and prevent the bit from getting too hot. You should also use protective eyewear, as metal shards may get thrown all over the place. After a while, you should have a hole that's big enough to feed the knockout punch through.

2. USING THE KNOCKOUT PUNCH

The knockout punch comes in two pieces that unscrew. One piece fits flat against the side of the kettle, and the other screws onto the other side. As you tighten the punch, the not-flat piece will be pulled inside the flat piece, and that's what will cut the metal. With my pilot hole big enough, I fed the punch through, and got ready to tighten that bad boy down.

Knockout punches are expensive (see if you can borrow one or get one used), but they sure do make a really clean cut without the rough burrs that could prove to be problematic with weldless ports.

3. INSERT AND TIGHTEN THE NIPPLE CLOSE

Next, feed the nipple close in from the outside. This is actually important—if you feed it from inside, you will wind up with too much slack on the inside. Some of the threads that would wind up on the inside need to wind up under the o-ring and locknut on the outside, so that all the connections can be tight, including the one holding the o-ring up against the kettle wall. I applied PTFE tape to both sides of the nipple, fed it in from the outside, and twisted the smaller washer and coupling on the inside. Once there, I put the o-ring on the outside, placed the larger washer around it, and tightened down the locknut, making sure the grooved side was against the kettle wall.

4. ASSEMBLE THE REMAINING HARDWARE

You can now attach your quick disconnect (or camlock fitting, or barbed fitting, or whatever you use to connect your hoses) to the 3-way ball valve. First, get some PTFE tape onto the fitting.Then screw it firmly into the ball valve.

Now you can attach the compression fitting to the inside and the ball valve to the outside. With a 3-piece ball valve, you don't need to get it perfectly aligned. Just get it to the closest 90 degrees, and then you can disassemble the valve and re-position the handle on top (or wherever you want it). Crank everything down extremely tight—the large washer and groove in the locknut will prevent you from overcompressing the o-ring.

5. BEND AND INSERT THE STAINLESS TUBING

You'll want to bend the stainless tubing so that the wort comes out as close as possible to parallel to the kettle wall. I borrowed a conduit bender from a friend, and with some fancy clamping and abuse of a screwdriver, was able to bend the stainless tubing to better match the curve of the kettle wall. The clamp and the screwdriver both deformed the ends of the tubing a bit so that they wouldn't fit into the compression fitting, but if this happens, you can just cut off about half a centimeter of the end of the tubing on the affected side it should fit again. Insert the tubing into the compression fitting, tighten it down by hand, and then use a wrench to get another turn or so to swage the ferrules and seal the fitting.

6. BREW DAY

Brew day just got a little bit easier. When it's time to chill, instead of running wort once through the chiller, or putting a hose in the top of your boil kettle, hook up the output of the chiller to the whirlpool port, open the ball valve, and start whirlpooling! I actually do this *before* the boil is done, to make sure I completely sanitize my whole chilling setup. (Be sure your pump is properly rated to handle boiling temperatures though.) Once the temperature coming out of the chiller hits my desired pitch temperature (or as close as I can get if the chilling water isn't very cold), I simply turn off the pump, close the whirlpool port, and move that hose to my sanitized fermenter(s). BYO

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BY MARSHALL SCHOTT

BREWING UP A BRÜLOSOPHY

Questioning the tenets of homebrewing

I can't recall a time I wasn't insatiably curious, a characteristic quirk that not only influenced my career choice (psychologist), but seems to find its way into pretty much every aspect of my life. When I started brewing in 2003, I quickly became engrossed and absorbed everything I could from books, magazines, and other more experienced brewers, accepting most of what I learned as fact with little question. The beer I made was good, and that was all the evidence I needed.

One wife, three kids, a Ph.D., and numerous batches of beer later, I began to question these facts. I introduced a friend to homebrewing in 2010, someone who, like me, tended to think about things in a way most find supremely boring. We brewed together multiple times per month for over a year, and during that time he began questioning many of the "necessary methods" I was shoving down his throat. Sprinkled between talks about the poignancy of a single mundane experience and the noblest expression of love were discussions of the importance of transferring to a secondary fermenter and mashing for a full 60 minutes. Deep shit.

Just as we began tickling the idea of testing things out for ourselves, circumstances arose that led to my friend moving to a city far away, leaving me alone with my converted cooler MLT, a 15-gallon kettle, and a list of unanswered questions. I realized at this point that my love of brewing was about more than just making beer, it served as a point of connection with my friend, and his absence influenced my enjoyment of the hobby. So, I took it upon myself to ensure this activity I enjoyed so much remained a positive aspect of my life. Enter Brülosophy.

Throwing a decent degree of caution to the wind, I began testing some of the brewing process variables my buddy and I had been questioning, collecting data in a somewhat controlled manner, and sharing the results online. Passionate about both brewing and philosophy, I put them together to create the "brülosopher" moniker. As my "exBEERiments" began to pile up, some people recommended I compile them all at a single source to make referencing them easier, and after months of resisting, I eventually launched a website in February of 2014. The response was pretty immediate.

Having no clue what might come of this gig, and really no intention of turning it into anything in particular, my neurotic tendencies kicked in and I committed to producing content on a set schedule. This eventually led to me building a crew of other nerdy homebrewers to contribute as well, which resulted in me making even more nutty commitments like publishing two articles every week and starting a weekly podcast while maintaining a full-time "real" job and ensuring I spend quality time with my family.

It's odd for me to think that this thing I started as a way to keep me in the hobby has become what it has. I've made some of the best friends in my life, had opportunities to chat with rad people in cool places, and learned more about brewing than I ever imagined, all because of my annoying inability to accept fact as fact. I could talk about how the exBEERiments have influenced by views on water chemistry, lager fermentation temperatures, or mash and boil lengths. Indeed, my approach to brewing is different today than it was a few years ago. But more than anything, what I've appreciated most about Brülosophy is that it has provided me a point of connection with a bunch of great people, and even today, I'm regularly reminded of how fantastic the hobby of homebrewing is. BYO

Passionate about both brewing and philosophy, I put them together to create the "brülosopher" moniker.

Photo courtesy of Laura Schott

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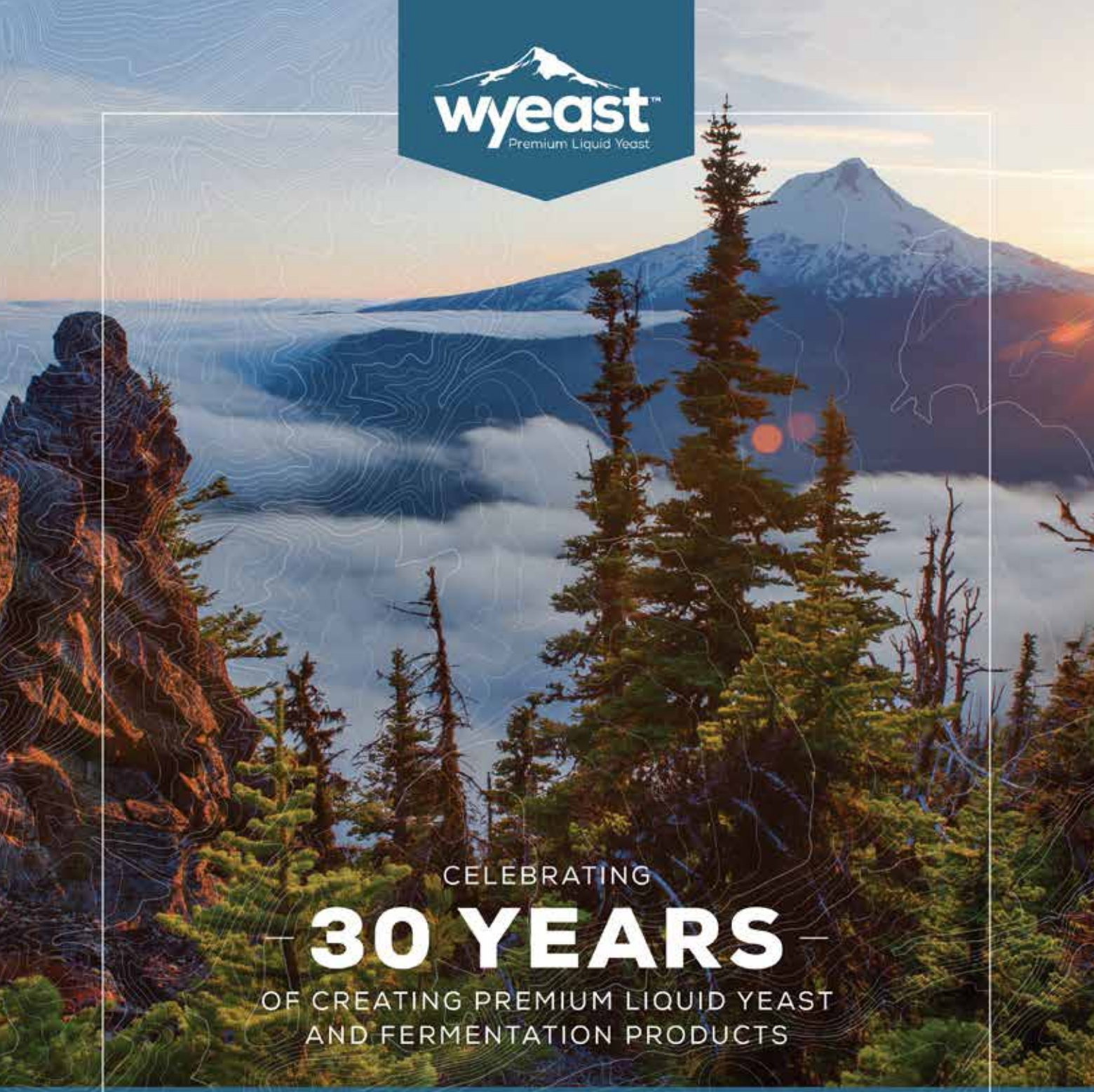

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