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BREWING FOR ALL OCCASIONS

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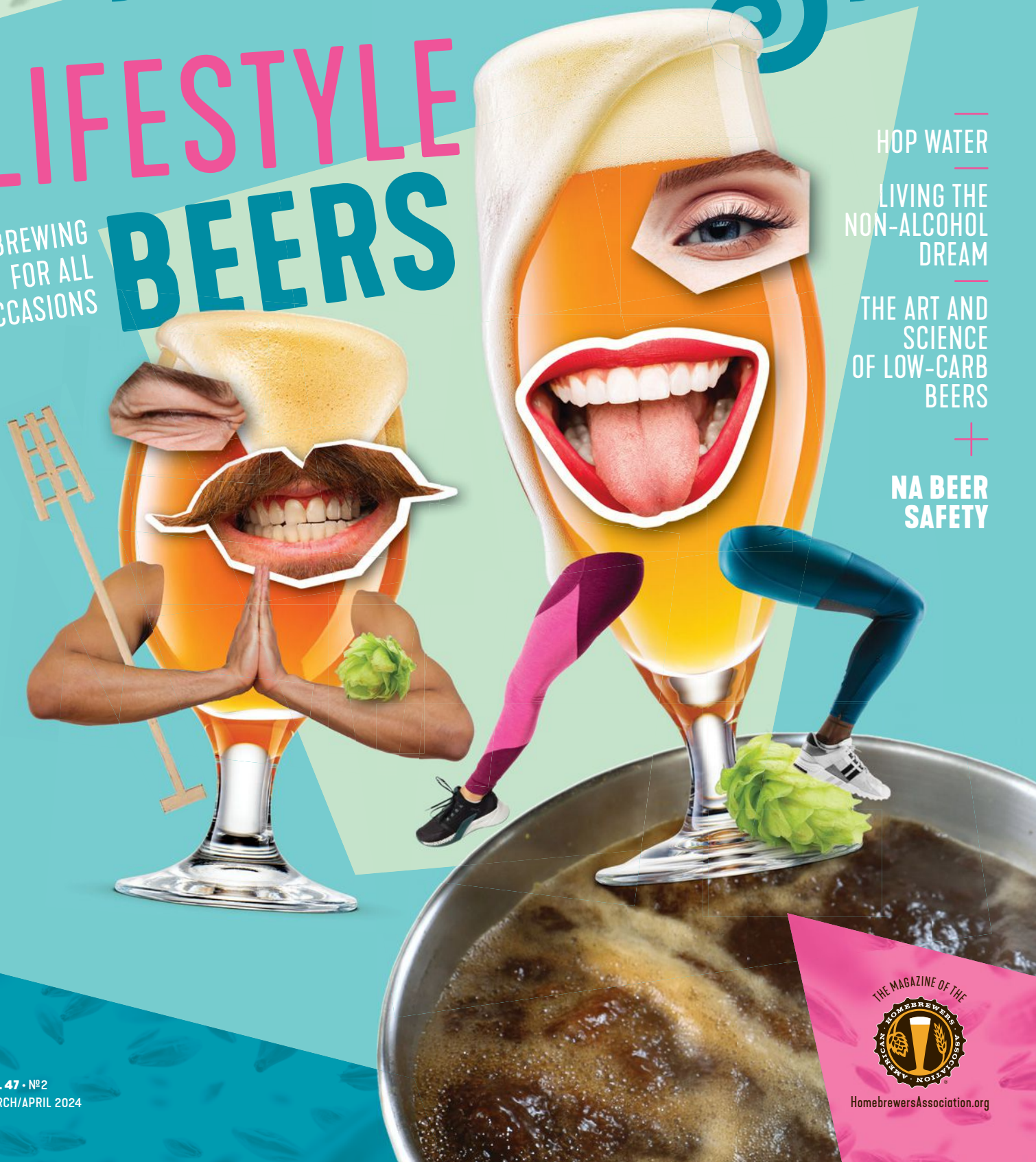

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HomebrewersAssociation.org

ZYMURGY Staff

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THE MAGAZINE OF THE AMERICAN HOMEBREWERS ASSOCIATION®

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EDITOR'S Desk

BY AMAHL TURCZYN

Lifestyle Brews—

enjoying our freedom to brew for any occasion

Calcium oxalate. Brewers know it as beer stone. It's a tenacious scale that can form on your keg's inner surfaces, including poppet valves, downpipes, and other hard-to-reach places. Those deposits can also harbor beer-spoiling bacteria, rendering your kegs nearly impossible to sanitize properly. I've been brewing with the same collection of pin-lock Cornys for nearly 30 years now, and they've seen their share of this tough white mineral deposit. Nearly 30 years is about the same amount of time I've been contributing, in one capacity or another, to *Zymurgy* magazine, and it is my honor and privilege to finally take the reins as editor-in-chief as friend and mentor Dave Carpenter changes career paths. But even with his sage guidance, I often learn things about homebrewing by stumbling upon them, and one such stumble provided a solution—quite literally—to calcium oxalate deposits in my kegs.

This issue is dedicated to lifestyle beers and brewing for all occasions. In it, we'll cover non-alcohol (NA), alcohol-free, low-carbohydrate, and session beers, because we as homebrewers should have the freedom to blow the froth off a pint any time we want. I also believe it's our duty as considerate stewards of our hobby to always have something for non-drinkers as well. Brewing for any occasion is central to enjoying life to the fullest, and this issue explores delicious brews you can enjoy anytime, anywhere.

Aroma hops have exploded in popularity over the last decade, and with Cody Gabbard's guidance, you can brew up a batch of hop water packed with the big, bold, juicy flavors of your favorite varieties. NA and alcohol-free beer is normally the province of the big brewers, but more and more craft brewers are brewing their own interpretations. There are plenty of challenges to making NA beer without mega-brewer equipment, but Amanda Burkemper presents a comprehensive field guide to tackling this delicious, anytime sub-style. Though from a food safety perspective, calling it "beer" might be inadvisable…Katie Nasiatka and Meagen Anderson delve further into keeping your homebrewed NA beer safer to drink. Sam Loader looks at brewing beers that are low in carbohydrates for anyone looking to lighten their calorie intake. We also touch on session beers: low-alcohol, high-flavor, easy-to-drink brews that for centuries have lubricated protracted social gatherings in pubs, parks, and taverns worldwide. Franz Hofer explores how one session lager in particular has formed a unique culture in southern Germany, and he presents a nostalgic look at the value of sipping kellerbier with friends and family in your local neighborhood biergarten. Memorable social occasions, whether you are having or hosting them, are what our hobby is all about.

On one such occasion, friend and homebrew buddy John Evans and I mixed up a batch of sparkling limeade, and upon pouring this tart, fizzy aqua fresca, we noticed the first pint or two came out an opaque, milky white. Serendipitously, the citric and carbonic acid from the limeade removes beer stone from your steel kegs just as effectively as cooking tomato sauce cleans the chalky mineral deposits off your steel cookware. Since that happy accident, I always try to have a batch on hand, and rotate it throughout my keg collection, keeping that pesky beerstone buildup at bay. It's a drink I can enjoy first thing in the morning, after a workout, before driving—pretty much anytime I want. And I know next time I go to wash that keg, it will be sparkling clean inside. Sure, there are chemical solutions to beerstone as well, but why not brew up a delicious non-alcoholic beverage you can enjoy while you clean?

Sparkling Limeade

Recipe for 5 gallons

Juicing a gallon's worth of limes is no small task. You are certainly welcome to cut this recipe volume in half, and the use of an electric citrus juicer makes things much easier. Just remember to use a fine sieve to strain out any citrus pulp before adding the juice to your kegs—your poppet valves will definitely clog otherwise. This recipe assumes you'll be drinking the limeade with ice, so it's fairly tart, but feel free to add more sugar if you like a sweeter beverage.

6	lb granulated sugar (more or less, to taste)
1	gal (1.18 L) hot water
1	gal (1.18 L) fresh-squeezed lime juice, strained (a 2 lb bag of Persian limes yields about a quart of juice)

DIRECTIONS

Dissolve sugar in hot water. Strain fresh lime juice through a fine sieve, press out remaining juice with a spatula, and add juice to keg. Add syrup, blend, and top up keg with cold water to desired strength. Force carbonate to desired level of CO_2. Chill and enjoy.

Of course, calcium oxalate is also responsible for kidney stones, so even though drinking the white mineral deposits probably won't hurt you, I generally advise dumping the first pint or so until things pour a light, clear, limey green. By the way, sparkling limeade also makes a killer margarita (of the virgin, or less-than-chaste variety). I hope you enjoy this lifestyle beer issue, and I look forward to bringing you more tips and tricks over the coming year's issues. Have tips, tricks, or serendipitous homebrew stumbles of your own? We'd love to hear them, and share them.

Amahl Turczyn is editor-in-chief of Zymurgy.

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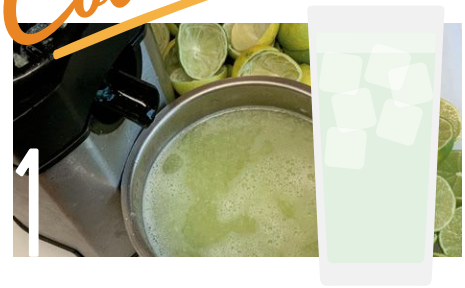

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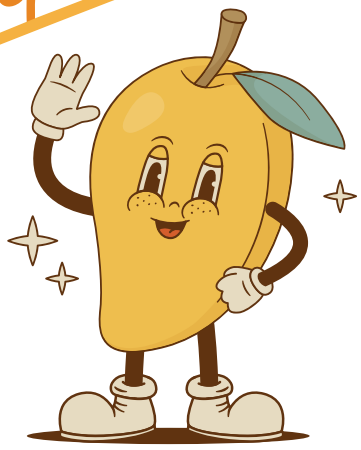

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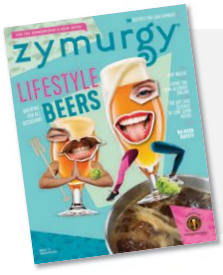

Cover Photo
Composite by Jason Smith

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zymurgy®

(zī'm ɜr jē) n: the art and science of fermentation, as in brewing.

ON THE WEB
Find these homebrewing recipes and more on our website @ HomebrewersAssociation.org/homebrew-recipes

NOW ON Tap

Do Some Good!

THE SOCIETY OF OSHKOSH BREWERS (SOBS) CASK AND CASKETS CHARITY HOMEBREW EVENT

By Randy Bauer

In response to Dave Carpenter's "Inspiring Homebrewers to Fuel Philanthropy" [Editor's Desk, *Zymurgy* November/December 2023] and using our hobby to do some good, I would like to give a shout out to the Society of Oshkosh Brewers (SOBs) and their past president Mike Engel. It was Mike's vision years ago that we could use homebrew to help our community. Some of us had doubts whether doing a homebrew tasting for charity could work, but Mike was undeterred.

The first one in 2009 was organized and run despite threats from the State Department of Revenue that homebrew could not leave a homebrewer's home. Through the work of Wisconsin homebrew clubs, and help from the AHA, the Wisconsin laws were changed in 2012 and Mike and the SOBs hit the ground running. They held several annual Cask and Caskets events at Halloween with members donating their beer (and dressing for the occasion and theme of their beer) with all proceeds being donated to the city food bank through United Way. Tens of thousands of dollars were donated. But eventually, some local establishments complained and the state stepped back in, saying that by charging for admission, the club was selling homebrew, and that was not allowed. Mike was again undeterred and the club had another Cask and Caskets with no admission, just donations accepted. Again, they were successful. But with the state now involved again, it left the event venue owners unsure of how it might affect their licenses.

So, kudos to the clubs mentioned in Dave's column. Overwhelmingly, the homebrewers I have met don't look to recoup the costs of their brews—they just want to share their love. But our hobby still has a way to go for us all to learn how we can use our craft in the most effective ways to help our communities.

Photos courtesy of Randy Bauer

Wisconsin Homebrew Clears Legal Hurdle

In December, Act 73, an overhaul of Wisconsin's alcohol beverage legislation, was signed by Gov. Tony Evers. Within that legislation, an amendment was added to remove the obstacle regarding homebrew being transported into the state.

The change, as outlined below, should clear the way for Wisconsin's ability to host the National Homebrewers Conference and final round of the National Homebrew Competition as some point in the future. "Hopefully this legislative change will win some favor with the selection committee for a conference in the not-too-distant future," commented Bruce Buerger, a member of the Beer Barons of Milwaukee homebrew club who was instrumental in getting the amendment added.

125.06 ***(3m)*** *(c) If a competition or exhibition complying with par. (b) is held by a national organization and has participants from more than 25 states, a person who made homemade wine or fermented malt beverages in another state under conditions similar to those imposed under sub. (3) may, without holding a license or permit under this chapter, transport up to 10 gallons of homemade wine or fermented malt beverages into this state for purposes of participating in the competition or exhibition.*

According to Buerger, efforts were made to effect change for professional beer makers as well. "Unfortunately, we were unable to get a waiver included for out-of-state professional alcoholic beverages, but we're still working on it," he said. "Efforts are underway to have the Mazer Cup in Milwaukee this coming November. I'm currently attempting to get a waiver allowing professional entries to come into the state without requiring a costly retailers permit."

For now, the amendment is a win for Wisconsin's homebrewers and their ability to host national competitions.

Photo © Getty/timhughes

Cunning Plan Mild

To learn more about the inspiration for this beer see Last Drop on page 64 of this issue of *Zymurgy*.

Batch volume: 3 gallons (11.35 L)
Original gravity: 1.040 (10°P)
Final gravity: 1.0145 (3.6°P)
Efficiency: 64.75%
Alcohol: 3.4%
IBUs: 20
Color: 16 SRM

MALTS

2.5 lb. (1.14 kg) Chevalier Heritage malt
1.5 lb. (0.68 kg) Maris Otter pale malt
4 oz. (112 g) Victory malt
4 oz. (112 g) Crystal 40 malt
3 oz. (84 g) Carafa II malt

HOPS

0.9 oz. (25g) East Kent Goldings at 5.6% for 20 minutes

YEAST

1 pack Muntons

ADDITIONAL INGREDIENTS

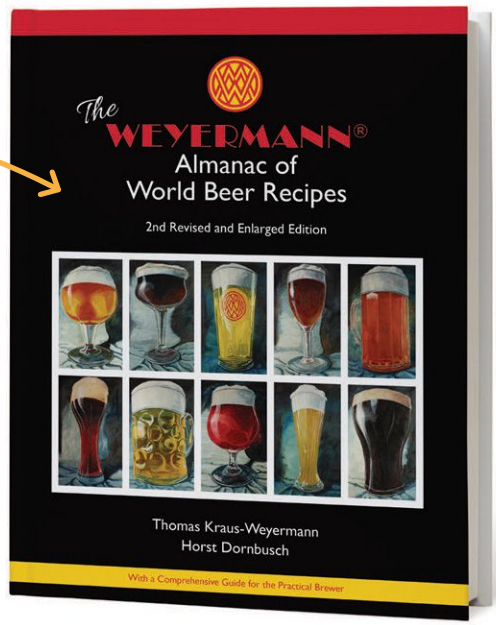
2.5 oz. sugar to prime

BREWING NOTES

Mash at 154°F (68°C) for 45 minutes with a mash thickness of 1.5 qt./lb. (3.1 L/kg). Vorlauf until clear and sparge with enough water to collect 3.25 gal. (12.3 L). Bring to a boil, add hops and boil for 20 minutes. Chill to 66° F (19° C) and pitch yeast. Bottle after two weeks.

The World is Your Beer

THE WEYERMANN® ALMANAC OF WORLD BEER RECIPES



The Weyermann Malting Company announced the publication of the all-new, revised, and expanded edition of *The Weyermann Almanac of World Beer Recipes* by Thomas Kraus-Weyermann and Horst Dornbusch.

The Almanac is the third book collaboration between the two authors, after *Dark Lagers* (Master Brewers Association, 2018) and *Untergärig und Dunkel* (Fachverlag Hans Carl, 2020). Kraus-Weyermann is one of the world's leading experts in malting and brewing and co-CEO of the Weyermann Malting Company in Bamberg, Germany. Dornbusch is a former brewer and the founder of Cerevisia Communications LLC, a consulting and content marketing firm for the international brewing industry in Williamsburg, Va. Together, they have poured their combined experience of almost a century in beer making into this seminal work.

More than three years in the making, the Almanac opens with a 150-page summary of the latest brewing knowledge for the practical brewer, condensed into an easy-to-read guide. This section deals with such topics as hops, malt, and water chemistry; brewing processes for different brewhouse and cellar configurations; yeast handling; beer styles and recipe formulations; lagering and barrel aging; the sensory aspects of beer evaluations; and many other topics relevant for making great beers every time.

The 300-page core of the book features an eclectic selection of 170 well-tested beer recipes—ranging from medieval beer styles to the classics that evolved during the Industrial Revolution, to the many innovations of the modern craft brew movement, and even to a few creative inventions by the authors. To round off the book, as an aid to recipe formulations, there are three handy, up-to-date appendices with specifications for hundreds of brewing ingredients available to brewers today. There are also almost 200 photos and illustrations and a general index. In short, this comprehensive brewing guide is an indispensable addition to any modern reference library of any size.

Co-authors Horst Dornbusch and Thomas Kraus-Weyermann.

Brew This!

Bob's Your Uncle Bitter

To learn more about the inspiration for this beer see Last Drop on page 64 of this issue of *Zymurgy*.

Batch volume: 3 gallons (11.35 L)
Original gravity: 1.040 (10°P)
Final gravity: 1.010 (2.5°P)
Efficiency: 75%
Alcohol: 4%
IBUs: 29
SRM: 7

MALTS

4.4 lb. (2 kg) Great Western pale ale malt
6 oz. (168 g) Carastan malt
4 oz. (112 g) Victory malt

HOPS

0.5 oz. (14 g) Challenger at 8.9% for 45 minutes
0.25 oz. (7 g) East Kent Goldings at 5.6% for 6 minutes

YEAST

1 pack S-04

ADDITIONAL INGREDIENTS

1/4 tsp Irish moss
2.75 oz. (77 g) sugar to prime

BREWING NOTES

Mash at 150°F (66°C) for 45 minutes with a mash thickness of 1.5 qt./lb. Vorlauf until clear and sparge with enough water to collect 3.5 gallons (13.25 L). Bring to a boil, add the first hops, boil 35 minutes, and add Irish moss. After 4 minutes add second hops, boil 6 more minutes, and remove from heat. Chill to 66°F (19°C) and pitch yeast. Bottle after two weeks.

Photos courtesy of Weyermann Malting Company

DIRECTOR'S *Cut*

BY JULIA HERZ

2024 OVERVIEW

The American Homebrewers Association (AHA) is dedicated to protecting, uniting, and educating homebrewers, while empowering an equitable homebrewing culture and showcasing the fun of fermenting. More than 30,000 members, yourself included, benefit from unmatched reasons and rewards to brew.

> The American Homebrewers Association is dedicated to protecting, uniting, and educating homebrewers while empowering an equitable homebrewing culture and showcasing the fun of fermenting.

Exclusive to members, we publish *Zymurgy* Magazine (*Zymurgy* celebrates AHA members and educates those who want to brew and ferment) and broadcast *Zymurgy* Live webinars featuring the world's homebrewing leaders. We curate robust member discounts at brewery taprooms and homebrew supply shops via more than 2,000 AHA Member Deals, publish top-of-class resources on homebrewing for beginning and advanced brewers via HomebrewersAssociation.org, curate an ongoing club insurance program, maintain the world's most extensive homebrew club and retail supply shop online directories, and host one of the longest standing online homebrew communication platforms, the AHA Forum. Ongoing, we offer presentations from our executive director and have a team devoted to assisting members with account questions.

Annually, we host the world's largest homebrew competition, the National Homebrew Competition (February 27 to March 15 is the entry registration deadline!), and the annual gathering of AHA members (October 10–12 in Denver at the Great American Beer Festival®), the GABF Pro-Am Competition, in which competition-winning amateur brewers collaborate with craft brewers to win medals at GABF, and present annual recognition awards including the Homebrew Shop of the Year and several others.

We host the annual homebrew holidays Big Brew (May 4), Home Fermentation Day (August 3), and Learn To Homebrew Day (November 2). We also sanction homebrew competitions with the Beer Judge Certification Program (BJCP) and encourage homebrewers to enter, steward, and judge in competitions; plus, we support a prize donation program for sanctioned competitions.

We advocate for the advancement of homebrewers' rights and privileges, including ongoing work to legalize homebrew shipping for competitions. The AHA helped ensure homebrewing was legalized in all 50 states, and today, we stand ready to assist the unified efforts of homebrew clubs and state brewers' guilds.

Here is a summary of the AHA's celebrated past—one that your membership fueled.

AHA HISTORY

- **January 17, 1920:** Prohibition begins as the 18th Amendment to the U.S. Constitution.
- **December 5, 1933:** The 21st Amendment repeals Prohibition, but leaves out the legalization of home beer making (home wine making is legalized at this time).
- **October 14, 1978:** President Jimmy Carter signs H.R. 1337, creating an exemption from taxation of beer brewed at home for personal or family use.
- **December 7, 1978:** The AHA is founded by Charlie Papazian and Charlie Matzen in Boulder, Colo. with the publication of the first issue of *Zymurgy* magazine.

ON THE WEB
For direct links to all resources underlined, check out the *Zymurgy* digital edition at HomebrewersAssociation.org.

- **February 1, 1979:** Homebrewing becomes legal on a federal level in the U.S.
- **May 5, 1979:** The AHA holds its first-ever National Homebrew Competition and Gala Homebrewers Ball.
- **September 1, 1982:** The AHA debuts the Great American Beer Festival as part of the AHA's fourth annual conference for homebrewers.
- **1985:** The AHA and Home Wine and Beer Trade Association (HWBTA) create the Beer Judge Certification Program.
- **May 2, 1988:** Rep. David Skaggs of Colorado declares May 7 as National Homebrew Day before the U.S. Congress. In response, the AHA creates Big Brew as an annual event to celebrate National Homebrew Day worldwide.
- **September 1992:** The organization's name is updated to the Association of Brewers.
- **December 1998:** The designation of the Association of Brewers (also representing the AHA) evolves to a 501(c)(6) from a 501(c)(3), setting the stage to fuel and grow today's modern-day independent craft beer movement.
- **November 1999:** Learn To Homebrew Day is established.
- **2005:** The Association of Brewers and Brewers Association of America join to form the Brewers Association, as published in the March/April 2005 issue of *Zymurgy*. The AHA board of advisors is renamed the AHA governing committee.

- **May 31, 2005:** The AHA introduces the GABF Pro-Am competition, in which AHA members team up with professional brewers to compete with their award-winning recipes.
- **2013:** Alabama and Mississippi legalize homebrewing, officially making it legal in all 50 states.
- **August 2023:** The first annual Home Fermentation Day, formerly Mead Day, debuts.
- **December 7, 2023:** The AHA turns 45 with more than 30,000 members from around the world.

GOVERNANCE TODAY

The AHA is the world's leading individual homebrewers community, part of the 501(c)(6) Brewers Association, and is proud of its role as a catalyst for today's full-flavored craft beer movement. It is supported by a committee of volunteer leaders. In December 2023, the BA approved BA bylaw revisions and reduced its board size. The AHA committee is now governed under the same structure as all other BA committees. A summary of changes related to the AHA was published on HomebrewersAssociation.org on January 23 and can be viewed at HomebrewersAssociation.org/news/american-homebrewers-association-bylaws-update/. The revisions modernize the AHA's status, whereas the previous structure stemmed from when the AHA was a standalone organization. AHA membership services and benefits were not affected by these changes.

2024 AHA COMMITTEES

The AHA committee supports homebrewing, the health of the AHA, and is responsible for supporting AHA awareness, member resources, membership advocacy, and membership growth.

The Events and Education subcommittee brings together AHA member leaders to provide input and support for AHA-driven events and educational offerings for the purpose of increasing member value and retention.

The BA Diversity, Equity, and Inclusion (DEI) Committee is currently co-chaired by an AHA representative, giving AHA members an expanded voice in organizational DEI work and resources.

Committee and subcommittee participation is voluntary. For those interested in reviewing the committee charter, volunteer commitment, vetting, and onboarding requirements, see HomebrewersAssociation.org/membership/aha-committee/.

We are proud and honored to deliver ongoing reasons and rewards to brew and ferment, and your AHA membership gives you access to unmatched benefits. Thank YOU for being a part of this extraordinary community.

Cheers.

Julia Herz is executive director of the American Homebrewers Association. You can follow Julia's homebrew talks and travels on Instagram @ ImmaculateFermentation.

How heavy is a Black Razz?

***Dear* Zymurgy,**
I was looking through the latest *Zymurgy* edition for Jan/Feb. The recipe for Black Razz on page 43 did not have the weights for the two malts and the hops. I don't know how to proceed in making this beer. Can you give me some guidance?

Bob Grove | Columbus, Ohio

***Zymurgy* editor-in-chief Amahl Turczyn responds:** *Many craft brewers work in percentages for the recipe, as they can scale them between brew systems. But it's not always so approachable for us homebrewers, unless we run the recipe through brewing software. This should get you pretty close:*

BLACK RAZZ BLONDE ALE
OG: 1.051 (before fruit addition)
FG: 1.011
Bitterness: 15.4 IBU
Alcohol: 5.2% by volume

MALTS
9.5 lb. (4.31 kg) pale malt
8 oz. (227 g) 20L crystal malt

HOPS
0.6 oz (17 g) Columbus (15% aa) @ 15 min

YEAST
Fermentis SafAle US-05

FRUIT
3.5 lb. (1.59 kg) blackberries, in FV @ day 3
2.5 lb. (1.13 kg) raspberries, in FV @ day 3

Hope this works! That's a whole lot of fruit for a 5-gallon batch, but I'll bet it's sure pretty. Please let me know how it turns out if you end up brewing it!

SERIOUSLY?

***Dear* Zymurgy,**
Had a gander through the November/December 2023 Holiday Gift Guide, and I have to say, hoo boy. I've never thought about homebrewing as a particularly expensive hobby, so seeing a gift guide where the average gift price, with discounts, is $500, was quite a shock. I know it's an ad, but come on now. Maybe some gift ideas for those of us in the real world?

Cheers,
Scott Petrovits
Lakewood, Colo.

***Zymurgy* editor-in-chief Amahl Turczyn responds:** *I hear you. One thing I've always loved about the hobby is that you can approach it a couple of different ways: the parsimonious, DIY spirit (which is the direction I personally lean), to get the biggest bang for your buck, reuse, repurpose, or even manufacture your own equipment, and still make the best quality beer you can with as little out of pocket investment as possible. That's something we celebrate in Zymurgy's annual Gadgets feature. The flip side of that is the Gift Guide, because, as we all know, there are homebrewers out there with the wherewithal to purchase the very best of everything. Top-notch equipment doesn't always result in top-notch beer, but in most cases it certainly doesn't hurt!*

But point taken, we will strive to offer a range of options in future Gift Guide issues, from wallet-friendly to money-is-no-object. Thanks for your feedback.

DEAR *ZYMURGY*
Send your Dear *Zymurgy* letters to **zymurgy@brewersassociation.org**.
Letters may be edited for length and/or clarity.

YOUR HOMEBREW LABELS

Homebrew labels that I created for my son's wedding.
(Homebrewer 3 years, AHA member 3 years)

Mark Albers | *St Charles, Ill.*

YOUR HOMEBREW EXPERIENCE

Show us your labels, brewing/fermentation day, who you brew with, the ingredients you include, what special processes you use, and how you enjoy the final product of beer and beyond.

Upload photos of your homebrew-related fun at HomebrewersAssociation.org/your-homebrew-experience

Fennec and Numa supervising the crushing of the grain here at "No Tails Ale."

KP Glass
(AHA member 4 years)
Central Arkansas Fermenters
Cabot, Ark.

My brew buddy Diana, stealing an early snack of fresh spent grain before it is baked into treats.

Jason Lash
(Homebrewer 4 years, AHA member 4 years)
P.A.L.E.
Joliet, Ill.

Female-led How to Brew in a Bag class at our local homebrew supply store (OG Homebrew Supply) with a full brew day demo by myself and fellow Hogtown Brewer Jackie Rothberg.

Amanda Kent
(Homebrewer 9 years, AHA member 7 years)
Hogtown Brewers
Gainesville, Fla.

When starting out, I dreamt that one day I would have a child who I could brew with. Little did I know that 15 years later, that would become a reality. While setting up for a brewday, I turned my back for one second and my three-year-old is "brewing," complete with lavender ("they're hops, Daddy"). It did smell good.

Blake Morillas
(Homebrewer 15 years, AHA member 10 years)
Brewers of Paradise; That Dam Brew Club
Loomis, Calif.

SHARE YOUR BEST HOMEBREWING SHOTS!

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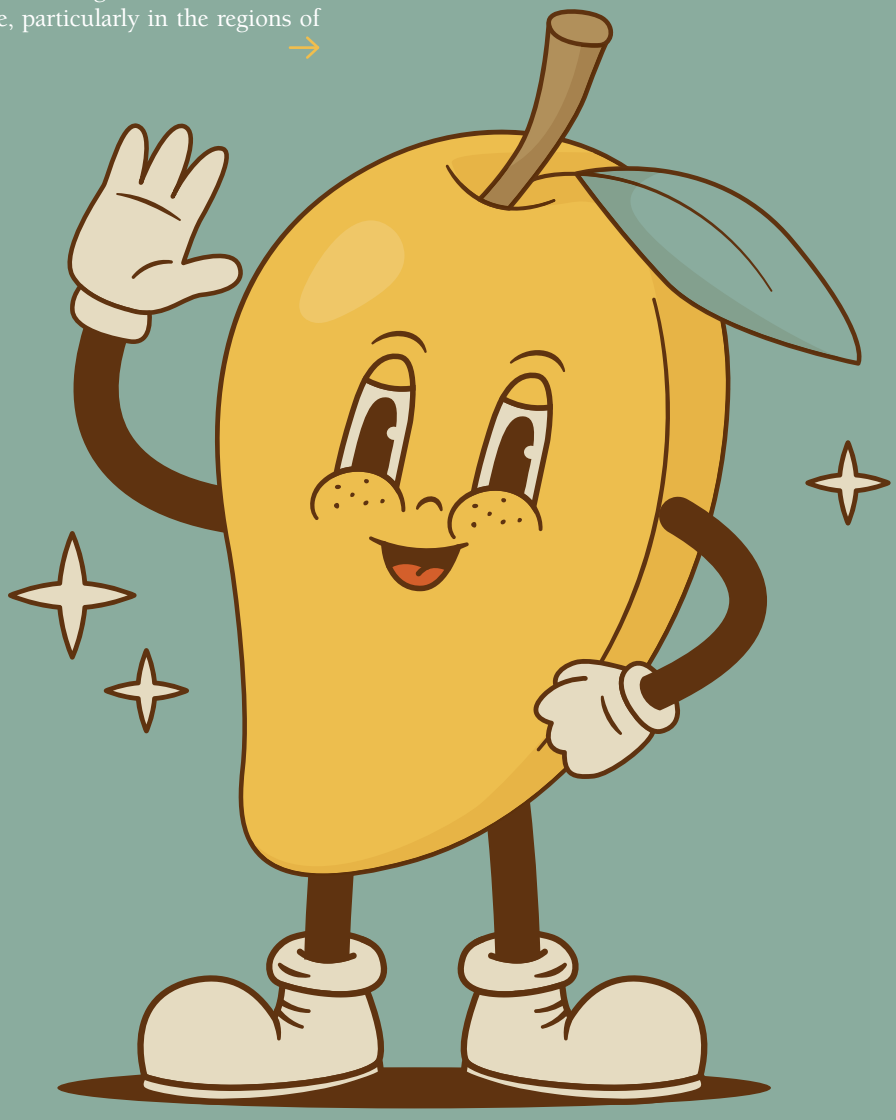
SCAN ME

MANGO CHUTNEY

By Amahl Turczyn, with a recipe by Gabe Toth

Although the word chutney is derived from the Hindi word "chatni," which means to crush or grind, many say the 2,000-year-old condiment's origins are actually from central Asia. According to that theory, ancient cultures in India adopted these often-pickled relishes from Mughal emperors, who flavored their grand feasts with dried fruit chutneys made with saffron and other exotic herbs and spices. Peoples of India adopted fruit and vegetable-based chutneys not only for their ability to spice up staple foods such as rice and legumes, but because they were preserved enough to keep. Thanks to the heavy spicing, along with a low pH from fermentation and a generous addition of salt, the seasoning blends would last through the monsoon season, when fresh fruits and vegetables were difficult to obtain. Chutneys became part of Indian cuisine, particularly in the regions of Dosa, Cheela, Samosa, and Dahi Bhalla.



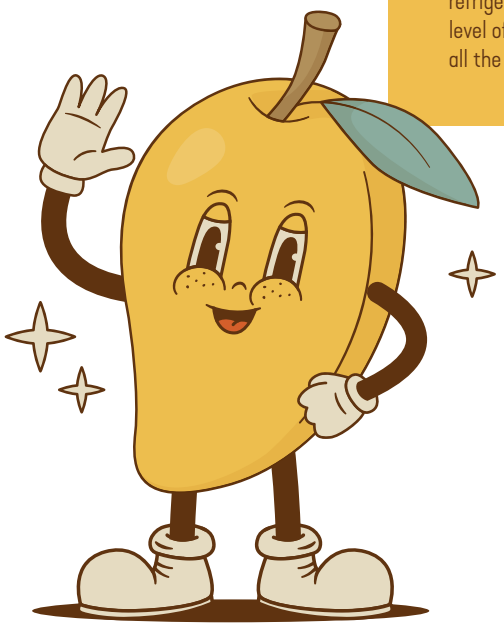
Later, both the Romans and British adopted chutney as their own, and brought it to the rest of the world. They too recognized its resistance to spoilage, which they enhanced by adding greater quantities of sugar and vinegar to prolong the shelf life. They also substituted tropical fruits such as mangoes with the more-available rhubarb, apples, raisins and onions. Sweet, savory, spicy or tart, and many times all those flavors at once, chutney comes in all tastes and consistencies. It isn't always fermented, but some of the best versions are.

My own first encounter with chutney was my mom's mango version, which she would make in vast quantities, since our family was stationed in Guantanamo Bay, Cuba at the time, and mangoes were easy to come by. They grew practically wild in our neighborhood, and the smell of the over-laden trees, with fallen fruit rotting and fermenting beneath, was pervasive.

Her recipe was vinegar-based, and combined fresh, barely-ripe mango, chopped dried fruit, and spices. A jar was always on hand when she made curry, which we knew as a bed of rice topped with a thick chicken sauce spiced with supermarket curry powder, on to which we would heap chopped scallions, flaked coconut, crushed peanuts, and a host of other embellishments. Indian people are quick to point out that there is no single dish called "curry" in India, and what Westerners know as "curry powder" is a blend of spices often including turmeric, ginger, fenugreek, coriander, chili powder, mustard, cloves, and others, all ubiquitous in Indian cuisine, but never actually referred to as "curry powder." The British are much to blame for this compartmentalization, and "curry" is still wildly popular in the UK, but I for one applaud them for making these rich, (in my mind) exotic spices accessible, since my early love of "curry" sparked a life-long love affair with Indian food. I was compelled to learn the real story, study the regional cuisine, and try to reproduce the authentic recipes behind the generic, Westernized concept I'd first been introduced to.

And along with that early introduction was mango chutney, which may or may not even be authentically Indian, let alone British. Included from author and brewer Gabe Toth's *The Fermentation Kitchen* comes a fermented version that I bet my mom would love, perhaps minus the serrano chile. I've also included her original recipe. One can drive oneself crazy searching for "authentic cuisine"—as with art and literature, the culinary world is confoundingly derivative. You'd be better served finding a recipe, appreciating it for what it is, and tweaking it to your particular taste as you see fit.

***Amahl Turczyn is editor-in-chief of* Zymurgy.**



Ferment This!

Mango Chutney

Recipe courtesy of Gabe Toth from his Brewers Publications® book *The Fermentation Kitchen*. Fermented mango, raisins, chile peppers, and spices make a delicious chutney.

INGREDIENTS

- ❍ 1 mango, chopped (about 300 g)
- ❍ 20 g raisins, chopped
- ❍ 1 serrano pepper, minced
- ❍ 1 clove garlic, minced (about 3 g)
- ❍ 5 g fresh ginger, minced
- ❍ 1.5 g fresh turmeric, minced (or use powdered if fresh is not available)
- ❍ salt, 3% by weight, about 12 g
- ❍ brown sugar, 1% by weight, about 5 g

DIRECTIONS

1. Mix mango, raisins, pepper, garlic, ginger, and turmeric together in a bowl. Weigh all ingredients in grams. First, multiply the ingredients' weight by 0.03 and add that amount of salt in grams; second, multiply the ingredients' weight by 0.01 and add that amount of brown sugar in grams. Let sit for a few hours to allow the salt and sugar to draw moisture out of the mango.

2. Pack the mixture into a jar, pressing down hard to try to submerge as much of the mixture as possible. Add a weight to keep the chutney mixture down, adding a splash of water or lemon juice as necessary to cover the chutney.

3. Ferment for a few days at room temperature and transfer to the refrigerator when it reaches your desired level of fermentation, which may be before all the fruit sugars have been fermented.

"Horse mango".

Ferment This!

Horse Mango Chutney

In Cuba, there are several varieties of mango, but the locals referred to the ones that grew near our house as "horse mangoes." This is my mom's recipe from Guantanamo Bay, Cuba. Makes about 7 qts.

INGREDIENTS

- ❍ 4 qts firm, crisp, almost-green mangoes, peeled, seeded, and chopped
- ❍ 1.75 qts apple cider vinegar
- ❍ 6 cups cane sugar
- ❍ 1 qt mixed dried figs, apricots, plums, currants, and raisins, chopped
- ❍ 1 lb dates, seeded and chopped
- ❍ 4 large cloves garlic, chopped finely
- ❍ 3 whole tangerines, chopped (including rind)
- ❍ 1 whole orange, chopped & seeded (including rind)
- ❍ 1 Tbs crushed red pepper flakes, or more to taste
- ❍ 4 Tbs fresh ginger root, grated
- ❍ 3 Tbs whole yellow mustard seed
- ❍ 0.5 cups fresh lime juice
- ❍ 3 tsp salt
- ❍ 3 tsp powdered allspice
- ❍ 3 tsp powdered cinnamon

DIRECTIONS

Peel, seed, and slice the mangoes into bite-sized chunks. (You can also substitute fresh pear, apricot, nectarine, or apple for some or all of the fresh mango.) Place fruit in a non-reactive container and cover with cider vinegar. Weigh fruit down with a plate so that it is submerged in the vinegar, cover, and allow to steep and ferment at room temperature for 3 to 4 days, stirring once daily. Make sure the fruit remains fully submerged and that there are no air pockets.

When you are ready to cook the chutney, have all the remaining ingredients ready. Drain off ¾ quarts of the steeping vinegar and reserve. Add the sugar to the remaining quart plus the steeped fruit, bring to a boil to dissolve, add remaining ingredients, and lower heat to a gentle simmer. Balance and acidity of the final chutney will depend on the ripeness of the mangoes…the riper and sweeter they are, the more reserved vinegar you'll want to add back as the chutney cooks for two hours. Stir frequently, adding water and/or vinegar as necessary. Chutney will thicken as the fresh and dried fruit cooks down and absorbs liquid. Mango chunks will begin to turn translucent around the edges toward the end. Taste and adjust with salt, sugar, or vinegar as necessary, then jar up in sterilized lidded glass jars and allow to seal. Keeps (ideally refrigerated) for 3 months, or for however long your monsoon season lasts.

Photos © Getty/ changphoto (mango); Getty/ nata_vkusidey;

SPUNDING
Primary Fermentation

By Jack Hendler and Joe Connolly

Spunding is the simplest and most straightforward way of carbonating beer; all that is required is that a spunding valve is put on a fermenting tank at the correct time. Spunding requires less cellar processing than both krausening and force carbonating, and it is the process we use most consistently at Jack's Abby.

Some believe that spunding is a necessary finishing touch on a lager. Brian "Swifty" Peters at Austin Beer Garden Brewing believes that the brewery's beer only begins smelling like European lager after undergoing spunding. Peters believes that the spunding process reduces grassy and grainy flavors while slowly dissipating sulfur compounds, the beer achieving sublimity in the process. →

Editor's Note: *The following is an excerpt from* Modern Lager Beer, *available in March from Brewers Publications.*

For consistency and quality, knowing when to bung a tank for spunding is essential. Spunding too early will result in pressurizing your tanks for more time than necessary during active fermentation and may capture off-flavors that are normally blown off. As mentioned, increased top pressure puts extra stress on your yeast, which can delay how long it takes for the beer to pass the vicinal diketone (VDK) test. It also may slow conditioning time or potentially inhibit the fermentation completely.

Even more important is ensuring a tank is bunged before it passes the determined target gravity; failure to do so may mean the carbonation target is missed. If a tank is bunged late, there is no option to retroactively fully carbonate the tank via spunding; an alternative method, such as force carbonating, krausening, or bottling conditioning will be required.

What follows is a calculation to determine when to bung a spunded beer. It is based on the formula by Stephen Holle in *A Handbook of Basic Brewing Calculations*. First, determine the required increase in CO_2 per liter in grams to hit your target final carbonation level; do this by subtracting the target final CO_2 level per liter from the existing CO_2 level per liter (both also in grams):

$$\text{required increase grams } CO_2 \text{ per liter} = \text{target grams } CO_2 \text{ per liter} - \text{existing grams } CO_2 \text{ per liter}$$

Now convert the required increase in grams of CO_2 per liter into extract in degrees Plato. This can be done by assuming about 46% of total extract is converted to CO_2 and also knowing that degrees Plato is the percentage weight extract in the wort (i.e., 1°P is equivalent to 10 g extract in 1,000 g wort):

$$\text{required extract in °P} = \frac{(\text{required increase grams } CO_2 \text{ per liter} / 0.46)}{1{,}000\ g} \text{ X } 100$$

Now add that amount in degrees Plato to your expected terminal gravity (also in °P) and this will tell you the spunding target gravity (i.e., when to bung during primary fermentation):

$$\text{spunding target gravity} = \text{°P to reach target carbonation} + \text{°P terminal gravity}$$

There are only three variables to identify in the above calculations. The target volume of CO_2 will be dependent on the brewer's goals for the beer. The terminal gravity will be as determined by the forced fermentation test. The only variable that needs to be calculated then is the existing CO_2 in solution. This can be identified by looking at the chart of CO_2 in solution by temperature.

As practice, let's say a beer is fermenting at 50°F (10°C). It will have 1.19 volumes of CO_2 (2.35 g/L). If the target carbonation level is 2.6 volumes of CO_2 (5.14 g/L), that means 2.79 (5.14–2.35) grams of CO_2 per liter need to be added. The terminal gravity has been determined to be 3.2° Plato. Based on these values, the calculation to determine degrees Plato to reach target carbonation looks like:

$$\text{required extract in °P} = \frac{(5.14\ g\text{-}2.35\ g / 0.46)}{1{,}000\ g} \text{ X } 100$$

$$= 0.61\text{°P}$$

$$\text{spunding target gravity} = 0.61\text{°P} + 3.2\text{°P}$$

$$= 3.81\text{°P}$$

In some literature, a theoretical 1.1° Plato (4.3° specific gravity) above terminal gravity is suggested for spunding. This estimate assumes that the beer that needs to be carbonated has no CO_2 already in solution. As seen in the above example, the beer already contains roughly half the carbonation needed in the finished product and so the required additional extract was calculated at 0.61° Plato (2.4° SG). If we assumed this beer had no CO_2 in solution, then this extract quantity would need to be roughly doubled, that is, approximately 1.1° Plato would be needed for full carbonation.

When the beer hits its target spunding gravity, attach a bunging device to the clean-in-place or gas arm of the tank. Calibrate and set the spunding valve to the desired pressure and allow pressure to build in the tank. When the pressure within the tank reaches the set-point of the spunding valve, the valve will begin to release pressure in the tank. When the fermentation is 100% complete the tank will maintain the set pressure.

Even with constant monitoring, it is nearly impossible to bung every fermentation at the exact right time. Each brewer will need to find a range above the required amount that is acceptable to them. At Jack's Abby we have a range of 1–2° Plato (approx. 4–8° SG) above our target spunding gravity that we feel keeps flavor consistency and allows for a realistic expectation of timing.

At Cohesion Brewing in Denver, Colo., owner and brewer Eric Larkin racks his open-fermented lagers into horizontal tanks when the extract is about two-thirds finished. This leaves enough residual fermentables to properly carbonate the beer in the secondary tank. Cohesion's beers generally hit about 68–70% attenuation. For a 10° Plato beer, this should theoretically leave about two degrees Plato in the wort to ferment and carbonate the beer. For brewers who spund, finding the maximum amount of residual fermentation that still gives consistent fermentations will be important.

A well-executed spund is simpler and safer than force carbonating or krausening. Spunded beers are less likely to be aerated during the normal course of cellaring, unlike operations such as krausening that add fermentables or force carbonation that may add oxygen from external CO_2 sources. Once your original brewhouse wort enters a spunding tank, there will be no transferring or special processes, all of which represent opportunities for aeration or infection. You also won't need to worry about yeast health during a secondary fermentation, which needs to be considered when krausening.

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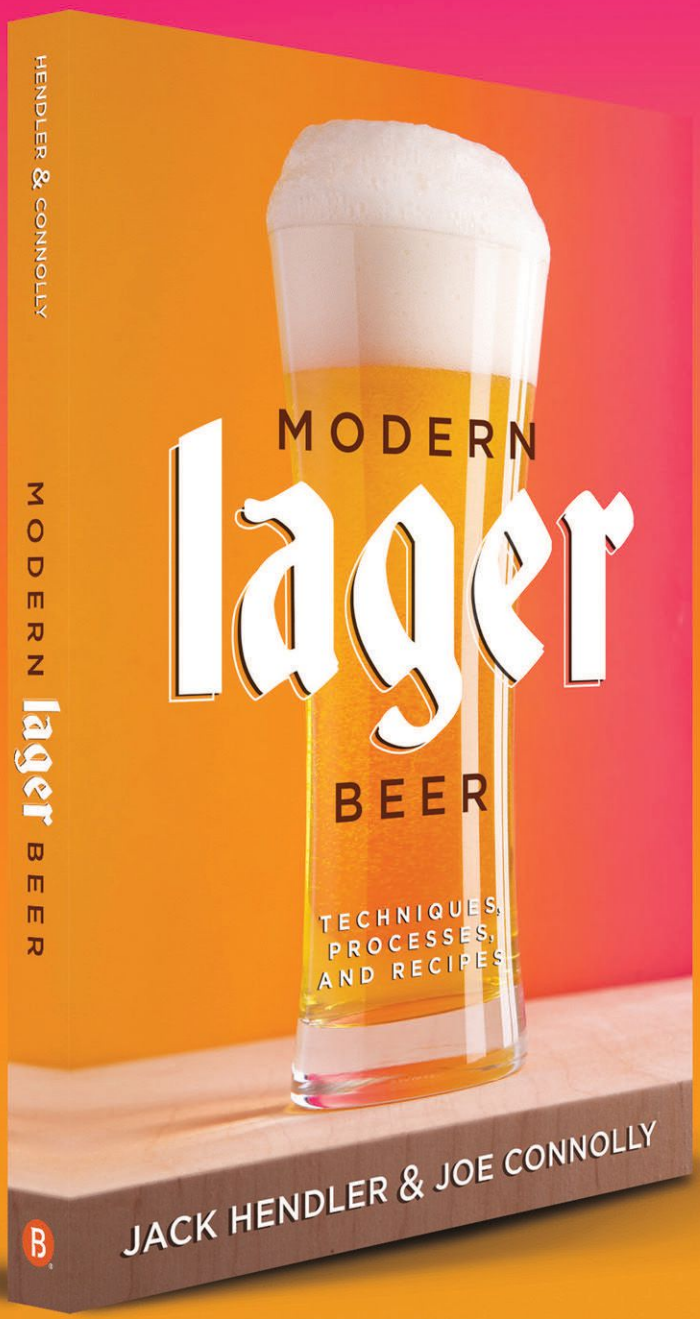

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TIPS FOR SIMPLER SPUNDING

In the event that you can't perform a forced fermentation, you can ballpark the values required for the spunding process based on historical data for attenuation limits. You'll still need a spunding valve and overall familiarity with the spunding process. For most temperatures and average CO_2 volumes, spunding a fermenting tank 24–48 hours before the end of primary fermentation at 12–15 psi (0.82–1.03 bar) gauge pressure should get you close to your goals.

You can adjust carbonation to your specifications by either adding external CO_2 or degassing the tank.

At Germany's Klosterbrauerei Ettal in the far south of Bavaria, Andreas Hussel explains that his beers are generally bunged around 3.5–3.8° Plato at the end of primary fermentation. In the Lagerkeller, he anticipates a finishing gravity of around 1.9–2.2° Plato. Weekly gravity readings will determine when the beer has reached this final gravity. This process is slow and time consuming, particularly at the temperatures used. The tanks during this process are cooled close to freezing. While it takes a long time to finish, the added benefit is the process can happen under very low pressures.

Spunding does increase the risk of yeast autolysis, on account of the extra gauge pressure applied in the tank. Some precautions are likely necessary to prevent this outcome, especially in American breweries where single-tank conical fermentations are the norm. When beginning a spunding program, the pH of the bunged tank should be closely and continually monitored at the end of fermentation. A rise in pH will likely be caused by autolysis of the yeast. Racking the beer to a secondary tank to minimize yeast load is one way to mitigate this issue. Some brewers will cool the beer so that a lower top pressure can be used for spunding. Yeast cell vitality suffers minimally when using gauge pressures of 5 psi (0.34 bar) or lower. Over 5 psi and lager yeast becomes stressed.

Most traditional Bavarian brewers already take steps to rack and cool beer, negating a need for extra caution. In most brewhouses in the US, where open fermentations are not standard, racking, cold fermentation rooms, constant dumping of yeast, lower pressures, and highly vital yeast are the keys to successful spunding.

Jack Hendler is the founder and co-owner of Jack's Abby Craft Lagers in Framingham, Mass. Following years of experience and a degree in brewing from the Siebel Institute in Chicago and the Doemens Academy in Munich, Jack opened Jack's Abby in 2011 with his brothers, Eric and Sam. Joe Connolly is the sales director for Jack's Abby Craft Lagers. Since joining the beverage industry in 2007, he has developed a passion for beer education and its importance to brewing.

A modern spunding valve in use at Müllerbräu.

SPUNDING AND KRAUSENING FOR HOMEBREWERS

There are significant safety concerns when using pressurized vessels in a homebrew setting. Using quality equipment appropriate to the task is particularly important. Never attempt to spund or krausen beer in a glass or plastic fermenter. Even most stainless-steel homebrewing fermenters are not designed to hold pressure. Using pressure-rated stainless steel kegs or Cornelius kegs is the recommended option. Spunding/bunging valves with Cornelius keg connections are now available for homebrewers from most homebrew supply shops. [...] If your secondary fermenter is a keg, you can mimic the effects of a horizontal secondary tank by leaving the keg on its side. However, if using a spunding valve, make sure the valve is not covered by liquid or it will not work properly and create a safety hazard.

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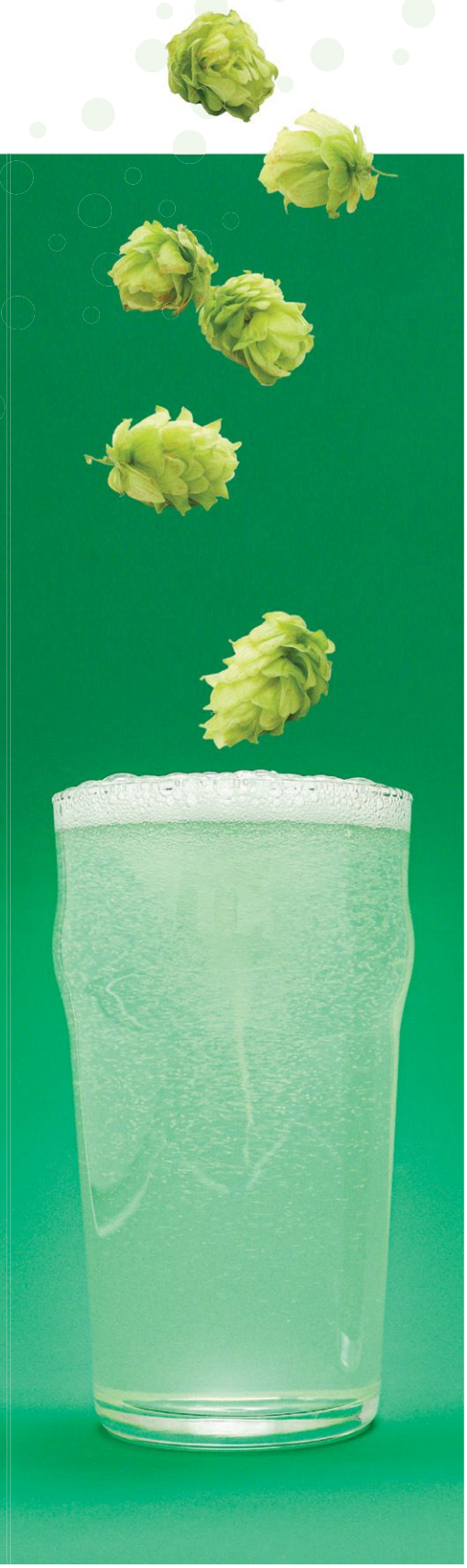
HOP WATER

CAPTURING THE ESSENCE

By Cody Gabbard

Despite lagging sales trends in craft beer, non-alcohol hopped seltzer water (aka hop water) is experiencing massive growth. According to figures published by NielsenIQ, off-site sales toward the end of 2022 reached over $5.5 million and more than doubled in the past two years (up 142.5 percent).[1] Compared with craft beer styles (e.g. American lager, hazy American pale ale) it would have been the fifth-largest growing style. Whether or not this trend continues its current trajectory, hop water has certainly made its way, as both craft and national brands, to your local taproom. At the time of this article's submission at the end of 2023, the popular homebrew experiment website Brülosophy had already published no fewer than five "exbeeriments" on hop water. On a personal note, I had initially shrugged the product off as a passing fad. However, on a recent trip to Asheville, N.C. I picked up a sixer of Sierra Nevada's Hop Splash, both out of curiosity and as an alternative means of hydration in between visits to the plethora of breweries. When I first cracked open a can, I was met with a burst of familiar aromas…citrus, fresh grass, herbs. Being an amateur zymologist, my next inclination was of course, "I have to make this."

So, what makes a good hop water? And furthermore, how do you recreate those favored characteristics? The first phase of my process was to do a little market research that involved sampling every commercially available hop water I could get my hands on. There aren't any existing guidelines for hop water as there are for beer styles, so I would need to develop some in order to rank the examples. Armed with more than a dozen commercial products ranging from nationally available brands to taproom-only offerings, I created a spreadsheet to track the five Beer Judge Certification Program →



characteristics (aroma, appearance, flavor, mouthfeel, and overall enjoyment) and identify what components made up the most enjoyable examples, as well as what could be considered flaws.

When choosing brands, they only had to adhere to two parameters: the product had to be malt and alcohol free, and hops had to be a central ingredient. This meant no non-alcoholic beers, but included hop water beverages with additional ingredients such as fruit, tea, and other flavorings. Fellow hop water enthusiast and NHC gold medal-winning homebrewer Jordan Folks and I tasted each seltzer, noted what worked and what didn't, and narrowed the list down to the best examples. These finalists would then be reevaluated by a broader panel during a blind tasting.

Unsurprisingly, the main characteristic that we looked for and also enjoyed in our favorite examples was a bright, fresh hop character. The ones that worked best had characters of fresh herbs and fruit and weren't overly vegetal. Experiencing hops in both the aroma and the flavor was preferable, but not at the expense of drinkability. Our favorites were refreshing and had clean flavors over artificial ones, much like their non-hopped seltzer counterparts.

Mouthfeel was a key factor in separating the great examples from the mediocre. The spritzy carbonation elevated hop flavors and released aromas, but was also thirst quenching. Although we didn't anticipate having much of a discussion around mouthfeel outside of carbonation, two other sensations proved to be integral. Firstly, and difficult to avoid, was astringency. Body doesn't exist to counterbalance any bitterness, so even the mildest of bitterness came off as overly drying and sharp. The second sensation was sweetness. We put this into the category of mouthfeel versus flavor, as even the smallest bit of perceived sweetness gave an odd fullness, with one example that had moderately low carbonation as well as added cane sugar.

Appearance was another afterthought that proved to be important from the standpoint of an overall pleasurable experience. We created two homebrewed versions to taste alongside the commercial products, and compared to the mostly crystal clear, nearly colorless versions from the professionals, our slightly hazy and greenish-yellow creations were much too reminiscent of what might be found in a public restroom.

With our newfound appreciation for all the components of our idealized version of a hop water, we designed a BJCP-esque style guideline for our next round of tastings. This second round would be opened up for a larger group to judge blindly. These guidelines are of course our preference, but we designed them to be fairly broad and open to interpretation, so judges could explain why they preferred certain characteristics over others. See the sidebar for our guidelines.

Narrowing the field to our six favorite examples, we then hosted a blind tasting to be judged by a BJCP Recognized judge, two Certified judges, a National judge, and a professional brewer. Not only were these commercial examples our favorites, but they also ran the gamut of flavors, and as we'll see, creation processes. To view an interactive visual of the panel's scores and notes, navigate to the QR code at right (best viewed on a desktop or tablet, but also compatible with mobile phones). Additionally, click on

OUR GUIDELINES

AROMA (12 POINTS): Moderate to high hop aroma. Typically includes tropical and citrus descriptors, but can be any variety. Some grassiness is allowable, but aromas should not seem artificial, but rather fresh. Added flavors (e.g., fruit & spice) are optional, but should not overshadow hop aroma or be artificial in character.

APPEARANCE (3 POINTS): Should be very clear. No head is typical. May have a very light tinge of color, typically green or yellow, but should not be murky.

FLAVOR (20): Moderate to high hop flavor. Can often be characterized as tropical, citrus, or floral, but any variety is acceptable as long as it is fresh and not artificial tasting. The focus should be on freshness and may include light grassiness. Very low bitterness or light acidity is allowable, but neither should impair drinkability. Very light perception of sweetness is allowable. Some added flavors are acceptable, but should marry well with the hops and not contain artificial off-flavors.

MOUTHFEEL (5): Carbonation should be moderately high to very high. No astringency. Extremely light body. Some very mild sweetness is allowable but should not contribute to any type of fullness in the body.

OVERALL (10): A clean, unsweetened, and highly carbonated beverage with noticeable hop character and nominal to no bitterness. The focus should be on refreshment and high drinkability with a fresh character.

the products within the visual to view tips from the brewers themselves (only available on desktop version).

INTERACTIVE VISUAL OF SCORES AND NOTES

https://public.tableau.com/app/profile/cody.g3230/viz/HopWater/Scores

THE RESULTS

From the perspective of pronounced aroma and flavor, Sierra Nevada's Hop Splash and Lagunitas' Hoppy Refresher were at the top of the list based on the judges' notes. These characteristics also made for some pretty divisive scoring as Lagunitas' Hoppy Refresher received both the highest and lowest score among the five judges. Pelican Brewing, a mid-size regional favorite in the Pacific Northwest, also created some disagreement among the judges, with several enjoying the fresh citrus of its Sparkle Hops Citra & Lemon, while others felt the hops were overshadowed by the fruit flavor. Another Pacific Northwester, Aslan Sparkling Hop Water, didn't have the emphatic detractors that the more robust offerings did, but lacked the hop punch the panel was looking for. Finally, and by the narrowest of margins to take the top spot, the definitive favorites were a pair of smaller-sized breweries that delivered the most consistent scores. St Elmo Brewing Company's Hop Water out of Austin, Texas was notable for its subdued flavor but high drinkability, and winning the panel's favor was Ruse Brewing's Familiar Flower from Portland, Ore., which was described as having a well-rounded range of hop flavors on top of being very refreshing.

All of the hop waters on the panel are clearly well-made and have their fans, so we went to the brewers themselves to see how they were able to coax flavor out of the hops,while walking a tightrope of not creating off-flavors on the blankest of canvases. Somewhat surprisingly—although it really shouldn't be, considering the myriad ways in which a single style of beer can be made—processes varied widely. A few key techniques, which relied on a bit of science, emerged among the top-rated examples.

WATER AND pH

The one unifier among the top-rated hop waters was initial water acidification. The various products differed in the way and extent to which they adjusted pH, but all of them acidified for both taste and safety. An important and necessary factor to consider when making non-alcohol beverages is that they should be pasteurized as well as acidified to deter pathogens. According to a 2016 fact sheet published by William McGlynn of Oklahoma State University, the food industry's standard is 4.6 pH.[2] At and below this pH, botulism spores are unable to grow. In an article for MoreBeer! on Lagunitas' Hoppy Refresher, author Vito Delucchi suggests a pH between 3.2 and 3.6 to guard against bacteria, as well as for taste balance.[3] [***Editor's Note:*** *Hop water has a lot less growth potential for pathogens than non-alcohol or alcohol-free beer. Please see Food Safety Basics: Acidification on page 40.*] Any acid should suffice, but the top ranked waters used citric acid. Shaun Kalis, co-founder and brewer at Ruse Brewing, says they aim for a pH between 4.2 and 4.4. Oregon State University's Thomas Shellhammer and Jeff Clawson (who also helped Ruse with the development of our panel's favorite hop water) also suggest using a buffer such as sodium citrate. Hops will nominally raise the pH so a buffer can help maintain and stabilize a targeted pH. Another option, as suggested by Pelican Brewing brewmaster Darron Welch, is to use fresh fruit juices such as lemon and lime, as Pelican does in some of its Sparkle Hops series, including in one of our panel's favorites, Citra & Lemon.

It is still recommended that these "high-acid" foods be pasteurized, so you should at a minimum bring your water up to a boil. This also serves to deaerate. Welch of Pelican Brewing says they use water deaerated to 50 ppb dissolved oxygen for their Sparkle Hops. Delucchi also suggests boiling water for 10 minutes to deaerate.

Photo © Getty/Jag_cz

As for the water itself, a soft profile is encouraged. Several of the brewers said they do a nominal treatment to their already soft water, and Delucchi's article on Lagunitas suggests a 2:1 ratio of chlorides to sulfates, a not-uncommon reference point for many hazy IPAs. Again, any harshness whatsoever in the hops will become readily apparent, and with a piquant level of carbonation, anything that would create more of a drying sensation and accentuate perceived bitterness should be avoided.

HOP ADDITIONS

To hot steep or cold steep? That seems to be the main question for producers. Among the six reviewed and contacted, three cold steep, two steep at whirlpool temperatures, and one didn't disclose their process. Ruse and St. Elmo, the two top scorers from the panel, as well as the highest scorers on flavor, both cold steep their hops, while the third highest scorer, Lagunitas, conducts two separate heat-treated methods. Shellhammer and Clawson are also advocates for the cold steep, saying it promotes aroma while limiting bitterness and astringency.

Hop guru Scott Janish, author of *The New IPA: A Scientific Guide to Hop Aroma and Flavor*, makes the case for short, cool dry hopping, explaining that terpenes such as myrcene and linalool reach their solubility threshold in a matter of hours.[4] Janish also cites studies that suggest a cooler extraction (mid 30s compared to 68°F) is also faster, with maximum extraction of linalool after two days. He goes on to explain that studies have shown that a longer extraction time will impart more bitterness and polyphenols, which would be much more recognizable in a hop water compared to the beer used in the studies. The types of compounds and thus flavors can also change with contact time. Janish cites a 2019 study that used the hop Eureka! in which shorter dry hopping (one day) was perceived as having much more fruity and citrus character, compared to longer dry hopping, which produced "greener" herb and spice characteristics.

Although none of the producers boil their hops, two use a hot steep during whirlpool. According to Delucchi, Lagunitas employs two steps. In the initial stage, a portion of the water is heated to 170°F (77°C), and pulled off to steep half of the total hops, a method referred to as "dip hopping"—they claim this drives off vegetal compounds. The rest of the water is boiled for 10 minutes, then the remaining hops are added at flameout for a 10-minute whirlpool. After chilling and separating the liquid from the flameout hops, it is combined with the dip hop slurry in the fermenter. At Aslan Brewing Company, head brewer Austin Umbinetti-Hutton says they stick with a single addition of whole cone hops at 175°F (79°C) that is whirlpooled for 15 minutes.

The amount of hops varies among producers, but all use much less than what you'd see for a typical IPA or even a pale ale. On the higher end, Ruse has settled on around 2.5 lbs per barrel (or roughly 1.25 ounces per gallon), and Lagunitas uses closer to 1 ounce per gallon. What they all recommend is trial and error based on your own setup. The hop variety and oil content will help to determine the amount to add, but producers are using the same popular high oil varieties they use for their IPAs. All of the producers on the panel use Citra except for Aslan, which prefers Cascade and Chinook. Mosaic (Ruse) and Simcoe (St. Elmo) round out the pairing for the top two scorers on the panel, and some more old-school favorites in Centennial (Lagunitas) and Amarillo (Sierra Nevada) are used for the remainder.

ADDITIVES AND OTHER INGREDIENTS

Two producers on the panel use additives for extra complexity in their beverages. The only "flavored" hop water to make it to our final six was Pelican Brewing's Sparkle Hops Citra & Lemon. Compared to other fruited examples in our initial tasting, Pelican's had a much fresher character that also melded well with the hops. Based on feedback from the panel, any detection of "artificial" flavors was cause for a lower score, so producers walk a fine line when adding anything else but

Brew This!

QUICK & COOL

Recipe courtesy of Cody Gabbard

Batch volume: 1 US gal. (3.79 L)

WATER

1 gal. (3.79 L) soft, filtered water

HOPS

1 oz (28 g) fruit-forward hops such as Citra
1 oz (28 g) resiny hops such as Cascade

YEAST

3 g dry, neutral ale yeast (optional)

OTHER ADDITIONS

½ tsp calcium chloride
Lactic acid or lemon/lime juice to adjust water pH to 4
1.5 oz (42 g) corn sugar to carbonate (optional)

PROCEDURE

Water: I have very soft, low-ion water in Portland so I add about a ½ tsp per gallon of calcium chloride to emphasize sweetness and forgo sulfate additions. Your pH should be 4.6 or lower. I usually shoot for 4 using lactic acid at about 1 gram per gallon, but your source water may differ, so a pH test is highly recommended. For an additional flavor boost, try adjusting pH with fresh lemon or lime juice.

Boil: Bring your water to a boil for five to 10 minutes to deaerate, then quickly chill to 40°F (4°C) or below.

Hops: Add your hops at a rate of 0.5–1.0 ounce (14–28 g) per gallon to start with. I like using a fruit-forward variety such as Citra coupled with a more resiny varietal to bring more balance and nuance. A 50/50 split is a good place to start. After 24 hours at 40°F or below, filter out your hops.

Yeast: (Optional) If using, you'll just need a partial packet of dry yeast per gallon—too much and you'll get yeasty aromas, so be frugal. I like to use the short and cool method for hops along with the biotransformative properties of adding a little yeast (especially when bottle conditioning), but feel free to forgo the yeast or do a split batch to test the differences.

Carbonation: Force carbonate to 3.0 volumes of CO_2. If bottle conditioning (which will add about 0.5% abv), I use a calculator and set the desired volume of CO_2 to 3.5. This comes to about 1.5 oz corn sugar per gallon.

hops. Pelican brewmaster Welch suggested that when adding fruit, you should use as close to the real thing as possible; in their case, real fruit puree. As with any beverage without alcohol, Welch was adamant about pasteurizing your product and making sure it's shelf stable. Much like the cold steep for hops that is effective at shorter contact times, Welch also recommends a short, cool infusion of fruit puree along with the hops—theirs is just 24 hours. I've personally played around with artificial extracts and have found that they tend to overpower the hops at any concentration, so whole fruit or real puree is recommended.

In any other context, yeast would not be considered an additive, but for a product with no added sugars, it certainly provides a unique contribution. Lagunitas has popularized this method, adding yeast with the hop slurry for brief "fermentation." According to Delucchi, the addition of yeast results in biotransformation that turns otherwise vegetal and dank character into more fruity notes. On the exBEERiment website Brulosophy.com, frequent contributor Folks, who also assisted with this article, conducted a side-by-side comparison of two hop waters using the Lagunitas method with some interesting results.[5] Utilizing a triangle test in which two hop waters were not yeasted and one was dosed with Imperial Yeast's Flagship after chilling, a total of 18 testers out of 20 were able to identify the odd water out. A visual side-by-side showed a much clearer and lighter-colored product for the yeasted water as well. Seventeen of the 18 testers in Folks' experiment preferred the yeasted sample. Notes from my hop water panel for Lagunitas' Hoppy Refresher included aromas and flavors of "sweet fruit," "mixed berry," and "tropical," but also noted that it veered into "artificial fruit drink" territory. For those without carbonation equipment, the addition of yeast (and of course sugar to create the carbonation) is also a necessity. My ABV calculations have estimated around 0.5 percent when using yeast and corn sugar to carbonate batches, which is right around the legal limit for non-alcohol beers. One thing I've noticed is that again, there is nowhere to hide any off-flavors, and that goes for yeast as well. Any bready, yeasty aromatics will likely carry through to the finished product, so if you do choose to yeast your hop water, try to pitch a fresh, flavor-neutral strain.

CARBONATION

Make 'em spritzy! That's the major takeaway from every discussion I've had with producers. Of the five who provided CO_2 volumes, they all ranged from 3.0 to 4.0, while most stayed right around 3 volumes. It's tempting to get them up around soda levels, but remember that you're balancing against hop bitterness, not sweetness, so a higher carbonation will make any perceived bitterness sharper. Sugary sodas keep from being overly cloying by having exceedingly high carbonation levels, so as Bryan Winslow of St. Elmo suggested, you want to be just below soda—that way you aren't fighting astringency. All the waters tested scored well above four out of five points for mouthfeel, and most are right around 3 volumes, with panel tasters providing the note "moderate high" carbonation more than any other mouthfeel descriptor.

From a safety perspective, note that the typical glass beer bottle is not rated to withstand this type of pressure, so if you insist on using glass, Belgian-style bottles with thicker glass are suggested. I personally recommend soda and seltzer PET bottles. These are not only safer, they let you know when carbonation levels have peaked, as the bottles get nice and firm.

FINAL CONSIDERATIONS

At the end of the day, this is not a beer product, so it would be a mistake to take a beer-centered approach when crafting a recipe. Winslow of St. Elmo says, "Keep the focus away from bitterness and treat it like water because it's not beer." Kalis of Ruse echoes this sentiment, adding that you should take a "food and beverage approach." Kalis also recommends good filtration if you have the means, as any leftover solids at packaging can lead to astringency. Umbinetti-Hutton of Aslan and Welch of Pelican also suggest keeping it simple. Any attempt to amp up the flavor, as you would with a double IPA, will likely lead to an imbalance of flavors. All of the producers suggest trial and error, as this is still a product in its infancy, but that your favorite hops for beers will likely also be good choices for hop waters (we're looking at you, Citra).

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Brew This!

LUPULA CROIX

Recipe courtesy of Jordan Folks

Batch volume: 5 US gal. (18.9 L)

WATER

5 gal. (18.9 L) soft, filtered water

HOPS

2 oz (57 g) Citra (dip hop)
2 oz (57 g) Strata @ flameout/whirlpool

YEAST

1 pack neutral ale yeast strain such as Imperial Flagship or Chico

OTHER ADDITIONS

Add desired salts at a chloride:sulfate ratio of 2:1. Lactic acid to adjust pH to 3.3.

PROCEDURE

Dip Hop: Heat water and at 170°F (77°C) pull 17 ounces (500 mL), add 2 oz (57 g) of Citra hops, then seal/cover. Bring the main batch to a boil for 10 minutes. At flameout, add 2 oz (57 g) of Strata and conduct a hopstand for 10 minutes. Rack/strain the main batch off the hops and add to the dip hop slurry in a keg/fermentation vessel. Chill to 68°F (20°C).

Add yeast to the fermentation vessel. If kegging, purge the keg first with CO_2. "Ferment" for five days.

Rack/transfer to serving keg and burst carbonate at 40 psi for three days. Dial down to serving pressure and condition for several more days before serving.

LIVING THE NON-ALCOHOL DREAM

LOW- AND NO-ALCOHOL BEERS

By Amanda Burkemper

HISTORY, MARKET TRENDS, AND TODAY'S BEER

Prior to the late 2010s, the state of non-alcohol (NA) beer in America was likely not deserving of the craft beer moniker. Selection was relatively limited, and the quality was such that it did not measure up to the rest of the craft beer industry. But by 2021, there was a notable expansion in options on the market, even though the quality wasn't yet up to normal strength craft beer standards. I would know—I was pregnant with my two girls during those years. And when you are a beer judge who is heavily involved with your homebrew club, and you can't drink alcohol beer, you have to at least try out the options! For science, of course.

Now in 2024, the quality and variety of commercially available NA beer has improved to the point where in many cases it is indistinguishable from the "real thing." Driven largely by consumer demand, this leap in quality is impressive, as is the speed at which commercial brewers have been able to improve their products. It's been enabled by many commercially available products, such as NA yeasts from White Labs, Lallemand, and Fermentis, and advanced hop products, including distilled hop oils and concentrates from Hopsteiner and others.

The 2023 Great American Beer Festival® (GABF®) had 35 NA beers from 16 different breweries—a huge increase from 2022. Large breweries are now in the NA craft beer game. Sierra Nevada, Deschutes, Dogfish Head, Sun King, and AleSmith, among others, are joining NA-only pioneers such as

Athletic and RationAle in trying to capture a piece of the NA market demand.

For homebrewers, this trend presents an opportunity to explore and innovate within the non-alcohol beer space. New brewing technologies and techniques from commercial brewers and homebrewers alike are allowing the creation of non-alcohol beers with much better taste profiles, even approaching that of typical beer. This allows homebrewers to enjoy more beer more often without the negative effects of the accompanying alcohol. Put simply—you can drink more beer if there is less alcohol in it. So even if you aren't aiming for the United States federal regulation of 0.5 percent ABV at home, you can use these techniques to reduce the alcohol in your homebrew without impacting the overall quality of the beer.

EXPECTED ATTRIBUTES OF LOW/NA BEER

As a BJCP judge, I typically start thinking about a beer from a "what should I expect from this?" perspective. Given that the market offerings have gotten so good now, I can safely say that the analysis objective for low and NA beer should be to almost not notice the lack of alcohol. Low and NA beers should not be overly thin and watery "malt sodas." They should not be worty or have a potato starch-like character, as many of the earlier examples of commercial NA beer did. Overall, we should still be hitting the original intent of the base style, just with less alcohol.

TECHNIQUES AND CONSIDERATIONS

Alcohol Reduction

When commercial brewers create NA beer, they have a number of different methodologies at their disposal—typically mechanical methods such as reverse osmosis filtration or distillation to remove alcohol, methods that are not practical for most homebrewers. These types of mechanical techniques are what breweries such as Untitled Art use to produce their Hazy IPA and Italian Pils (both worthy of a try), and what Budweiser and Heineken use to produce their 0.0 percent beers on a much more massive scale.

There are other production techniques that are practical for homebrewers, known as biological methods. They can be broadly described as tweaking what you already know how to do in order to create less fermentation and therefore less alcohol. Biological methods are far easier to manage at home. These are things such as mashing at much higher temperatures to create a less fermentable and therefore more dextrinous wort, having a lower starting gravity, cold crashing during fermentation to arrest yeast activity, or using one of the newer NA yeasts that have ~<20 percent attenuation. All of these techniques essentially result in less fermentation in the beer—that's it. Less fermentation means less alcohol.

If it were that simple, this article would end here. But flavor being what it is, things are a little more complicated. With less malt, you have less ability to develop flavor. With less malt flavor, your BU:GU will change (bittering units to gravity units ratio, a helpful metric for determining if bitterness is balanced with the sweetness in your beer recipe), so hopping needs to be adjusted. And you have a lower mineral content in your beer, since malt contributes to your end water profile, so water chemistry is affected. Alcohol is a major flavor component of beer, so without it you need to compensate for its absence. Alcohol provides body and sweetness, and is a solvent →

for flavors that are typically used in beer, such as hop oils. Oils are not very soluble in water, but they are in alcohol. Alcohol also acts as a preservative, meaning that an NA beer will need to follow more food safety practices than typical homebrew. So how do you approach recipe creation with all of that to navigate? Thankfully, there are a number of documented ways to accomplish these goals and have a lower alcohol beer in your kegerator at home.

Brewing Techniques

The high-level idea when designing and brewing a low to no alcohol beer is to design around not having alcohol. If alcohol brings a lot of flavor—both directly and indirectly—to the party, then we need to compensate for its absence. Thankfully there are people who have already started the research for us. Between several Mad Fermentationist posts, the guys at Ultra Low Brewing (ultralowbrewing.com), a presentation at Homebrew Con 2023 by Meagen Anderson, research being shared by White Labs, Lallemand, Fermentis, and others, more and more knowledge on these compensation processes is being presented and published.

Malt Bill

The first place to start with low-ABV beer design is with the malt. When brewing a beer that starts at, say, 1.020 or so, you'll definitely have less malt to develop flavor. If you're normally using 10 pounds of malt to make a 1.050 beer, imagine if you only were using 4 pounds of malt to make a 1.020 beer. That is a lot less opportunity to develop flavor.

The common methodology for increasing malt flavor is something that isn't common in typical homebrewing: ditch the normal base malt percentage and increase the specialty malt dramatically. Target base malt in the 50 percent range or less, and specialty malt in the 50 percent range or more.Imagine if you brewed a 7-percent ABV IPA with 50 percent specialty malt—that would likely be nasty. Your goal with a 7-percent IPA typically isn't to make the malt as characterful as it can be, but that is your goal here. Additionally, you can get away with more characterful malt in a 2-percent ABV IPA because there won't be alcohol there to provide sweetness.

A typical malt bill for a lower-alcohol IPA might replace the usual two-row or Pilsner malt for pale, Golden Promise, or Maris Otter. You can also increase the specialty malts in both amount and variety to build a more complex flavor.

Mashing

When mashing a lower-alcohol beer, the goal is to not create too fermentable of a wort. Again, this is somewhat counterintuitive based on what we homebrewers typically do. In the case of lower-alcohol worts, the more dextrinous the better. Mash temperatures can easily be in the mid-170s for the whole mash; 176°F (80°C) isn't an uncommon temperature. Who needs a mash-out when your whole mash is hotter than a typical mash-out?

Another way to build more malt flavor is another atypical way of thinking: use only the first runnings of a mash for your wort. First runnings are stronger, and therefore more flavorful. Yes, it's inefficient, but brewing a low-ABV beer is by definition inefficient. On the flip side, several local homebrewers make "second runnings" beers that are very good even though they only clock in around 2-3 percent ABV. Experiment for yourself and see what works for you and your goals.

Water Chemistry & pH

Water chemistry can certainly be a rabbit hole, but I will keep it relatively high level here. For my purposes, I'm just using the water calculator in BeerSmith, as it is usually close enough for me. I'll split the topic into two: water ions for building a water profile, and pH throughout the process.

For building the water profile, we can learn a lot from the hazy IPA world, where chloride and sodium are used more heavily. Why? Chloride induces a fuller body and enhances the chewiness of the mouthfeel. Salt (NaCl) enhances flavor. So, looking to both chloride and sodium to enhance a base water profile can help with both body and overall taste. We also should be cognizant that malt brings ions to the water profile. With less malt, you will need to increase water salt additions to accommodate for the decrease in malt-provided water ions. Check your water calculator to make sure that it is accounting for the lower amount of malt. You can do this by ensuring that the amount of suggested salts actually does increase when you lower the amount of malt from a normal ABV recipe, effectively keeping the water profile the same while increasing the amount of suggested salts.

Mash and process pH is an important topic in low and NA beers, not just for flavor, but for food safety. I cannot stress this enough: do not make low or NA beer without a pH meter, or at the very least, test strips. Food safety is no joke. Homebrewing normal strength beer comes with a sort of anecdotal guarantee that it cannot make someone sick. This is mostly due to the presence of alcohol. Without it, you are in the realm of canning food. The USDA recommends that for safety, foods are canned at a pH lower than 4.5. Higher than that, and your products can harbor botulism and other pathogens that can make consumers sick. Testing for pH is cheap insurance, and you should err on the lower side of 4.5—recent studies from NA beer researchers indicate that a pH of lower than 3.9 may be necessary to limit bacterial growth in beer. (More about this in the Food Safety section following.)

So how do you lower pH? In the beginning of my recipe design, I use BeerSmith water and mash tabs to get my mash pH close to where I want it, typically 5.2 to 5.4. Adding lactic acid in very small doses (0.1 to 0.5 mL) is effective for this. Once I've achieved my desired mash pH, I'll take a reading pre-boil and then plug that pH into BeerSmith as my "current" pH and aim to hit a target of around 4.8 to 4.9 in the boil. I will take another reading post-boil and then aim to hit about 4.5 with lactic acid before chilling. I step it down in this manner because I want to hit optimal pH at each stage in the process. After fermentation is complete, I will take another pH

Photos courtesy of Amanda Burkemper

reading to see how much it has dropped in fermentation. If it has made it below 3.9, then I don't adjust it. If it hasn't, then I adjust it down to 3.9 in the same way I have calculated and adjusted before. This all sounds fiddly and hard, but once you do it one time, you'll be a professional. It is also a required part of making NA beer—without it you would not know if what you are serving is even safe to drink.

Mini-Series "London Brown"

2.0% ABV

Recipe by Amanda Burkemper

This recipe is based on one from Kansas City homebrewer and member of ZZ Hops, Scott Okenquist. He has had his recipe scaled up at Grains & Taps in Lee's Summit, MO where I first had it. His version is 3.2% and I have modified it to reduce the alcohol to 2.0%--simply by mashing much higher, reducing the original gravity slightly, and using a less attenuative yeast. All of those techniques together gave me less fermentation while retaining the original intent of the beer. This recipe illustrates how just a few tweaks can keep the original intent of the style while reducing the alcohol.

Batch volume: 2.75 gal. (10.4 L)
Original gravity: 1.030 (7.5˚P)
Final gravity: 1.015 (3.75˚P)
Efficiency: 60%
Color: 18 SRM
Bitterness: 18 IBU
Alcohol: 2% by volume

MALTS & ADJUNCTS

28.2 oz. (800 g) Crisp Maris Otter Malt
7.8 oz. (220 g) C120
3.2 oz. (90 g) C80
3.2 oz. (90 g) C40
3.2 oz. (90 g) Victory Malt
3.2 oz. (90 g) Chocolate Malt
3.2 oz. (90 g) Rye Malt

HOPS

0.48 oz. (14 g) East Kent Goldings, in boil @ 45 min
0.18 oz. (5 g) East Kent Goldings, in boil @ 15 min

YEAST

Omega British Ale I

WATER

70 ppm calcium, 7 ppm magnesium, 5 ppm sodium, 65 ppm sulfate, 78 ppm chloride, 50 ppm bicarbonate

BREWING NOTES

Mash at 170˚F (77˚C), up from the 152˚F (66˚C) in the original recipe to lower attenuation further. Since this does have ~2% ABV, I was not as attentive with pH outside of mash pH. Boil for 45 minutes. Chill, pitch yeast at 75˚F (24˚C) and monitor fermentation. Yeast stopped on its own this time at 1.015 (3.75˚P). Final packaging pH was 4.1 without adjustment. Carbonate to 2.5 volumes. Counter-pressure fill 12-oz bottles. Pasteurize bottles at 176˚F (80˚C) for 15 minutes, then keep cold until serving.

SENSORY NOTES

Aromas of dark chocolate, bread dough, light toast, and dark stone fruits like plums. Light floral notes. Fairly complex aroma for a 2% beer. Flavor is more dark chocolate with a hint of light coffee, bready, some nuttiness like hazelnuts and pine nuts. Low bitterness, Light floral and earthy notes in the flavor as well. Moderate low dark plums and red apple flesh esters throughout. Just under a medium body, not dissimilar to a typical London Brown. I don't know that I'd change anything about this beer—the goal was to reduce the alcohol in Scott's original recipe and not notice it, and this does exactly that.

Hop Schedule & Advanced Hop Products

Hopping low and NA beers can be tricky, since we are adjusting so much of the overall beer, but still want it to retain its original intended balance. As with water and pH, I'll split this into two topics: hot-side and cold-side additions, since they are adjusted in two different ways.

Hot-side additions (in the boil) are typically reduced in a lower alcohol beer. Why? Since we are lowering the available gravity and therefore available malt character, we should also lower hop bitterness to keep everything in balance. I've been shooting for a similar, if not increased BU:GU ratio. Why increased? To me, this is the most interesting part of this whole experiment series—when I use a BU:GU ratio of >1.0 for these mini-IPAs, they do not taste overly bitter. A BU:GU of 1.3 would be the upper limit of style for an American IPA, and that's what I'm using for the 1.7-percent ABV mini-IPA. Counterintuitively, I'm using a BU:GU of 1.6 for the 0.7-percent ABV IPA. Generally accepted hop science dictates that hop utilization is better in lower gravity worts than in higher gravity worts, which doesn't seem to track here. Without spending too much time in the detailed math, this is likely due to limitations in the Tinseth formula for calculating IBUs. Newer and more complex methods exist to calculate IBUs more accurately across a range of beers. That said, Tinseth is good enough for our purposes. This is why the BU:GU ratio is a metric, not the be-all, end-all. In the end, what matters is how it tastes in your glass.

Cold-side additions (hops used after chilling the wort) are where things can get fun. There are many new products and hops on the market that can make our goal of packing flavor into the beer easier than a standard dry hop with a lower oil variety. There are several different considerations for dry hopping a lower alcohol beer, chief of which is that oils, hop oils in particular, are soluble in alcohol and not very soluble in water. This is another thing we need to work around—how to get a similar hop aroma when hop oils don't dissolve into beer with the same efficiency as normal alcohol beer.

There are two high-level ways of overcoming this efficiency gap: using hops with a higher amount of hop oils, something many manufacturers are now including in their packaging, or by trying out some of the new hop oil extracts available. The hop extracts have already solubilized the oils into suspension, so no alcohol is needed to dissolve them into the finished beer. What I have been using to good effect in the mini-IPAs is a combination of high-hop oil-content hops in the boil, and then a small dose of distilled hop oil as "dry hops." The goal here is to attain more hop flavor and aroma with lower overall IBUs, keeping in mind the balance metrics mentioned previously.

Yeast Selection

Choosing the right yeast for lower alcohol beer is just as important as it is for any beer, although it comes with a few additional considerations. Two of the more important ones are how much total attenuation you can expect, and what flavors the yeast will provide to your beer. In general, a lower amount of fermentation will create less yeast character than if you were fermenting a 5-6 percent ABV beer, so choosing a yeast with more character can help pack in flavor. It is not often that you see a lower alcohol beer recipe with WLP-001. That yeast is great—it is clean and attenuates well. But here, unless we are making a low alcohol lager, I will be choosing a more expressive yeast than Chico.

For attenuation, since you've likely mashed higher, the wort will have more complex sugars in it than if you had mashed at 150°F (66°C). Lower mash temperatures encourage maltose and glucose in wort, which are fermentable by brewing yeast. Mashing higher encourages more maltotriose and unfermentable dextrins; of the two, maltotriose is fermentable by some strains of brewing yeasts. Maltotriose-negative yeast strains that cannot ferment maltotriose include LalBrew Windsor, Fermentis SafAle S33, White Labs WLP618, and Fermentis SafBrew LA-01. For this article, I have stayed away from the newer NA yeast strains. I am also happy with the results from more typically available yeasts, so I haven't yet found the need to venture down the path of specific NA yeasts. The yeasts that have worked well for me are lower-attenuating English strains, some of which are maltotriose negative, and NEIPA yeast strains such as LalBrew Verdant IPA, many of which leave a fuller mouthfeel. These yeasts produce more flavor and body than a clean ale yeast strain would, especially given the very small amount of fermentation that happens in these beers.

Another consideration is to not fret about achieving too little attenuation, and ending up with a beer that's too sweet. If your typical 5- to 6-percent ABV pale ale ended at 1.017, you might be concerned about it being too sweet or too full. Remember that alcohol has a sweet flavor, so reducing or removing alcohol can allow you to have lower attenuation and still have a beer that's not too sweet. One of the mini-IPAs I made, for example, ended at 1.017 due to a very high mash temperature, but it is definitely not sweet.

Food Safety Concerns

We've covered a lot about the overall flavor of lower and no alcohol beers. But I want to go back to the most important consideration, something we homebrewers almost take for granted: food safety practices. We all know how to clean and sanitize our equipment to ensure clean fermentations. However, when we remove the alcohol from our beers, we no longer have a safety net. Alcohol acts as a preservative, preventing all sorts of nasties from growing in your beer. Without that alcohol, we need to take our sanitizing regime to another level.

According to White Labs' "Best Practices for Brewing Low Alcohol, Non-Alcohol Beers - Part 1," managing pH throughout the process and ensuring that the finished beer is below 4.5 pH (similar to the USDA recommendation for food canning) will inhibit microorganisms. Further research by Anderson indicates that a pH as low as 3.7 may be necessary. For reference, many normal strength beers can finish around 4.0 to 4.3.

You'll note that in the mashing section of this article, I aimed for a post-boil, pre-fermentation pH of 3.9. This is because the pH drop during fermentation, just like the attenuation, will not be much in a lower alcohol beer. In a normal-strength beer, you would start fermentation in the low 5s and the yeast would take the beer down to the low 4s. Less fermentation means less pH drop, which is why I have been targeting what Anderson recommends: 3.7 pH for finished beer.

Armed with this breakdown of the many components of making reduced alcohol beers, I hope you will try your hand at them. This is certainly a learning experience, one that has been exciting for me to navigate, and push myself to figure out what matters most on the palate. The NA beer market appears to be here to stay, with increasingly more examples available from our friends in the craft beer industry. I look

Brew This!

Mini-Series "IPA"

0.7% ABV Recipe by Amanda Burkemper

Batch volume: 2.5 gal. (9.46 L)
Original gravity: 1.015 (3.75°P)
Final gravity: 1.010 (2.5°P)
Efficiency: 60%
Color: 3.4 SRM
Bitterness: 24 IBU
Alcohol: 0.7% by volume

MALTS & ADJUNCTS

8.8 oz. (250 g) Weyermann pale malt
8.8 oz. (250 g) Weyermann Munich I malt
6 oz. (170 g) Weyermann wheat malt
2.1 oz. (60 g) flaked oats
2.1 oz. (60 g) Weyermann rye malt
1.4 oz. (40 g) Crisp C15 malt
0.28 oz. (8 g) Mecca Grade Opal 44

HOPS

0.16 oz. (4.5 g) Nectaron, whirlpool 30 min
0.2 oz. (5.7 g) Amarillo, whirlpool 30 min
0.15 mL El Dorado distilled hop oil (MoreBeer) at packaging

YEAST

Lallemand Verdant IPA

WATER

50 ppm calcium, 7 ppm magnesium, 5 ppm sodium, 75 ppm sulfate, 61 ppm chloride, 50 ppm bicarbonate

BREWING NOTES

Brew in a bag. Mash at 170°F (77°C), ensuring pH is within proper ranges from the article. Boil 30 min. Whirlpool 30 min. Chill, ensure pH into the fermenter is ~3.9 pH for food safety. Pitch yeast at 72°F (22°C) and monitor fermentation, cold crashing to stop fermentation around 1.010. Add hop oil at kegging. Force carbonate to 2.5 vol. Counter-pressure fill 12-oz bottles. Pasteurize bottles at 176°F (80°C) for 15 minutes, then keep cold until serving.

SENSORY NOTES

Hazy beer with a moderate head retention—not bad for a <1% beer, since foam retention can be reduced with lower ABVs. Initial aromas of fresh hop oils up front—mango, grapefruit, light passionfruit. Behind the hop aromas is a light, freshly-cracked malted barley aroma with a light wheatiness. Aroma is light in comparison to a typical strength IPA. Flavor follows the aroma, with an initial light mango and passionfruit hop flavor that is followed quickly by a fresh wheat and fresh grain note. Moderate-low bitterness. Light bready notes with a bare hint of spicy rye in the back. Overall the malt is there, but the flavor is still thinner than typical IPAs. Body is medium-thin, not watery like a "malt soda."

forward to seeing what craft brewers and homebrewers dream up next!

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Amanda Burkemper is a lifetime member of the Kansas City Bier Meisters, the three-time AHA Club of the Year. She is a BJCP Grand Master beer, mead, and cider judge and is the BJCP Midwest assistant rep.

Brew This!

Mini-Series "IPA" 1.7% ABV

Recipe by Amanda Burkemper

Batch volume: 2.5 gal. (9.46 L)
Original gravity: 1.030 (7.5°P)
Final gravity: 1.017 (4.25°P)
Efficiency: 60%
Color: 5.3 SRM
Bitterness: 36 IBU
Alcohol: 1.7% by volume

MALTS & ADJUNCTS

16.6 oz. (470 g) Weyermann pale malt
16.6 oz. (470 g) Weyermann Munich I malt
11 oz. (310 g) Weyermann wheat malt
3.9 oz. (110 g) flaked oats
3.9 oz. (110 g) Weyermann rye malt
2.8 oz. (80 g) Crisp C15 malt
0.56 oz. (16 g) Mecca Grade Opal 44

HOPS

0.27 oz. (7.7 g) Nectaron, whirlpool 30 min
0.35 oz. (9.9 g) Amarillo, whirlpool 30 min
0.25 mL El Dorado distilled hop oil (MoreBeer) at packaging

YEAST

Lallemand Verdant IPA

WATER

50 ppm calcium, 7 ppm magnesium, 5 ppm sodium, 75 ppm sulfate, 61 ppm chloride, 50 ppm bicarbonate

BREWING NOTES

BIAB. Mash at 175°F (79°C), up from the 170°F in the previous recipe to lower attenuation further, ensuring pH is within proper ranges from the article. Boil 30 min. Whirlpool 30 min. Chill, ensure pH into the fermenter is ~3.9 pH for food safety. Pitch yeast at 72°F (22°C) and monitor fermentation; yeast stopped on its own this time at 1.017. Add hop oil at kegging. Force carbonate to 2.5 vol. Counter-pressure fill 12-oz bottles. Pasteurize bottles at 176°F (80°C) for 15 minutes, then keep cold until serving

SENSORY NOTES

Hazy gold beer, with good head retention and lacing in the glass. Initial aromas of hops and yeast esters up front, fresh mango, red apple flesh, passionfruit. Malt aromas behind that, wheaty, bready, very light spicy rye. Aroma is more expressive than the <1% IPA, yet still lower than a typical IPA. Flavor follows the aroma, with malt flavors of wheat and bread up front that quickly turn to bigger hop flavors of mango, orange, passionfruit. Mod-low bitterness. Mild spicy rye in the aftertaste, finish is off-dry.

FOOD SAFETY and BREWING NA BEER

By Katie Nasiatka and Meagen Anderson

Non-alcohol (NA) beer is a fast-growing segment in the beer scene. NA beer has become popular for having the novelty of enjoying an "alcoholic" beverage without the booze. People who live life sober are now able to enjoy an NA beverage at social outings to a pub or taproom with friends and family. While many mainstream breweries are starting to create their own non-alcohol and alcohol-free offerings, homebrewers and small independent craft beverage makers are also trying their hand crafting NA beer.

As homebrewers, we can of course refer to our homebrewed NA beverages as "beer," but whether they are made by an amateur or professional brewer, these brews are really closer to food products than the hopped, ~5%-ABV, low-pH, and therefore generally recognized as safe beverages we've come to know as beer. For label compliance, the U.S. Tax and Trade Bureau (TTB) does not allow commercial brewers producing and packaging "non-alcohol" (< 0.5% ABV) or "alcohol-free" (0.0% ABV) beverages to refer to them as "beer." According to the Brewers Association, the "terms "malt beverage," "cereal beverage," and "near beer" are acceptable class designations under 27 CFR 7.24(d). "Brew" is an acceptable descriptor, however it is not a valid class designation."[1] See the sidebar on Beer Safety from the Brewers Association Quality Subcommittee [page 40] for more on the inherent safety nets that keep beer safe to drink.

From choosing the right production method to sourcing quality ingredients, creating a satisfying NA beer can be difficult. One of the most challenging food-safety aspects of alcohol-free and non-alcohol beer is the characteristic that draws consumers to the beverage in the first place: the lack of alcohol. Alcohol has an inherent antimicrobial property that can assist in food preservation by reducing the likelihood of microflora growth. Additional characteristics of fermented NA beverages, such as acidity and carbonation, also play a key role in maintaining the food safety of the final beer. Similar to the variety of production methods available to the brewer, there are different procedures and processes the brewer can use to create a safe food product.

While state-of-the-art equipment and methodology such as pasteurization, vaccuum distillation, and RO filtration are the food safety gold standards the big brewers use to ensure their NA products won't cause illness, low-tech options also exist. While food safety may not be monitored and enforced through guidelines and policies for non-commercial producers, maintaining it for these beverages is critical when sharing with the local community, neighbors, family, and friends. All it takes is one person to get sick from an NA homebrew and the whole category will be subject to legal scrutiny as potentially dangerous.

→

ALCOHOL-FREE AND NON-ALCOHOL, CHARACTERISTICALLY DIFFERENT

Innate food safety properties of alcohol-containing beer are different or entirely absent in NA beer. The lack of alcohol is the point of NA beer, but without it, the preservation qualities of alcohol are also gone. Pure alcohol is very dehydrating to microorganism cells and can destroy important cell proteins even at half strength (50 percent dilution). A study completed by David Quain demonstrated that the spoilage potential of NA beers is overall higher compared to beers containing 4.5% alcohol.[3] [see Figure 1] This key fact implores NA brewers to pay extra attention to cleaning, sanitizing, packaging methods [see Packaging of NA Beers sidebar on page 39], and storage conditions. Additionally, treatment of NA beers may differ compared to alcoholic beers of similar styles.

Once the NA brewer understands that alcohol-free and non-alcohol beverages are different in nature compared to those with alcohol, processes can be employed to ensure their product's food safety. Suggestions on methods for how homebrewers or small independent craft brewers can achieve the best food safety are explored more in depth below. For brewers who sell their products commercially, no matter how limited, it is highly recommended to reference local and federal guidelines and policies that may impact the products' distribution.

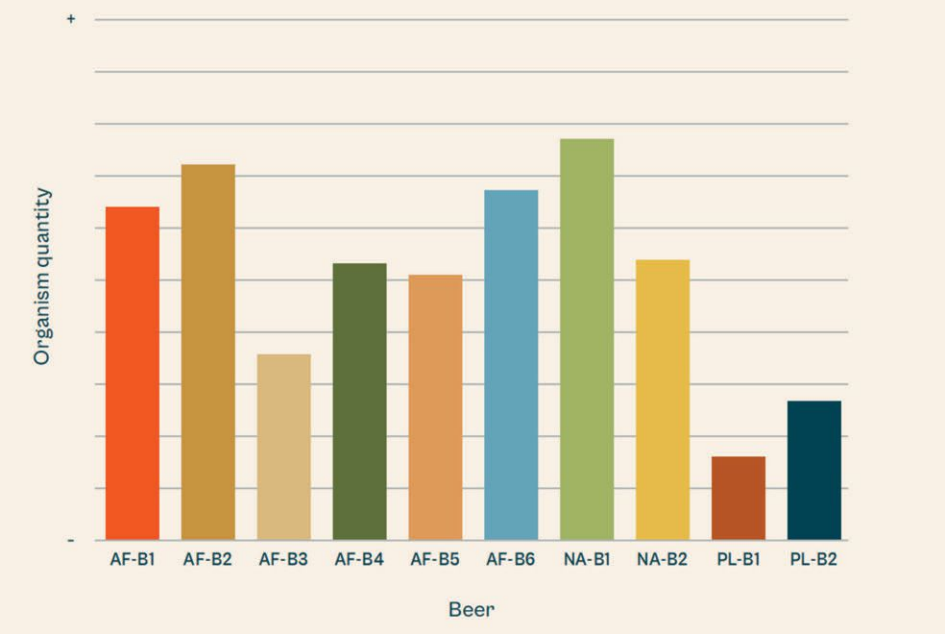
SALT AND ACID APPLICATIONS DURING THE BREW

Another important factor to consider is how the pH environment of the beer impacts the potential for microbial growth. This is a characteristic the homebrewer or independent craft brewer can lean into when producing NA beers. The brewer can modulate the pH level of beer through salt and acid additions throughout the production process.

Water quality is a vital consideration for the brewer. Brewing water adjustment with salts allows the ability to attain specific flavors or mouthfeel, but some salts also lower the mash pH.[4] A significant amount of salt would be needed to make large changes in pH, but used in combination with a food-safe acid, salts can help the brewer to acidify the brew during production.

It is important to pair pH acid adjustment methods to the production method of choice; some production processes may dictate when and how much to add. For example, less acid may be needed when using arrested fermentation—there may be less of a pH increase with a fermentation that doesn't go to completion. A variety of food-safe acids, including lactic, citric, malic, and tartaric, allow brewers to adjust pH. These acids vary in how "sour" they are perceived, so it's best to test additions on a smaller scale, with water or a commercially available NA beer in a light style such as a lager. This will give brewers an idea of how much acid is needed, and what overall sensory effect the acid may have. For example, the use of citric acid may contribute a "tangy" flavor as well as lower pH; this acid may therefore work well with a Citra®-forward IPA. When ready for application during the brewing process, add less acid at first and keep adding more in smaller amounts until the desired pH is reached. Finally, acid additions can occur at more than one point during the brewing process: during the boil, at whirlpool, or to treat sparge water, for example. Also keep in mind that even during restricted fermentation, the pH will drop slightly.

FIGURE 1: SPOILAGE POTENTIAL IN 6 AF BEERS, 2 NA BEERS AND 2 CONTROL BEERS



Spoilage potential of six alcohol-free beers (AF-B1, AF-Be, AF-B3, AF-B4, AF-B5, AF-B6) and two non-alcoholic beers (NA-B1 and NA-B2) against two control premium lagers (PL-B1 and PL-B2). Overall, the AF and the NA beers showed greater growth of microflora (yeast and bacteria) compared to the controls.

Source: Quain, D.E. The enhanced susceptibility of alcohol-free and low alcohol beers to microbiological spoilage: implications for draught dispense.

Salt	Mineral	Impact
Gypsum	Calcium sulfate	- Lowers mash pH - Stabilizes malt enzymes from thermal degradation - Enhances 'hoppiness' and 'crispness'
Calcium chloride	Calcium chloride	- Lowers mash pH - Stabilizes malt enzymes from thermal degradation - Body and palate fullness - Accentuates sweetness

SANITIZING AND PACKAGING BEST PRACTICES

While cleanliness is critical throughout the whole brewing process, especially for alcohol-free and non-alcohol beers, cleanliness and sanitizing practices become critical once the beer has chilled and is about to be packaged.

Long-standing head brewer Josh Brewer, soon opening BrewWell in Asheville, N.C., is perfecting his Alcohol-Free IPA on his Spike homebrew system. The new brewery will focus on the intersection of wellness with a dedicated space for yoga and meditation and a taproom serving alcohol-containing beer as well as NA offerings. Brewer is packaging in unique screw-top cans to share with friends, family, and lucky folks in his local community. When it comes to ensuring food safety throughout the packaging process, he suggests, "spend extra care cleaning and extend sanitizer soak times" with packaging equipment and containers. It is ideal for brewers to disassemble equipment as completely as possible,

PACKAGING OF NA BEERS

Ever wonder why you never see Clausthaler or Heineken 0.0 on tap? There's a reason the big brewers never package their NA products in kegs.

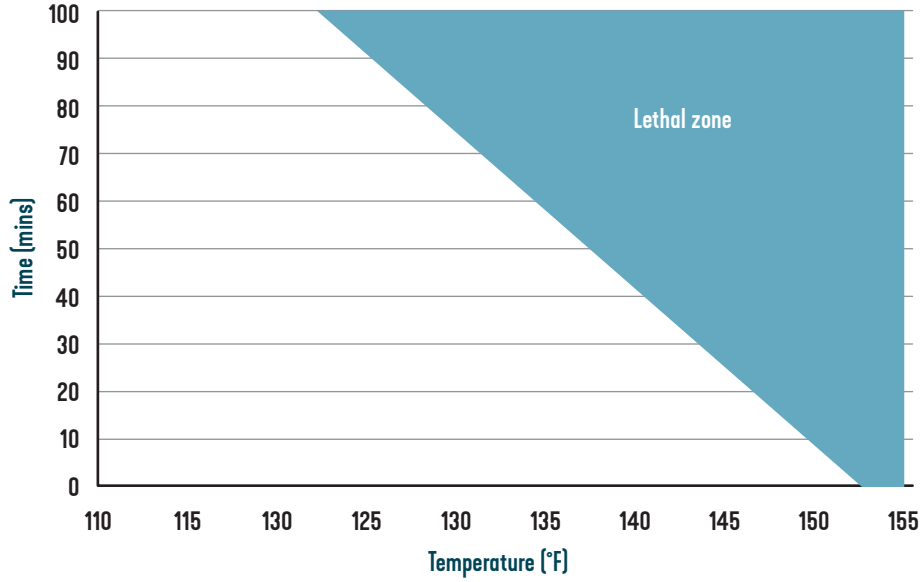
According to the Brewers Association, "While non-alcohol beer can be rendered microbiologically stable for service in bottles and cans, draught beer presents a problematic form of service. Even if a keg of beer is sterile on delivery, the act of connecting the keg to a coupler for bar service can expose the beer to contaminant organisms already present in the draught system. Until substantial further study is conducted regarding the safety of low/non-alcohol beer served on draught, packaging and service of these styles should be restricted to small-pack forms."[1]

Homebrewers looking to share their NA beers with friends and family, or to submit them for competition, should batch-force-carbonate them in a keg, then counter-pressure package in cans or bottles, all under sterile conditions. According to Chris White at White Labs, NA beer under 3% ABV should always be packaged, and those cans or bottles should be pasteurized. His recommendation for homebrewers is to heat a water bath to 176°F (80°C) and submerge the 12-oz cans or bottles in this bath, a few at a time, for 15 minutes, or until they reach the same temperature. Once cool, they should be stored refrigerated (<40°F or 4°C) until consumption.

thoroughly scrub all nooks and crannies, and even go as far as to sanitize individual bottles or cans. Be sure to catch any dead legs or crevices that may exist and fully unhook hosing or attachments to thoroughly scrub and sanitize. When soft parts such as gaskets and hoses start to look worn or old, replace them. Then finish the job by using a reliable sanitizer to soak all equipment, parts, and containers in up to the moment of packaging. Pasteurization of cans and bottles once they are filled is necessary from a safety standpoint.

Alcohol beers	Alcohol-Free (AF) and Non-Alcohol (NA) beers
• Contains alcohol - Alcohol is an inherent preservative and can prevent microorganism growth (e.g., pathogens, beer spoilage organisms, yeasts)	• Lacks alcohol - The inherent preservation quality of alcohol is absent, significantly increasing the risk of microorganism growth (e.g., pathogen, beer spoilage organisms, yeasts)
• pH is generally 4.6 or lower - Acidic conditions reduce the likelihood of microorganism growth	• Concentrations of alpha acids from hops may be lower - Lower concentrations of hop acids can increase the likelihood of microorganism growth
• The likeliness of residual fermentable sugars present is lower - The possibility of refermentation is reduced with the absence of residual sugars - Combined with the presence of alcohol, the absence of residual sugars reduces the possibility of microorganism growth	• The likeliness of residual fermentable sugars present is higher - The possibility of refermentation is increased with the presence of residual sugars › Refermentation can produce alcohol › Packaging degradation (e.g., exploding cans) is also a risk - Combined with the lack of alcohol present there is an increased risk of bacteria and pathogen growth
• Carbon dioxide (CO_2) has inherent food preservation properties - Both alcohol beers and NA beers are carbonated • The presence of CO_2, or the lack of oxygen, can inhibit microorganism growth	

FIGURE 2: IMPACT OF CONSTANT TEMPERATURE OVER TIME ON MICROORGANISM CELL KILL



Graph adapted from Beer Treatment, Hough et al., 1982.

Continued on page 40 >

FOOD SAFETY BASICS[2]

Traditional brewing processes yield a set of inherent properties that have a long history of ensuring microbiological food safety even before modern scientific methods were developed, allowing civilization to thrive when potable water was limited. This article, prepared by the Brewers Association (BA) Quality Subcommittee, will briefly describe the five main points of microbiological food safety control and how they work together to make beer food-safe: thermal processing, alpha acids, pH, ethanol, and low concentrations of oxygen. Each contributes to beer being safe for consumption, and together they form a set of "hurdles" that inhibit human pathogens, essentially stopping these microorganisms dead in their tracks.

Modern research has shown that these hurdles can't function in isolation. Much like the factors that determine the efficacy of cleaning procedures, these food safety hurdles work in concert. This article aims to discuss the different food safety properties of beer and help illustrate the necessary considerations when innovating or changing these safety controls. If you would like a deeper dive on food safety at your brewery, see the BA Food Safety Planning Guide for Brewers.

1. THERMAL PROCESSING

Thermal processing is a technique traditionally used in brewing and many other types of food processing to eliminate pathogens. When heat is applied to a product at a high enough temperature for a sufficient duration, the proteins that comprise cells are denatured, which renders proteins essential for proper cell function useless. Brewing utilizes thermal processing in the boiling of wort to disrupt any microbes carried by incoming raw materials (e.g. malt, hops, and adjuncts). Pasteurization is another common form of thermal processing used in the brewing industry and may occur before or after packaging. Both methods work by heating the liquid up to an appropriate control point. The benefit to thermal processing is that unlike the other hurdles, it can function in isolation when applied to the final product. Unfortunately, thermal processing can sometimes change the flavor of the final product, which should be taken into consideration.

INFORMATION

The benefit to thermal processing is that unlike the other hurdles, it can function in isolation when applied to the final product.

2. HOPS ISO-ALPHA ACIDS

Alpha acids are chemical compounds that reside in lupulin, the resin portion of a hop cone, which is largely responsible for bitterness in beer. While these compounds are not very soluble at room temperature, they become much more soluble in the boil step of brewing, where they become isomerized into iso-alpha acids. In addition to bittering, these iso-alpha acids have been shown to have useful antimicrobial properties. They are considered to be fairly weak acids that act as ionophores to disrupt microbial cell functions. This results in a significant decrease to cellular metabolism and nutrient uptake, which can lead to cell death. However, it is important to consider situations that influence the effectiveness of these antimicrobial properties. First, iso-alpha acids tend to only have an impact on gram-positive bacteria. Several gram-negative foodborne pathogens, including Salmonella and E. coli, can exhibit hop resistance. Second, the antimicrobial effects of iso-alpha acids are greater in an acidic environment such as the pH of a typical beer; beers with an elevated pH can begin to lose this benefit.

WARNING

Several gram-negative foodborne pathogens, including *Salmonella* and *E. coli*, can exhibit hop resistance.

3. ACIDIFICATION

Adding acids to foods, either directly or as a result of fermentation, is a centuries-old technique for preserving food. Acidic environments, i.e. low pH, inhibit the growth of microorganisms by disrupting essential hydrogen bonds in proteins, DNA, and RNA, and also by interfering with the cell's ability to produce ATP through cellular respiration. Very few foods have pH values low enough to completely inhibit the growth of microorganisms, especially yeasts and molds, which can tolerate lower pH conditions than most bacteria. When it comes to food safety and the inhibition of pathogens, most processes require a pH below 4.6 under the assumption that other hurdles are present. For beer specifically, as long as other hurdles such as heat, alcohol, and hops remain in play, a pH control limit of 4.6 is generally acceptable. If those hurdles are removed, some pathogens can survive in environments with pH as low as 3.7.

WARNING

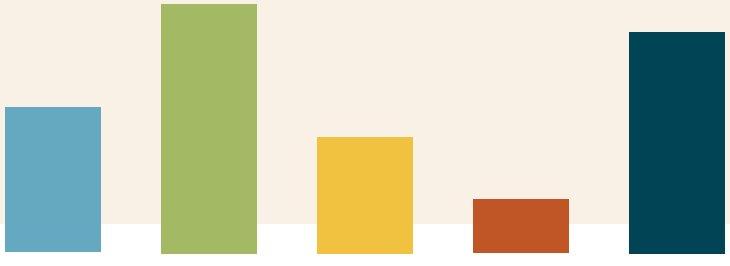
If other hurdles are removed, some pathogens can survive in environments with pH as low as 3.7.

4. ETHANOL

Ethanol is a potent barrier to bacterial growth. Ethanol achieves this through the disruptive effect on cell membranes and walls, thereby affecting cellular regulatory and reproductive functions. That said, studies have shown that gram-negative pathogens can survive in a 5% ABV beer for several days and for several weeks in alcohol-reduced beers (2.3-2.9% ABV), particularly at lower temperatures. With this time-delay, it's possible pathogens could survive through to beer dispense. Alcohol-free beer is an entirely different story where it has been shown that gram-negative pathogens are capable of vigorous growth, especially at a slightly elevated pH. Gram-positive bacteria are largely inactivated by iso-alpha acids even in alcohol-free beer.

WARNING

Gram-negative pathogens can survive in a 5% ABV beer for several days and for several weeks in alcohol-reduced beers.



5. LOW OXYGEN CONCENTRATION

The low levels of oxygen in beer have long been referenced as one of the pillars of beer as a food-safe beverage. This makes intuitive sense: since humans are aerobic, human pathogens naturally would also be aerobic. Unfortunately, this isn't entirely true. Of the top five foodborne pathogens listed by the Centers for Disease Control and Prevention (CDC), none are strictly aerobic. Several commonly known foodborne pathogens are either facultative anaerobes or anaerobic, including Listeria and E. coli. These pathogens may be more vulnerable and slower-growing in an environment with parts-per-billion oxygen concentrations compared to parts-per-million levels, but their inhibition is still largely caused by other factors.

INFORMATION

As brewers innovate with new production techniques and create new categories and flavor profiles, some of these inherent safety controls may be reduced, changed, or even removed.

In summary, beer is a remarkable beverage whose historical development naturally combined numerous unseen forces and created a pathogen-free environment. However, as brewers innovate with new production techniques and create new categories and flavor profiles, some of these inherent safety controls may be reduced, changed, or even removed. It is possible that by reducing or eliminating even one of these barriers, these intrinsic protections can be lessened or eliminated. The remaining controls must then make up for the altered safety control, otherwise the possibility of contamination that renders the product impure or harmful exists. Brewers have a responsibility to their customers, partners, and community to protect consumer health by ensuring that they follow food-safe practices.

Brewer's homebrew setup may be top-notch technology, but he still retro-fits equipment when he needs to. He innovated a bottle counter-pressure filler for his screw-top cans, with a stopper that perfectly fits the can tops. This allows him to purge and fill, reducing the amount of oxygen ingress and therefore the possibility of microorganism growth. Homebrewers and small independent craft brewers should continue to pioneer as they try their hand at alcohol-free and non-alcohol, retro-fitting where necessary. If the equipment doesn't exist, try constructing it. As long as the brewer exercises a strong understanding of cleanliness and sanitizing best practices, the nitty gritty of how to get NA beer into packaging with minimal contamination risk remains an area to be explored.

Even on a small scale, pasteurization is possible. For the homebrewer, this may involve the tried-and-trusted canning process well known for food preservation. Bottles or mason jars can undergo a lengthy boil to kill off all spoiling microorganisms. If available, a sous vide that consistently circulates heated water may increase temperature control for the brewer. An added benefit to this process is that with pasteurizing the beer, the vessel itself is also thermally sanitized, adding another layer of defense. Some trial and error may be necessary to dial in the optimal temperature, length of time, and packaging type. Figure 2 is the time versus constant temperature graph to help brewers to estimate contact time to successfully pasteurize their product. For those who want to brew NA beers like the pros, finding the necessary exposure time vs. temperature can be dialed in even more accurately by calculating pasteurization units, or PUs [see the Pasteurization Basics sidebar at right].

Finally, chemical pasteurization is also used to ensure the food safety of packaged NA beer. When adding a food preservative, NA beer keeps itself preserved, provided the correct amount of the chemical is used, and it is not compromised by exposure to extreme temperatures. Some examples of available food preservatives approved by the Food and Drug Administration (FDA) include sorbates, benzoates, and naturally occurring citric acid. Commercial brewers using chemical pasteurization to preserve their NA beers need to list them on the label.

PASTEURIZATION BASICS[5]

Pasteurization is a heat treatment applied to beer to increase biological shelf life. After sufficient time at high temperatures, microorganisms in beer are killed and enzymes are deactivated, preventing them from growing and making chemical changes that affect shelf stability and flavor.

A pasteurization unit (PU) is how pasteurization is measured, where one PU is a unit of heat equivalent to one minute at 60°C (140°F). The equation used to calculate PUs used during a pasteurization process describes the relationship between product exposure time (t) in minutes, temperature (T) in degrees Celsius, and the temperature sensitivity of microbes in alcohol-containing beer (Z). For traditional beers this is expressed by the simplified equation:

$$PU = t \times 1.393^{(T-60)}$$

Where 1.393 is a calculated value derived from constants specific to alcohol-containing beer (T_{ref} = 60°C, Z = 6.94) and will change depending on product type.

The number of PUs needed for each type of product will depend on the type of process used, the unwanted microorganisms needing to be eliminated, as well as the type of product—for example, traditional beer, non-alcohol beer, seltzers, and ciders. The metrics brewers can use to control PUs are time and temperature. Through this time and temperature relationship, a product that is heated for a longer time requires less heat to achieve the same PUs. Alternatively, a beer heated at a higher temperature will need to be held for a shorter time to achieve the same PUs.

STORAGE AND SERVING

The final line of defense to ensure food safety for alcohol-free and non-alcohol beers is proper storage conditions and servicing. Regardless of the packaging type, all NA beverages should be treated similarly to achieve microbial sterility and maintain freshness. Brewer suggests alcohol-free beers be consumed immediately. "I work hard to get all that good hop flavor into my alcohol-free IPA, and I tell my friends and local community to please enjoy it as soon as possible," he comments, adding that until an NA beverage is consumed, it should always be refrigerated to minimize food safety risk and keep the flavors fresh.

NA IPA brew crew Julia Herz, Josh Brewer, and Meagen Anderson.

Storage temperature of NA beer is one of the pivotal points in ensuring food safety. Temperature is a critical physical component to microorganism growth. By storing alcohol-free and non-alcohol beer (0.5 percent ABV or less) in cold, refrigerated conditions, the likelihood of pathogen growth is reduced. A recent study investigating pH and storage temperatures related to low- and non-alcohol beers iterates that while pH is still an important consideration, storage conditions are critical to maintain to ensure food safety.[6]

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ADDITIONAL RESOURCES

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- Hough, J.S., Briggs, D.E., Stevens, R., Young, T.W. (1982). *Malting and Brewing Science*. Springer, Boston, MA. https://doi.org/10.1007/978-1-4615-1799-3_9.
- Foodborne Germs and Illnesses
- FDA Bad Bug Book
- Growth and Survival of Foodborne Pathogens in Beer
- Thermal Processing of Food 101
- BA Food Safety Planning Guide for Brewers

Meagen Anderson has lived a zero-proof lifestyle since 2020 and has a deep passion for elevating the category of alcohol free and non-alcohol adult beverages. She is also a Certified Cicerone®, Certified BJCP judge, and has completed over 140 hours of in-person beer sensory training with Dr. Bill Simpson.

Katie Nasiatka has 10 years of technical experience in the beverage and hop industries with academic research efforts focused on hops chemistry. She holds a BS in Biochemistry from CU Boulder, an MS in Horticulture from Colorado State University, and has worked for Odell Brewing Company's Quality Team for nearly a decade.

Photo courtesy of AficioNAdo Certification Program

THE ART AND SCIENCE OF LOW-CARB BEERS

By Samuel Loader

> If your favorite beer style is not a mass-produced lager, but you would still like fewer carbs in your beer, there are ingredient and procedural changes to reduce carbs in virtually any beer recipe.

Low-carb Choco Stout with brewing ingredients.

As much as I love English ales, I'm not here to discuss low-carbonation beers. Rather, I'll be exploring low-carbohydrate beers and how to make them. I'm also not going to discuss the difference between standard and low-carb beers from a health perspective. If you enjoy beer, and for whatever reason want to lower your carbohydrate intake while enjoying one, that is awesome and all that matters. I will touch on low-calorie beers though, as they share much in common with low-carb beers.

First, let's get the science out of the way.

UNDERSTANDING LOW-CARB BEER

Carbohydrates are any large group of organic compounds, including sugars, starches, and cellulose, that have hydrogen and oxygen in the same ratio as water (2:1). E.g., glucose ($C_6H_{12}O_6$) has 12 hydrogens and 6 oxygens—a 2:1 hydrogen to oxygen ratio. These compounds are used as structural materials and for energy storage within the living tissues of plants and animals.

Where do carbohydrates in beer come from? In the brewing process, carbohydrates start in the grain as starches. These then break down during the mash into simpler carbohydrates (sugars) that the yeast can metabolize into ethanol, carbon dioxide, and flavor compounds. Essentially, through the mash process, we are breaking down large, complex carbohydrates into smaller ones that our yeasts can use. However, for most beer styles, we do not fully break down the starches into the simplest sugars during the mash.

While a large proportion is broken down, yeast do not metabolize all the sugars into ethanol, carbon dioxide, and flavor compounds. We know this because water has a density of 1.000. Carbohydrates (sugars) increase the density of water to greater than 1.000, but ethanol has a density of 0.79. Therefore, if all the sugars were consumed during fermentation, we would see a finishing gravity of less than 1.000, a proportional average between 1.000 and 0.79. But most beer styles have a finishing gravity of between 1.005 and 1.015, so the difference between ~0.995 and the finishing gravity of the beer is the amount of carbohydrates remaining in the beer.

The unofficial definition of low-carb beer is less than 2g of carbohydrates per 100 ml. This would be an FG of approximately 2 brix or 7.8 gravity points above the terminal gravity of ~0.995. Low-carb beer is primarily the realm of macro breweries making macro lagers. The style is well suited for the low-carb process, and these breweries have the labs and resources to back up their nutritional claims. However, craft brewers have also started making low-carb styles, applying macro knowledge to the flavorful craft beers we love.

Separate from low-carb beer, there is also low-calorie or "lite" beer. This can be considered in many ways synonymous with low-carb beer, but there are clear distinctions. A calorie is a unit of energy, whereas carbohydrates, as stated, are organic compounds—ingredients intrinsic to beer and other foods. Pure ethanol has calories, as your body metabolizes ethanol into energy, but it has no carbs. The calorific value of beer is primarily due to alcohol, but this is relatively fixed by the percentage ABV of the beer. These calories are not included on a typical beer label, at least not yet. (There are rumblings about the FDA and other international organizations making food nutritional information mandatory on beer labels in the near future.) Thus, lowering the calories in beer (as would be recorded on said food nutritional labels) can be achieved by either decreasing the carbohydrate concentration, or decreasing the alcohol percentage. In practice, if fewer fermentables were used to

> Malts and other grains are the other primary tools for making low-carb beers. With low-carb beers, we look to replace dextrins with a combination of alcohol sweetness and a higher protein content.

achieve a typical alcohol concentration in the beer, this would result in a beer with a lower calorific value as there are fewer carbohydrates left over. Lower alcohol content may result in a lower-calorie beer, but it is usually not a low-carb beer.

With the rise of low-carb beers, we see many marketing phrases such as "90 percent less carbs" from both macro and craft. But what does this mean? Take, for example, a standard beer with a finishing gravity of 1.008. Through manipulation of the brewing and fermenting process, the new low-carb beer has a finishing gravity of 1.0013. This is a comparative drop of 90 percent of the finishing gravity we would attribute to carbohydrates, as seen by the equation 1.0013 = ((1.008-0.995)*(1-0.9))+0.995. The degree of reduction that is possible depends on the calorie content of the standard brew. Generally, most low-calorie beers are 20 to 30 percent lower in calories than the standard product. Then, they need to validate this through nutritional testing. However, there is an alternative—many breweries worldwide use the internationally recognized Scandinavian Beer Calculator (beercalc.com/?action=calculator) to determine the amount of carbs in their final beer. This calculator was developed for commercial brewing and quantities. Therefore, many cells require calculations beyond the standard we typically use in homebrewing. However, it is possible to do the math to see your theoretical carbohydrates per 100 ml.

Low Carb Pale Ale

Recipe by Samuel Loader

Batch volume: 6.6 gallons (25 L)
Original gravity: 1.052 (12.8°P)
Final gravity: 1.008 (2°P)
Efficiency: 80%
Color: 3 SRM (5.9 EBC)
Bitterness: 21.7 IBU
Alcohol: 5.7% by volume

MALTS & ADJUNCTS

8.82 lb. (4 kg) Weyermann Extra Pale Premium Pilsner malt
3.53 lb. (1.6 kg) flaked brown rice
7 oz. (0.2 kg) Weyermann CaraPils
7 oz. (0.2 kg) Vienna malt

HOPS

0.88 oz. (25 g) Taiheke (NZ Cascade), 7% a.a. @ 30 min
2.65 oz. (75 g) Taiheke (NZ Cascade), 7% a.a., 20 min. hop stand @ 176°F (80°C)
0.88 oz. (25 g) Mosaic, 12.3% a.a., dry hop 2 days
0.88 oz. (25 g) El Dorado, 16% a.a., dry hop 2 days
0.88 oz. (25 g) Mosaic, 12% a.a., dry hop 2 days

YEAST

2 packets Hophead Ale yeast

OTHER INGREDIENTS

Amylase enzyme (in mash)
Glucoamylase enzyme (in primary, 8 days)

BREWING NOTES

Mash in at 154°F (68°C) and hold 60 minutes. Mash out at 167°F (75°C) for 1 minute. Boil 90 minutes. Ferment at 65°F (18.5°C) for 6 days, 71.6°F (22°C) for 2 days, then lower to 39°F (4°C) and hold for 2 days.

Low Carb Deletable Lager

American Light Lager

Recipe by Samuel Loader

Batch volume: 6.6 gallons (25 L)
Original gravity: 1.036 (9°P)
Final gravity: 1.005 (1.3°P)
Efficiency: 80%
Color: 2.2 SRM (4.4 EBC)
Bitterness: 9.9 IBU
Alcohol: 4.08% by volume

MALTS & ADJUNCTS

6.6 lb. (3 kg) Weyermann Extra Pale Premium Pilsner malt
2.2 lb. (1 kg) flaked rice
3.5 oz. (99 g) Gladfield Sour Grapes malt
3.5 oz. (99 g) Gladfield Vienna malt

HOPS

0.35 oz. (10 g) Chinook 13% a.a. @ 20 min

YEAST

2 packets Mangrove Jack's Californian Lager M54

OTHER INGREDIENTS

Amylase enzyme (in mash)
Glucoamylase enzyme (in primary, 30 days)
Deltafloc (boil, 15 min)
Chitosan Mangrove Jack's (in primary, 15 days)
Kieselsol (in primary, 16 days)

BREWING NOTES

Mash in at 156°F (69°C) and hold 60 minutes. Mash out at 167°F (75°C) for 5 minutes. Boil 90 minutes. Ferment at 65°F (18.5°C) for 5 days, 68°F (20°C) for 3 days, 73°F (23°C) for 1 day, 68°F (20°C) for 2 days, and 64°F (18°C) for 1 day. Lower to 50°F (10°C) for 1 day, 45°F (7°C) for 1 day, and then lager at 39°F (4°C) for 15 days.

If your favorite beer style is not a mass-produced lager, but you would still like fewer carbs in your beer, there are ingredient and procedural changes to reduce carbs in virtually any beer recipe. Many excellent low-carb versions of popular styles have come onto the market over the past five years. However, it is much easier to succeed in making a great low-carb beer when the base style supports a very dry finish, as with pale ales, modern West Coast IPAs, saisons, dry Irish stouts, and many light-colored lager and hybrid styles.

BREWING LOW-CARB BEER

Any time you manipulate an existing beer style, the first goal is to make a great-tasting beer. Otherwise, it doesn't matter if it is low-carb, low-calorie, low alcohol, no alcohol, gluten-free, etc. If it's not an excellent beer, why brew it? Therefore, we will seek to achieve the same goals for flavor and balance as outlined in Jennifer Talley's *Session Beers: Brewing for Flavor and Balance*. I highly recommend reading this book, even if you are not interested in session beers! While we are not seeking to make the beer low alcohol, low-carb beers face some of the same challenges session beers do. They can often taste thin and unbalanced because minimal malt flavor is left in the beer to support or counterbalance the hops and alcohol. Hoppy beers can taste like bitter hop tea, lagers can taste like licking a bath bomb or just bland, and the darker styles can feel like you are drinking coffee grounds. We should hopefully avoid all of these scenarios (but if you're into that, go for it).

First, we will look at enzymes to help break down excess carbohydrates. The alpha-amylase contained in the base malt acts to cleave the α- D (1-4) glycosidic bonds. This often leaves branched structures, called dextrins, that aren't broken down quickly. However, if more alpha-amylase and other specific enzymes are added, we can break down the dextrins into fermentable sugars in an acceptable timeframe. By using enzymes on a standard beer, the calorific value of the extra alcohol produced by the enzymes and fermentation of the additional sugars is less than that of the carbohydrates themselves; therefore, the beer would be higher in alcohol but lower in calories (but not by much).

For homebrewers, the most easily sourced enzymes are alpha-amylase and glucoamylase. Others are available for commercial use but are not easily found for homebrewing. Alpha-amylase has limited action on the starches because it is the same enzyme as is contained in the grains. But we can add extra alpha-amylase not already included within the base malt to speed up the mashing process and convert more starch in the grain bed to smaller molecules. This makes them easier to work on by the other enzymes. Glucoamylase can also be used in the mash. However, many brands of this enzyme have a lower peak activity temperature than our typical mash temperatures. As a result, this enzyme's activity tends to be slower than alpha-amylase at 64–71°C (148–160°F). Glucoamylase also tends to work more efficiently if alpha-amylase has already completed its work. Therefore, to get the fastest reaction out of glucoamylase, it is best to mash at traditional mash temperatures first, so that alpha-amylase can break the starches down into smaller molecules, then drop the mash temperature to the range where glucoamylase is at its peak activity. But this is a lot more effort than the alternative process, which is adding glucoamylase to the fermenter, where it can slowly work to break down any larger carbohydrates as the yeast ferments. (Of course, without halting glucoamylase activity after reaching the desired terminal gravity, one can run into other issues, such as over-carbonation post-packaging.)

Malts and other grains are the other primary tools for making low-carb beers. With low-alcohol or no-alcohol beers, the alcohol sweetness is often replaced with

Brew This!

Low Carb Choco Stout

Irish Extra Stout Recipe by Samuel Loader

Batch volume: 6.6 gallons (25 L)
Original gravity: 1.053 (13.1°P)
Final gravity: 1.005 (1.3°P)
Efficiency: 85%
Color: 33.1 SRM (65.2 EBC)
Bitterness: 22.2 IBU
Alcohol: 6.26% by volume

MALTS & ADJUNCTS

6.6 lb.	(3 kg) Simpsons Maris Otter malt
3.97 lb.	(1.8 kg) Simpsons Golden Naked Oats
21 oz.	(595 g) Gladfield Biscuit malt
17.6 oz.	(499 g) Gladfield Vienna malt
7 oz.	(198 g) Muntons Black Patent malt
7 oz.	(198 g) Gladfield Light Chocolate malt

HOPS

1 oz. (28 g) Pacific Jade, 13% a.a. @ 20 min

YEAST

2 packets Liberty Bell M36

OTHER INGREDIENTS

Amylase enzyme	(in mash)
Deltafloc	(boil, 15 min)
Glucoamylase enzyme	(in primary, 14 days)
2	vanilla beans (in primary, 14 days)
150 g.	cocoa nibs (in primary, 14 days)

BREWING NOTES

Mash in at 145°F (63°C) and hold 60 minutes. Mash out at 167°F (75°C) for 5 minutes. Boil 90 minutes. Ferment at 66°F (19°C) for 14 days.

dextrins. With low-carb beers, we look to replace dextrins with a combination of alcohol sweetness and a higher protein content. These proteins add body to the beer, which helps to make up for what is lost by the lack of residual sugars. As for high-protein grains, almost all our typical adjunct grains, such as wheat, oats, rice, spelt, etc., have a higher protein content than barley, and unmalted versions of these grains have even higher levels, as up to 50 percent of the proteins are typically broken down during the malting process. Flaked and other non-malted barley varieties usually have the highest protein content, followed by the malted varieties Munich and Vienna, and then 6-row malts. Therefore, we can replace low-protein malts with these grains where appropriate. We are not trying to achieve maximum protein, because this would too often create more body than what is suitable for the style.

For base malts, we can use more flavorful varieties such as Maris Otter, which, when fully fermented out, will still have some residual bready/biscuity flavors, but this is only appropriate for some beer styles. We can also use a small amount of caramelized malts; these contain a significant proportion of dextrins to be broken down, but there will remain some flavor compounds of caramel, toffee, and dried fruit that will give our brains the impression of sweetness even though it won't be there. But again, restraint is vital. We are trying to match what suits the style using different ingredients and techniques.

We also have adjuncts. We have talked about adjunct grains, but there are other products we can add. You can try to add artificial sweetener, but I don't recommend this, as the flavor is not what we expect in beer styles outside of, perhaps, milkshake beers and pastry stouts. If you do want to experiment with this, I recommend making a solution with the sweetener and dosing a sample of your beer first. You will have much more control this way, and will get a sense of how the artificial sweetener affects overall perception of the beer. In dark beer styles, we can instead use adjuncts such as fruit flavors, vanilla beans, and cacao to naturally add the perception of sweetness without adding much in the way of carbs. The carbohydrates these adjuncts do contain will need to be broken down enzymatically, so they will need to be added at the start of fermentation. Note that this will add up to approximately 0.2 percent ABV to your beer, depending on the amount used.

Our last tool is to use a "beer gas" blend of nitrogen and carbon dioxide rather than CO_2 alone for carbonation, with its accompanying carbonic acid bite. Nitrogen creates a velvety texture on the tongue, giving the impression of body, while also softening bitterness and thus increasing the perception of sweetness in the beer. Using beer gas works well on dark beers and some sours, but the trade-off is that it can mute some of the other flavors, leading to beer styles with a subtle blandness. Hand pull systems help to add body and mouthfeel to the beers, especially in low-alcohol beer styles, but this also applies to low-carb. (Oh look, I did discuss low-carbonation beers after all.)

Let's look at style. Beer styles help to guide us in the framework and flavor profile for crafting a low-carb beer. Let's choose American pale ale or modern pale ale as a first example.

Per the BJCP, a pale ale's overall profile is "an average-strength, hop-forward, pale American craft beer with sufficient supporting malt to make the beer balanced and drinkable. The clean hop presence can reflect classic, modern American, or New World hop varieties with various characteristics."

Therefore, remembering that most of our "malt backbone" is from dextrins (carbohydrates) left over from fermentation, we need to use the tools discussed earlier for selecting our fermentables or substituting them for an existing recipe.

With low-alcohol or NA beers, we select malts and mash temperatures to facilitate a high proportion of dextrins to supplement the body and sweetness removed from having less alcohol. But as dextrins are carbohydrates, we cannot use these techniques. Instead, we are looking to remove as many dextrins as possible. We usually aim for a mash temp of 145°F (63°C). However, if you use unmalted grains, ensure your mash temperature is suitable compared to the grain's gelatinization temperature. For example, I use flaked rice in my low-carb pale ales and lagers; thus, I mash at 154°F (68°C).

As a result of the low mash temperatures and the enzymes used both in the mash and the ferment, your mash efficiency and attenuation will be significantly higher than normal. As a result, your ABV will also be considerably higher, while your final gravity will be lower. Alcohol is essential in low-carb beers as it surprisingly adds some sweetness, but too much will make it feel hot. Using my brewing software, I increase the mash efficiency by 5 percent and ensure the attenuation for the yeast is set to the maximum of that yeast's attenuation range. Then, I'll adjust the recipe to aim for approximately the middle of the style ABV range. This way, if you undershoot mash efficiency and attenuation, you will still be in range; if you overshoot, you should still be in range.

With the low finishing gravity, moderation with bittering and dry hopping is essential, as there is little sweetness to balance the hop bitterness. Therefore, I target the bottom of the BJCP IBU range for the style. For the boil, I tend to use hop extract or a suitable high alpha hop and one that is also low co-humulone, because I am a little bit old school that way. For hop selection in the whirlpool, I am trying to maximize fruity flavors and aromas, as these give an impression of sweetness without the associated sugar. I select whirlpool hops with high potential for biotransformation to fruity flavors (for more info, Mike Brennan has done several excellent talks on this on several platforms). When dry hopping, we are again looking for fruit-forward hops, and we want to dry hop in a way that minimizes any vegetable and hop burn flavors. I dry hop my pale ales at ~4g per liter for short contact at low temperatures (bsgcraftbrewing.com/reevaluating-dry-hop-techniques).

For yeast selection, you want what's suitable to the style, though a high attenuating yeast will ensure you reach the lowest FG possible. If you are using a low attenuating yeast, it is best to develop the recipe around a lower OG so that the FG is lower. We are aiming for low-carb, not no-carb, so an FG of 1.000 to 1.005 will achieve low-carb for most styles. In the case of a pale ale focusing on biotransformation, I have been using M66 Hop Head ale yeast, as it is a high attenuating ale strain containing the enzymes pectinase and glucosidase for biotransformation and reduction of VDK.

For the water profile, because we have few residual sugars, we want to increase the perception of malty flavors to help maintain the flavor balance, and keep things from feeling thin and watery. Therefore, we select a more malt-forward water profile with a higher calcium chloride ratio than the typical bitterness-forward water you'd use with most pale ale recipes. If you are modifying an existing pale ale recipe, this may mean that you need to adjust the bitterness for balance.

Included are my low-carb pale ale, Irish extra stout, and light lager recipes. With these recipes, I have adjusted the yeast attenuation and mash efficiency to what I typically get for these beers.

Lastly, I have listed some of my favorite craft low-carb beers. This is obviously not an exhaustive list of all the low-carb beers available in these countries…they are just beers I have tried, enjoyed, and would drink again.

New Zealand

- Epic Brewing Blue:
  Low-carb pale ale 4.8%
  with Centennial and Mosaic hops
- Behemoth Brewing Smashable:
  Low-carb pale ale 4.2% with US
  and NZ hops.

Australia

- Burleigh Brewing Co. Bighead:
  Low-carb lager 4.2%

United States

- Yuengling Flight:
  Low-carb light lager 4.2%
- Deschutes Da Scootz! Pilsner:
  Low-carb Pilsner 4% - I don't believe
  this is still available, but it was
  delightful.
- Surly Brewing Rosé:
  Rosé-inspired lager 5.2%

Samuel Loader has been avidly homebrewing for over 10 years. He discovered homebrewing during his chemistry undergrad. For the last six years, he has worked for Grainfather, currently as the technical brewing & distilling manager. He is a Certified BJCP judge and Cicerone, and holds certifications in brewing and distilling from Siebel and IBD. His taste in alcohol is eclectic, given the day and the circumstances, but his daily drink of choice is usually a dry pale ale during the warmer months and a dark mild in the cooler months.

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FINDING Your Place IN THE SHADE

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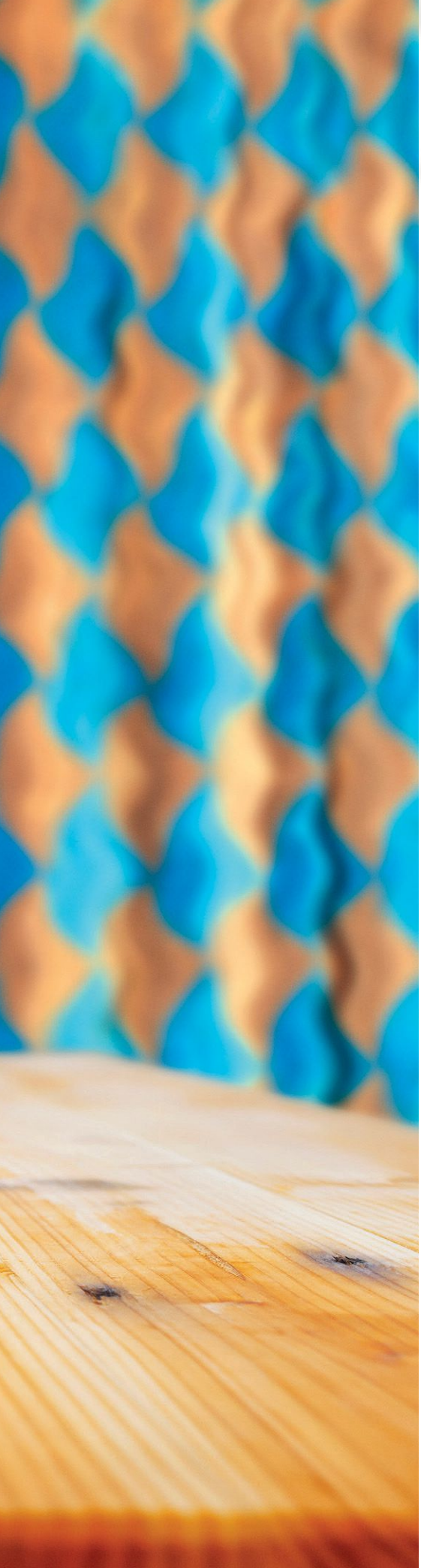


Bavarian Beer Garden Culture

By Franz Hofer

A Way of Life

Call it a beer garden, a biergarten, or a bierkeller. Call them what you want, these green oases are so important to Bavarian identity that the Beer Garden Ordinance of 1999 gives statutory expression to the fact: "As a result of their long history and deep-rooted tradition, beer gardens have become a part of the Bavarian cultural heritage." In short, they are "an expression of the Bavarian way of life."

With all traditions and ways of life come certain customs, unwritten rules of etiquette that make a day or evening in the beer garden that much more enjoyable for everyone. Though beer garden etiquette is not a hard-and-fast set of rules, observing a few of these customs will have you drinking like a beer garden pro in no time.

On warm days it's as if the whole of Bavaria has come together under the chestnut, oak, and linden trees of the nearest beer garden. Do as they do. If you arrive and find all the seats seemingly taken, just find a friendly-looking group and ask if you can join in.

There's a reason why you won't find a table for two in the beer garden. Shared tables create and reinforce a sense of fellowship among strangers. Don't be surprised if strangers ask if they can sit at your table. If you're reserving some spots for friends who are on their way, it's fine to say so. In all other cases, making room for others is the order of the day. Not doing so is borderline sacrilegious.

→

Beer Garden Victuals

Speaking of tables in beer gardens, indulging in a refreshing beer and a meal is a beloved pastime that dates back to King Maximilian's 1812 pronouncement settling a dispute between Munich's brewers and innkeepers. Hungry patrons were henceforth free to bring along their own food to eat with their beer. Nowadays, not every beer garden lets you bring your own food for a picnic, though many do. And the tradition is something that sets Bavarian beer gardens apart from those in other German regions and Central European countries.

You can partake of this venerable beer garden picnic tradition by packing your own Brotzeitkorb (picnic basket) with some Bavarian classics: a selection of sausages, cheese, Wurstsalat (sausage salad), potato salad, tomatoes, radishes, cucumbers, and bread or pretzels.

Even if you don't show up sporting a picnic basket stocked with provisions, you won't go hungry. Just about every beer garden has a food kiosk, and many are attached to Wirtshäuser (inns). You have two choices of seating. Tables set with tablecloths and cutlery are for ordering à la carte from a server. Bare tables are for those who bring a picnic basket or want to put together their own meal at the food stands ringing the beer garden.

The following is my shortlist of beer garden staples that I can't do without.

- **Brezn:** A soft and doughy pretzel.
- **Obatzda:** A spread that consists of soft cheese, butter, onions, paprika, and caraway seeds—perfect for that Brezn you just ordered.
- **Radi:** Billowing mounds of thinly shaved white radish sprinkled with salt.
- **Weißwurst:** Veal bratwurst served in a broth, accompanied by a soft pretzel and sweet mustard.
- **Leberkäs:** A kind of meat loaf served with sweet or hot mustard and a slice of bread.

The Maß of Munich and the Tonkrug of Franconia

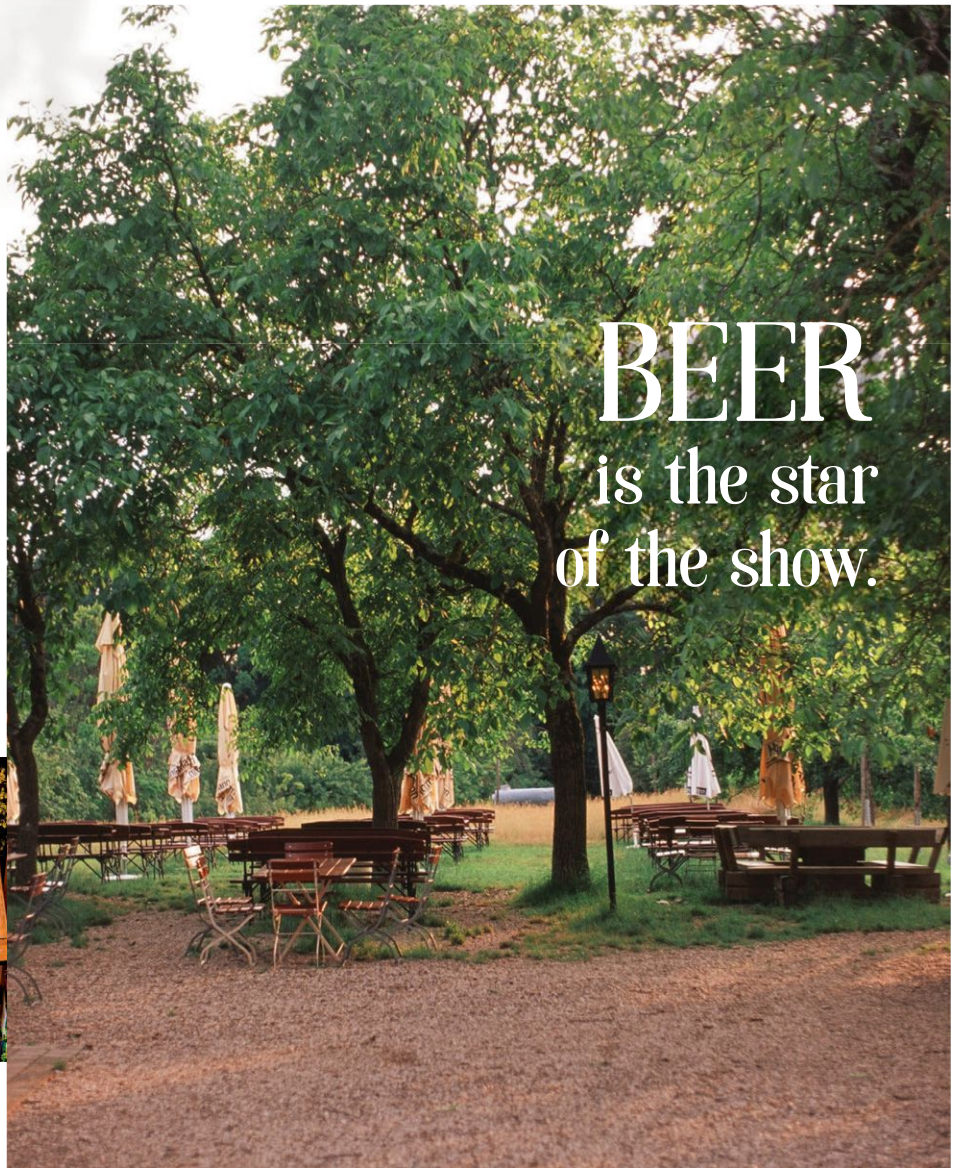
Picnic baskets are all fine and good, but beer's the star of the show. Keep in mind that if you just want a small glass of beer after a certain time of the day in Munich's beer gardens, you're usually out of luck. Signs in larger beer gardens announce variations of the following: "No half-liter orders after 4 p.m." Unless you opt for a Weissbier, which is served in a 500 mL glass, there's one size, and one size only: the majestic Maß (pronounced mahss), a hefty one-liter mug of frothy beer, usually a Helles. In Franconia, where you're more likely than in the rest of Bavaria to find Kellerbier, that Ur-Bier of all beer garden beers, it's all about the rustic Tonkrug (earthenware mug).

Finding Your Place in the Shade

And now for a few places to put your newfound knowledge to work.

It's been said that residents of Munich know only three beer gardens: the one around the corner from where they live, the one down the street from their best friend, and the one near where they work or study. The same could easily be said of Franconia as well. Where to begin?

These three beer gardens that were once beer cellars represent the tiniest tip of a huge iceberg—just enough to inspire you to go out exploring.



Photos © Getty/FooTToo (sign); Unsplash/markus-spiske (garden)

Waldwirtschaft (Munich)

Known locally as the "WaWi," the Waldwirtschaft in southern Munich is nestled in the woods beyond a residential neighborhood lined with villas. Perched atop a beer cellar cut into an embankment along the Isar River, the WaWi's expansive beer garden draws guests in with sweeping vistas across the valley below.

As with any top-notch beer garden worth its hops, local lore has woven a certain mystique around the WaWi, which found itself at the center of the "Beer Garden Revolution" of 1995.

The antecedents of the Beer Garden Revolution date to April 1993, when residents filed a noise complaint about live music and loud beer garden denizens. In response, the Munich Administrative Court obligated the WaWi to close at 9:30 p.m. and prohibited it from opening on the first and third Sundays of each month. Appeals came in from all ends.

Then, in April 1995, the Bavarian Higher Administrative Court ruled that all beer gardens (not only the WaWi) had to close by 9:30 p.m. This galvanized people across Munich's social strata. Opponents of longer opening times were derided in the press as killjoys who'd just as soon try to stop cowbells from clanging and church bells from chiming.

On May 12, 1995, thousands of people from all walks of life gathered on Munich's main square, the Marienplatz. The atmosphere was carnivalesque. Oompah bands set the tone, and the Münchner Kindl, Munich's mascot, put in an appearance. A famous Oktoberfest actor and impresario set up a mock guillotine to symbolically behead the Liberalitas Bavarieae, the figure that watches over the Oktoberfest grounds. In the speeches that followed, politicians of all stripes praised the beer garden as a place of uniquely Bavarian conviviality.

The demonstration hit the mark. Not long after, the Bavarian government passed a law that balanced the desires of Bavarians to preserve the traditional beer garden way of life with those of local residents in need of sleep. Music was to end at 10 p.m., and folks were to be on their way home by 11 p.m. These provisions later found expression in the now-famous Beer Garden Ordinance of April 1999, adding legal heft to a sacrosanct way of life in Bavaria.

Spezial-Keller (Bamberg)

First, that view! In spring and summer, the old town of Bamberg is like a painted backdrop of green foliage, red-tiled roofs, grey churches, and the soft colors of sandstone. In autumn the church spires stand out sharply against the sky, like an engraving of a medieval townscape.

Spezial-Keller isn't as densely shaded as some beer gardens that feel like they're deep in a primeval forest. Instead, the loosely woven canopy of maple leaves lets in plenty of dappled sunlight, which lends Spezial-Keller an airy lightness perfect for relaxing afternoons.

Angle for one of the front-row seats with a view over the city. If that doesn't work out, find a spot in the main garden, which gently slopes away from the whitewashed Ausschank (tap counter) on several terraces.

Keep an eye out along the far southwestern edge of the garden for the cask elevator once used to haul barrels up from the cellar 23 meters below. Back in the day, the occasional careless cellarman lost control of his cask while unloading the precious cargo at the top of the elevator. These errant barrels would plummet back down the shaft with an ungodly racket, shattering to pieces below. Alas.

The Spezial-Keller serves up all the Rauchbier standards of the Brauerei Spezial in the city below. The food is a mix of hearty Franconian fare and healthier options. If you're feeling full from all that rich Franconian food, opt for the tasty spinach strudel in cream sauce.

Photos © Getty/Nikadalbeer); Unsplash/markus-spiske (hops); Getty/Foxys_forest_manufacture(food)

Augustiner-Keller (Munich)

The Augustiner-Keller began life in 1812 as a lagering cellar for the Büchlbrauerei, a brewery that was in the possession of a book publishing family. Joseph Wagner (whose initials still grace the Augustiner logo) acquired both the brewery and the surrounding property in 1862. At the time, only the small horseshoe-shaped area above the cellar was planted with trees. Wagner went on a foresting spree, and now over a hundred stately horse chestnut trees cast their shade over a space large enough for 5,000 beer garden aficionados. Today, 45 of these trees are under heritage protection. Look for numbers on these trees.

The vast and amply shaded grove wasn't the only reason that the Augustiner-Keller was the talk of the town. Up to 1891, the "beer oxen" made their rounds turning a rope-and-pulley system that hoisted casks of beer from the cellar. These bovine beer haulers made for quite the amusing spectacle for Munich's beer lovers, especially after a few beers.

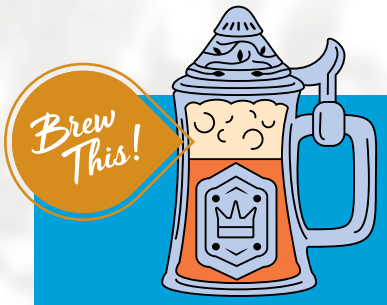
Nowadays, the combination of beer garden ambience and stellar cask-conditioned Augustiner Edelstoff doesn't get any better than this, even without the beer oxen. On warm, sunny days, take a seat in this beer garden oasis and forget the hustle and bustle of the city. If it's winter or if a storm happens to be rolling through, head inside to the traditional beer hall for rustic splendor and oompah bands on stage at the front of the hall. Both the beer garden and the beer hall are boisterous in that uplifting kind of way.

Pro tip: Tram 17 connects the Augustiner-Keller with the nearby Hirschgarten beer garden.

Last Call? Not Yet

If these beer gardens have put you in the mood for a beer in the shade, here's a list of 15 more beer gardens to seek out next time you're in Bavaria. All of these are within walking distance of public transportation. In Munich, the vast Hirschgarten is set amid a former royal hunting preserve where the deer still wander. Paulaner's Salvatorkeller is the home of the legendary Strong Beer Fest during Lent. And Kugler Alm is where the Radler was supposedly invented. Other Munich spots worth a visit include the picturesque Michaeligarten on the banks of a pond, the pastoral Insel-Mühle next to a mill on a stream, and the secluded Aumeister in the English Garden.

Close to Munich are beer gardens attached to famous breweries such as Ayinger, Kloster Andechs, and Weihenstephan. Elsewhere in Bavaria, check out the Wilde Rose in Bamberg, the Alte Linde in Regensburg,



Color Me Kellered

Recipe by Franz Hofer, inspired by Scott Burgess' Bamburg-style Kellerbier

Batch size: 5 gal. (18.93 L)
Boil time: 90 min
Original gravity: 1.051 (12.6°P)
Final gravity: 1.013 (3.25°P)
Efficiency: 75%
Bitterness: 30 IBU
Color: 10 SRM (orange-amber)
Alcohol: 5.2% by volume

MALTS & ADJUNCTS

7.5 lb. (3.4 kg.) Weyermann German Pils Malt
3.25 lb. (1.47 kg.) Weyermann Munich II Malt
2 oz. (57 g.) Weyermann Carafa I Malt

HOPS

0.7 oz. (22 IBU) (26 g) Perle, 8% a.a., in boil @ 60 min
0.5 oz. (8 IBU) (14 g) Perle, 8% a.a., in boil @ 15 min

YEAST

WL830 German Lager Yeast or Wyeast 2124 Bohemian Lager Yeast, both of which are said to be the Weihenstephan 34/70 strain. Make an ample starter stepped up at least twice.

OTHER INGREDIENTS

Yeast nutrient, in boil @ 10 minutes

BREWING NOTES

Perform a double-infusion mash with a beta amylase/maltose rest at 144°F (62°C) for 20 minutes, followed by a 30-minute alpha amylase/dextrin rest at 154°F (68°C). Check for starch conversion before mashing out at 169°F (76°C) for 10 minutes.

Sparge to collect 6.75 gallons (25.6 L) of wort. Boil for 90 minutes, cool, aerate the wort well, and pitch your yeast. Ferment at 48°F (9°C) until primary fermentation is finished (7–9 days), then lager for 3 weeks around 30°F–32°F (-1°C–0°C). Carbonate to 2.2 volumes of CO_2. To get that smooth, low-carbonation creaminess of a Kellerbier, dose your keg with priming sugar or bottle condition.

When it's ready to drink, find a place in the shade, pull everyone a Kellerbier in an earthenware mug (*Tonkrug*) for that Franconian feel, and serve with hearty Franconian fare like Schäufele (roasted bone-in pork shoulder) with a potato dumpling and dark beer sauce.

Photos courtesy of Franz Hofer

the Drei Königinnen in Augsburg, and the Wochinger beer garden in Traunstein. The St. Georgen-Bräu Keller in Buttenheim is absolutely stunning at sunset. Last but not least, the St. Bartholomä beer garden on the placid Königssee might seem out of the way, but you can reach it via train, bus, and boat in about four hours from Munich.

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KELLERBIER, THE ORIGINAL BEER GARDEN BEER

Say you find yourself thousands of miles from those sylvan groves of Bavaria but still want a taste of beer garden bliss when the weather's warm. Fewer beers better conjure up an image or memory of Bavaria than a cool Franconian Kellerbier.

A Kellerbier, You Ask?

Home to a prodigious number of small, family-run breweries and a dazzling array of beers and styles, Franconia is a beer lover's paradise. What's more, you're never more than a hike or bike ride away from the nearest bierkeller (the Franconian word for beer garden). And it's those places where you'll find the OG of beer garden beer, the Kellerbier.

Like its close relative Zwickel, Kellerbier is an unfiltered and unpasteurized beer that hasn't spent as much time lagering as, say, a Helles or a Pils. Traditionally, Kellerbier was served straight from casks drawn from fermentation vessels in the cellar beneath the beer garden. You can expect a beer that's slightly hazy, generally fuller in flavor than its filtered cousins, and typically hoppier. A variation on this theme is the "Ungespundetes," a beer fermented "unbunged" and vented to the atmosphere. This results in a softer, creamier carbonation. Among the most famous of these beers is Mahrs Bräu's "a U" (pronounced ah OO).

Kellerbier Stateside

Mahrs Bräu's "a U" is the beer that inspired Bierkeller Columbia's Scott Burgess to brew a Kellerbier for his beer garden along the Columbia riverfront in South Carolina. An erstwhile comparative literature student, Burgess decided during a 10-year stint in Bamberg that the life of a scholar wasn't for him. Instead, he found himself drawn to the breweries and beer gardens of Bamberg and its environs. Burgess eventually traded in his quill for a mash paddle, bringing his love of Franconian beer back to his native South Carolina.

And that old-school "U" that inspired Burgess? It's a gently carbonated treat that

glistens luminescent amber. Aromas are redolent of honey meets raisin bread and sugar cookies, all accented by a subtle pepperiness with a suggestion of orange blossoms. The palate serves up a malty base of Leibnitz biscuits, light caramel, and almonds, with a gentle bitterness and lemon-orange citrus notes rounding things out. Smooth and just a notch off-dry, it's the kind of beer that calls forth the next.

Brewing a Taste of Franconia

When Burgess brews his Bamberg-style Kellerbier, he aims for "a nice maltiness with a bit of heft" balanced by Perle for bittering. "We love Perle," states Burgess, who sources his hops from the Seitz family farm in the Hallertau. Burgess and his crew use a 70/30 mix of Pils and Munich II malt and do a two-step infusion mash. When it comes to hops, they shoot for an IBU in the high 20s to low 30s with charges at 60 and 15 minutes.

After boiling for 90 minutes, cooling, and pitching an ample amount of 34/70 yeast "in the high 40s," Burgess lets the beer free-rise into the low 50s. Burgess foregoes a diacetyl rest, slowly reducing temperature once the beer has reached terminal gravity. "Primary takes a little less than a week or so and from there we follow Narziß's protocols for secondary/lagering." (The late Ludwig Narziß was a professor of brewing technology at the Weihenstephan campus of Munich's Technical University.) The beer then spends three weeks in horizontal lagering tanks before it's drawn into casks, kräusened to reduce any diacetyl, and served in-house—just like in Franconia.

What Burgess loves about his Kellerbier is that beguiling whiff of sulfuric minerality. "You can't get that character from forced carbonation," he says.

So how can homebrewers achieve these qualities that make Kellerbier sing? First, use a spunding valve during primary fermentation if you can, which will introduce natural carbonation into the beer. [Learn more about spunding in this issue's Beer School on page 19.] When all is said and done, prime your keg with a low dose of priming sugar. "Then," says Burgess, "drink all 5 gallons in a sitting"—preferably under some trees on a summer evening with friends and family.

Franz D. Hofer is a cultural historian, beer judge, and author of the Tempest in a Tankard blog. When not brewing, teaching, or writing, Franz enjoys hiking and cycling—preferably when there's beer involved along the way.

Relax, Don't Worry, Have a *Homebrew!*

That mantra rings as true today as it did in 1978 when Charlie Papazian cofounded the American Homebrewers Association with Charlie Matzen. Homebrewing can be as simple or as complex as you want to make it, but the first step is always to relax and not worry.

To aid your relaxation and help you get the most out of *Zymurgy*, here are some standard assumptions and methods for our recipes. Of course, when a recipe says to do something different, follow the recipe. But you can always fall back on these general tips to brew great beer.

ON THE WEB
For more detailed info, head over to HomebrewersAssociation.org and dive into our How to Brew resources.

BREWING WITH *ZYMURGY*

MAKING WORT

Most recipes in *Zymurgy* offer an all-grain version and a malt extract or partial-mash alternative. Pick the procedure you prefer and prepare some wort! Some recipes might include a water profile. If you can't (or don't want to) deal with water chemistry, don't worry about it: just go ahead and brew! Extract brewers needn't add minerals to water.

Malt Extract Recipes
Making wort from malt extract is easy.

- Crush specialty grains, if any.
- Place milled grains in a mesh bag and tie it off.
- Steep bag of grains in 150–160°F (66–71°C) water for 30 min. in your brew pot.
- Remove bag of grains from the pot.
- Fully dissolve extract in the hot, grain-infused water (if there are no specialty grains in the recipe, you can skip directly to this step).
- Top up with water to your desired boil volume. (Leave some room for foam!)

All-Grain and Partial-Mash Recipes
Unless otherwise specified, all-grain brewers can conduct a single-temperature infusion mash with these parameters:

- Water/grain ratio: 1.25 qt./lb. (2.6 L/kg)
- Mash efficiency: 70%
- Mash temperature: 150–153°F (66.7–67.2°C)
- Mash duration: 60 minutes

Partial-mash recipes make the same assumptions but use a smaller amount of grain and augment the wort with malt extract.

BOILING

No matter how you get here, everyone loves adding hops.

- Boil time is 60 minutes unless otherwise stated.
- Boils are assumed to be the full batch volume, but you can also boil a concentrated wort and top up with water in the fermenter.
- Hop additions are given in minutes before the end of the boil.

Photo © Jesse James Galarza

Brew Lingo

Every field has specialized language, and homebrewing is no different. Here are a some of the key terms, abbreviations, and acronyms you'll find throughout *Zymurgy*.

AA – alpha acid

ABV – alcohol by volume

AHA – American Homebrewers Association

BBL – US beer barrel (31 US gal or 117.3 L)

BIAB – brew in a bag

BJCP – Beer Judge Certification Program

Chico – American ale yeast, AKA Wyeast 1056, WLP001, SafAle US-05, and others

CTZ – Columbus, Tomahawk, and Zeus: interchangeable high-alpha-acid hops

DME – dry malt extract

DMS – dimethyl sulfide, an off flavor similar to canned corn or cooked vegetables

DO – dissolved oxygen

EBC – European Brewing Convention (beer color)

FG – final gravity

FWH – first wort hops, added to the boil kettle as it fills with sweet wort after mashing

HERMS – heat exchange recirculating mash system

HLT – hot liquor tank

IBU – international bittering unit

LHBS – local homebrew shop

°L – degrees Lovibond (malt color)

LME – liquid malt extract

LTHD – Learn to Homebrew Day

MLT – mash-lauter tun

NHC – National Homebrew Competition

OG – original gravity

°P – degrees Plato (wort/beer density)

RIMS – recirculating infusion mash system

RO – reverse osmosis, a water purification process that removes most dissolved ions

SG – specific gravity (wort/beer density)

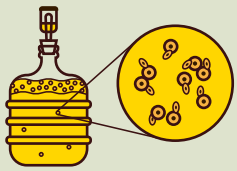
SMaSH – single malt and single hop

SMM – S-methyl methionine, precursor to dimethyl sulfide (DMS)

SRM – Standard Reference Method (beer color)

FERMENTING & CONDITIONING

Pitch yeast into chilled, aerated or oxygenated wort.



- Use twice as much yeast for lagers as you do for ales.
- Ales ferment at 60–70°F (15–20°C). Lagers ferment at 45–55°F (7–13°C).
- Condition ales at room temperature or colder for a week or two.
- Condition lagers at close to freezing for several weeks if you can (traditional but not required).

BOTTLING & KEGGING

If you bottle,

- Use 1 oz. of dextrose (corn sugar) per gallon of beer (7.5 g/L) for a good, all-purpose level of CO_2.
- Use less sugar for less fizz.
- Take care with higher carbonation levels—many single-use beer bottles aren't designed for high pressure.

If you force carbonate in a keg,

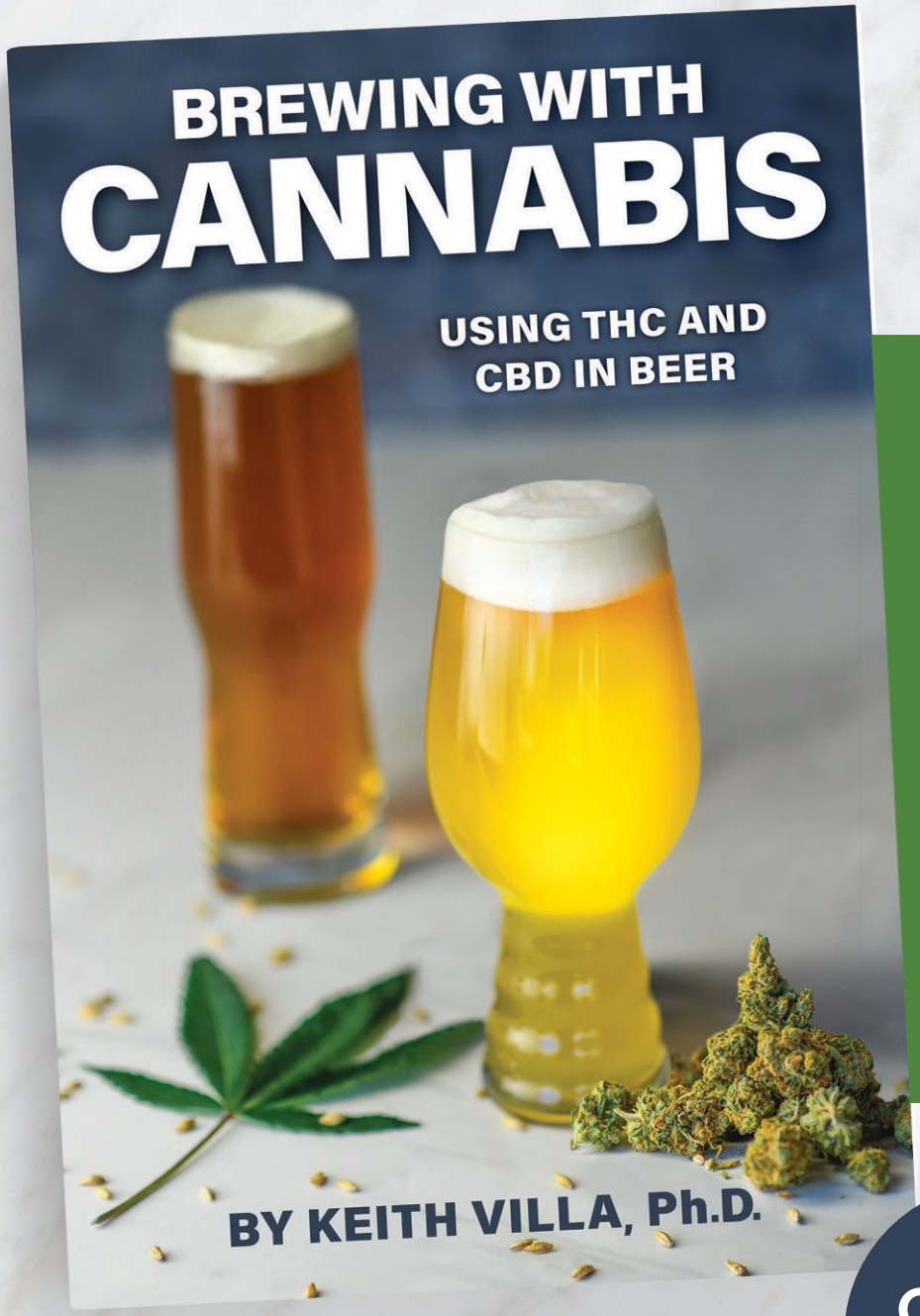
- Use the chart to dial in the gauge pressure on the regulator.
- Add 0.5 psi (35 mbar) for every 1,000 feet (300 meters) you live above sea level.
- To convert psi pressures to mbar, multiply by 69.
- To convert volumes of CO_2 to g/L, multiply by 2.

REGULATOR PRESSURES (PSI) FOR VARIOUS CARBONATION LEVELS AND SERVING TEMPERATURES

TEMP. (°F)	VOL. CO_2										
	2.1	2.2	2.3	2.4	2.5	2.6	2.7	2.8	2.9	3.0	3.1
33	5.0	6.0	6.9	7.9	8.8	9.8	10.7	11.7	12.6	13.6	14.5
34	5.2	6.2	7.2	8.1	9.1	10.1	11.1	12.0	13.0	14.0	15.0
35	5.6	6.6	7.6	8.6	9.7	10.7	11.7	12.7	13.7	14.8	15.8
36	6.1	7.1	8.2	9.2	10.2	11.3	12.3	13.4	14.4	15.5	16.5
37	6.6	7.6	8.7	9.8	10.8	11.9	12.9	14.0	15.1	16.1	17.2
38	7.0	8.1	9.2	10.3	11.3	12.4	13.5	14.5	15.6	16.7	17.8
39	7.6	8.7	9.8	10.8	11.9	13.0	14.1	15.2	16.3	17.4	18.5
40	8.0	9.1	10.2	11.3	12.4	13.5	14.6	15.7	16.8	17.9	19.0
41	8.3	9.4	10.6	11.7	12.8	13.9	15.1	16.2	17.3	18.4	19.5
42	8.8	9.9	11.0	12.2	13.3	14.4	15.6	16.7	17.8	19.0	20.1

= PSI

Source: Brewers Association Draught Beer Quality for Retailers



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Keith Villa, Ph.D., is brewmaster and co-founder of Colorado-based CERIA Brewing Company, a trailblazer in the rapidly growing market of non-alcoholic, cannabis-infused beers. After earning his Ph.D. in brewing from the University of Brussels in Belgium, Keith began his 32-year career as founder and head brewmaster at Blue Moon Brewing Company, an operating unit of MillerCoors. Since then, this beer doctor has gone on to brew several award-winning beers and continues to set new standards and push the boundaries of flavor, styles, and ingredients. Keith also is co-founder and head brewer of family business Donavon Brewing Company based in Arvada, Colorado.

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An Experiment with Barleywine, Revisited

By Chris Pinnock & Phill Turner

In 2019, we brewed six different barleywines from one batch of wort. Each beer was fermented with a different yeast strain. Our beer circle, the County Beermakers, met just before the Covid lockdown in March 2020 to taste the barleywines, and recorded the results. *Zymurgy* published our results and conclusions in the March/April 2021 issue.

One of the authors was tidying his beer fridge in November 2023 and found a remaining bottle of each beer. We decided to revisit this experiment to see how each yeast affected the character of our barleywine over an additional four years of aging. This article summarizes the tasting session of the last of the barleywine.

The interested reader can find the background details of the experiment in the March/April 2021 article, which included the original County Barleywine recipe for 4 gallons. In this article is a scaled version for the experiment's volume of 6 gallons.

Our beer circle met again on the last weekend of November 2023 in a London pub. The final bottles were opened and judged. Given the small volume available, we graded them as we went. Here are the notes in the order of tasting:

1. London Ale Yeast

Completely unbalanced with a sickly-sweet cough medicine flavor. There were notes of sherry. This beer was never destined for greatness—it was an afterthought in the original process.

The yeast is a good choice for less alcoholic beers such as London porter or bitter. Over 20 years ago, one of the authors did a similar experiment fermenting an English bitter with five different yeasts. The London Ale yeast produced by far the best result for that one.

2. Nottingham Yeast

The beer had no condition and no head. The flavor was harsh, rough, meaty, and flat. The beer also had signs of yeast bite usually caused by an excess of yeast. We pitched an entire dry packet of the yeast, and commented in the original article that this was probably too much. The beer dropped to the bottom of the league table immediately.

3. Saison Yeast

With a cherry-like character, the beer had some nice fruity Belgian tones to it. There was no bitterness but out of the first three, this beer was the most drinkable. The beer was sweet but complex, and a little dangerous, like many Belgian-style beers. The combination of high alcohol and drinkability in such beers can lead the drinker to believe that they are not as strong as they are.

We chose this yeast as a contender, as it is supposed to ferment up to 12% and be a high attenuator, but on this occasion it didn't happen. The beer was a mere 8.93% ABV.

4. Trappist Yeast

This beer was sweeter than the previous three. There was a bitterness at the end that kept on going. Unfortunately, the sweetness was unpleasant and excessive. We also detected musty and medicinal notes indicating a bottling problem. It fell behind the Saison and London Ale versions.

5. Thomas Hardy Yeast

The beer had lots of condition and for good reason. The Thomas Hardy ale yeast can take a beer to 25% under the right conditions. We also seeded all the bottles with 1728 Scottish Ale yeast to promote carbonation. The Thomas Hardy yeast did not need any help.

The flavor was complex with a fruity nose. The sweetness was there but not excessively. There were port-like flavors and the expected spiciness and heat. It was like a Christmas pudding in a bottle. In fact, it would go very well as an ingredient in one. The beer had aged well. It immediately jumped to the top of the leader board.

6. Scottish Ale Yeast

We expected better of this beer. It had low condition, and we could smell Marmite on the nose. In Britain, you either like or hate Marmite. Unfortunately, this preference

County Barleywine

English Barleywine

Batch Volume: 6.07 US gal. (23 L)
Original Gravity: 1.103 (24.5°P)
Final Gravity: 1.010–1.034 (2.5–8.5°P)
Efficiency: 53%
Color: 20 EBC (10 SRM)
Bitterness: 100+ (calculated)
Alcohol: 8.7–11.8% by volume

MALTS & ADJUNCTS

29.8 lbs. (13.5 kg) pale malt
7 oz. (200 g) low color crystal malt
7 oz. (200 g) wheat malt

HOPS

10.6 oz (300 g) E Kent Goldings, 5.15% a.a. @ 90 min

YEAST

French Saison (Wyeast 3711)
London Ale (Wyeast 1028)
Nottingham (LalBrew Dry)
Scottish Ale (Wyeast 1728)
Thomas Hardy (White Labs 099)
Trappist (Wyeast 3787)

ADDITIONAL ITEMS

1 tablet Protofloc (Whirlfloc) @ 15 min

BREWING NOTES

All the yeasts were wet except for the Nottingham. We've found that the Scottish Ale yeast is a good choice for strong ales, and is our usual choice for barleywines, but the Thomas Hardy yeast is capable of ABVs as high as 25% under the right conditions. Nottingham yeast has been traditionally used in homebrewing for many styles, including barleywine.

The beers fermented at 18°C (64°F) in a fermenting fridge except for the London Ale version. This beer was the odd one out, as we had some spare wort and yeast. It fermented at room temperature.

At the meeting in March 2020, we concluded that the Scottish Ale version was the best. The Thomas Hardy version was a close second. Both the London Ale and Nottingham versions were not pleasant. The Saison and Trappist versions sat in the middle. See the summary in the chart.

Updated Barleywine Experiment Timeline

Feb 23, 2019	Brew day. Fermentation starts at 18°C (64°F).
Feb 24–25, 2019	Various air lock replacements.
Apr 8, 2019	Out of the fermenter, tasting. Bottling. Bottles put into the fermentation fridge at 18°C (64°F).
Aug 10, 2019	Bottles moved to a conditioning fridge at 12°C (54°F).
Mar 15, 2020	Tasting with BJCP and Guild judges, just before Covid lockdown
Oct 3, 2020	First tasting
Mar 2021	*Zymurgy* publishes results
Nov 25, 2023	Final tasting

SUMMARY OF 2020 EXPERIMENT

Position	Yeast	ABV	Notes
1	Scottish	10.5%	By far our favorite and is everything an English barleywine should be. It's clean, fits the profile, has complexity, and is not too sweet due to the relatively high attenuation.
2	Thomas Hardy	8.7%	A very close second. It's a lot sweeter than the Scottish variant, with stone fruit, hints of caramel, and higher alcohols. There may be judges and brewers who prefer this one to the Scottish.
3	Saison	8.93%	This was spicy, sweet, and hot. A slight harshness knocks it down unfortunately, and it doesn't fit the profile of an English barleywine. Favored by only one judge.
3	Trappist	8.14%	Very sweet and fruity, but one dimensional. The yeast is perhaps more suitable for the candi sugars typically used with Belgian monastic beers.
5	London	8.7%	Oxidized, harsh, wasn't treated as a contender.
5	Nottingham	11.8%	Slightly unpleasant, the harshness was not good. Perhaps we overpitched the yeast.

would not make any difference here. The beer was past its best. Something had happened to it in the bottle, rendering it harsh and medicinal. It came behind the Saison with the three other bottom contenders.

As we have said, our beer circle would normally use this yeast for barleywine. In fact, on the day of tasting we had another barleywine made from the 1728 strain and it was very good. Unfortunately, sometimes things just go wrong in homebrewing.

To summarize, below are the 2023 results compared to 2021.

The distance between the Thomas Hardy version and the Saison version was vast. The Thomas Hardy was our second favorite overall in 2021, but it was a close contender for first place. In fact, some of the judges preferred it to the Scottish Ale version. In 2023, it showed that it has developed and matured very well. Maybe this is due to the heavy-duty yeast. The Saison version was drinkable, and we would not have returned it in a bar. The Scottish Ale version was a disappointment. It's possible that the problem is unique to this bottle, but we have no other bottles left for comparison. The remaining three beers were simply not up to scratch.

These kinds of experiments are always difficult to measure when using wet and dry yeasts with different pitching rates. Using the correct yeast for the style and the correct pitching rate is a key factor of success. We still think that the Scottish Ale yeast is one of the best for barleywine, but we will also try the Thomas Hardy variant in the future. It certainly gave the beer a good level of condition along with a superb flavor.

The authors would like to thank the County Beermakers for their help tasting the beers and providing comments.

RESOURCES

1. Pinnock, Chris and Phill Turner. "An Experiment with Barleywine." March/April 2021 *Zymurgy*.
2. Mr Malty Wyeast Strain Guide. mrmalty.com/wyeast.php.

Chris Pinnock is an IT consultant and trainer who has been brewing beer at home for five years. He has won various awards at competitions and is interested in the science behind brewing. He is a Chartered Scientist and a Chartered IT Professional.

Phill Turner is a veteran homebrewer who has won many awards for his beer. He won Master Brewer at the National Association of Wine and Beermakers four times, including three times in consecutive years. He also won the London Amateur Brewers Hayesenbrau Award three years consecutively. He is both an NGWBJ judge and a BJCP judge.

2021 results compared to 2023

Yeast	FG	Approx. ABV	2021	2023
Thomas Hardy	1034	8.7%	2	1 by far
Saison	1032	8.93%	3	2
Scottish	1020	10.5%	1	3
London	1034	8.7%	5	4
Trappist	1040	8.14%	3	5
Nottingham	1010	11.8%	5	6

The aged bottles await judgment.

Photo courtesy of Chris Pinnock

LAST Drop
BY STEVE RUCH

Session Quest

Inflation and pandemic-related supply side issues have raised the price of everything, including homebrewing ingredients. Pennies have to be pinched even more by those of us with modest, fixed discretionary spending limits. Being naturally tight-fisted, I relish the challenge and enjoy bargain hunting, especially for ingredients less readily available. One of the reasons that I reduced the size of my batches several years ago was that three gallons of beer is less costly than five, and it matches my monthly beer-a-day-with-supper drinking regimen. Although I must admit, it was also done in large part to reduce the weight of a load of wet grain and the strain on my poor old back and shoulders.

My next money-saving step was to lower the original gravity of my brews: for my brewing purposes, session beer is beer with an original gravity in the low 1.040s or lower. While there are numerous low original gravity beers in the BJCP guidelines—everything from Czech pale lager at 1.028 to 1.044; Grodziskie at 1.028 to 1.032; to American lite lager at 1.028 to 1.040—I think the best place to look for session beer recipe inspiration is the United Kingdom, especially since I'm part Scottish (I have the red beard to prove it, although gray has launched a major incursion) and part English. Standard session styles are ordinary bitter at 1.030 to 1.039; best bitter at 1.040 to 1.048; mild at 1.030 to 1.038; brown ale at 1.040 to 1.053; porter at 1.400 to 1.052; golden ale at 1.038 to 1.053; Scottish light ale at 1.030 to 1.035; Scottish heavy ale at 1.035 to 1.040; Scottish export ale at 1.040 to 1.060; Irish red ale at 1.036 to 1.046; and Irish stout at 1.036 to 1.044—all of which fit into the United Kingdom's pub culture of long drinking sessions while not getting so legless that you can't safely navigate the way

Photo courtesy of Steve Ruch

home. Another benefit to lower gravity beer is that it can go from grain to glass quicker, in some cases two weeks or less.

There was a time, over 100 years ago, that United Kingdom beers in general had a higher starting gravity. IPAs in the late 19th century averaged 1.052 to 1.062, stouts and porters were 1.050 all the way up to over 1.090, and brown ale gravities started at 1.062.

During World War I, ingredients became hard to come by, and beer strength was limited by government decree.

In 1931 the beer tax was drastically increased. And because of the depression, brewers decided it was in their best interest to cut the strength of their beer even further to keep from having to raise prices and drive away their customers.

Then World War II broke out with its own ingredient shortages, and by 1945 the starting gravity of mild was barely 1.030, dropping below 1.028 for a while after the war. When the economy started to rebound in the early 1950s, average gravity rebounded to the low 1.030s, but never returned to pre-war levels. Some modern-day breweries actually still label beer with an original gravity of 1.040 as IPA.

Drinkability and balance are keys to a good session beer, and brewers in the UK have been dealing for a long time with the need to brew beer worthy of their customers' repeat business, while keeping costs affordable. I think I have both drinkability and balance in my Cunning Plan Mild recipe. I brew it multiple times a year, varying the percentage of Chevalier Heritage malt, which I recommend to anyone brewing United Kingdom-based recipes, depending how much I have on hand; the dark grain(s) I use to get my desired SRM; and the amount of crystal malt. In the July/August 2021 *Zymurgy* Last Drop entitled "Countdown Brewing," I detailed my normal recipe development using three grains or fewer, and I generally only deviated from that when doing low original gravity session brews to add a bit of complexity. On the other hand, each time I brew my Bob's Your Uncle Bitter, the grain bill stays the same while I use different hops in each batch. The best variety of British hops I've been able to locate is at Annapolis Homebrew Supply, with 20 available at last count.

Brewing a drinkable, well-balanced session beer can be harder than brewing most high-octane, hoppy, roasty, cloudy beers, and any homebrewer worthy of the name should be able to produce one when the occasion calls for it. See recipes for Cunning Plan Mild on page 5 and Bob's Your Uncle Bitter on page 6.

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