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BrewYour Own®

THE HOW-TO HOMEBREW BEER MAGAZINE

DECEMBER 2018, VOL.24, NO.8

FOR WHOM THE BELL'S POURS

5 Bell's Clone Recipes & Brewing Tips From A Classic Craft Beer Pioneer

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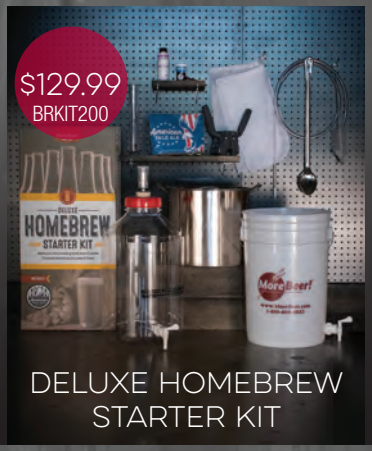

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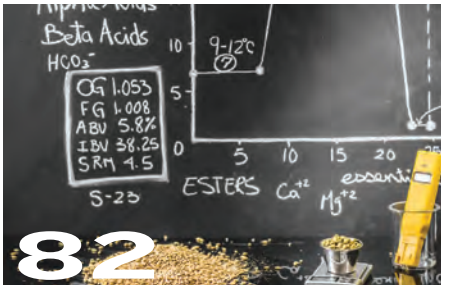

features

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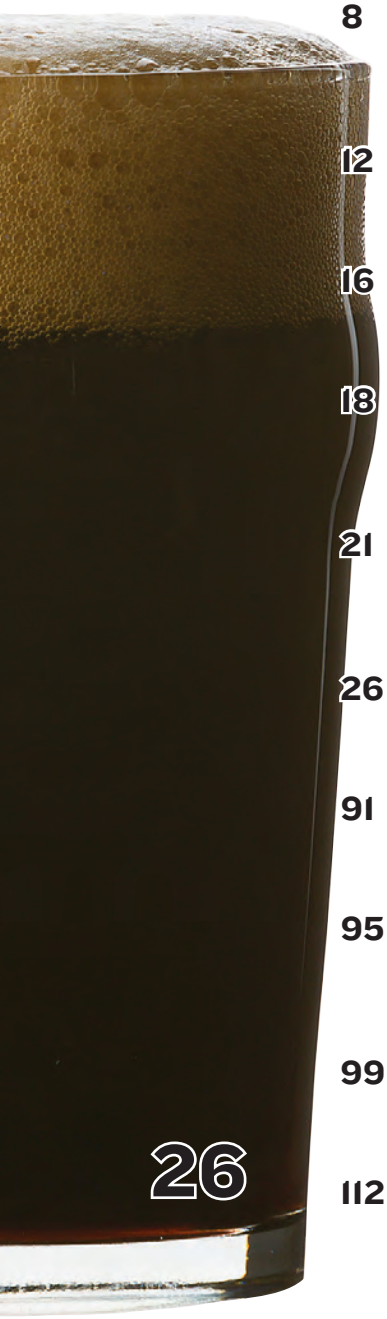
departments



where to find it

RECIPE INDEX

RECIPE STANDARDIZATION

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

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

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

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

Gallons:
We use US gallons whenever gallons are mentioned.

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Cover Photo Illustration:
Charles A. Parker/Images Plus

Q

What music do you most often find yourself listening to while brewing?

Either my Dire Straits or Dexter Gordon Pandora stations; these two selections give me a huge variety of sounds to keep me focused!

I try to pair my brew day music based on the beer style in the kettle, even if it's a bad pun. If I'm making an IPA I go with some Hip Hop. And I still have an old CD from the mid-90s called "Chant" with Benedictine Monks delivering an album worth of Gregorian Chants that I'll play anytime I make a Belgian-style beer to get me in the mood. I don't think any of this makes the beer any better, but it definitely makes for a more fun brew day for me.

Lately I've been listening to The Allman Bros. Band, The Dead, and some Phish, but my team gets a say too, so sometimes it's The Beatles, sometimes it's AC/DC, sometimes it's funk, and sometimes I don't know what the heck they are playing! It's all good!

Volume 24, Number 8: December 2018

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suggested pairings at BYO.COM

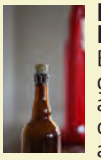
Founder's Brewing Breakfast Stout clone

Only 45 minutes north of Bell's Brewery, beer revelers find another coveted brewery in Grand Rapids: Founder's Brewing Co. Their Breakfast Stout helped redefine a style and an inspiration to a whole new phalanx of infused stouts. This coffee-chocolate oatmeal stout is nothing short of decadent. Find the recipe at https://byo.com/recipe/founder-s-brewings-breakfast-stout-clone/

MEMBERS ONLY

Keezer Collar Build

Chest freezers, modified into kegerators (keezers) are a popular choice for homebrewers looking to put their beer on draft. Often keezer designs are lumped into two categories, tower builds and collar builds. If you are interested in designing a collar for your keezer where taps are found on a collar between the freezer body and lid, check out the following build at https://byo.com/project/chest-freezer-to-kegerator-keezer-collar-build/



Bottle Conditioning Belgian Ales

Bottle conditioned Belgian ales certainly have a specific charm and often due to their ABV, an ability to age. If you are looking to bottle up a batch of Abbey- or Trappist-styled beers, an understanding of best practices can help elevate the beer to new heights. Be sure to read up! https://byo.com/article/on-the-yeast-guide-to-bottle-conditioning/

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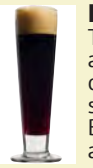

Baltic Porter

This beer moniker spans a rather large range of darker beers. In the southern and eastern Baltic regions these are a bottom-fermented, sweet-style beer resembling a dark doppelbock. Meanwhile in Scandinavia, they'll often be top fermented with a more firm bitterness, resembling a London imperial porter. Learn more of the style from the master of style, Jamil Zainasheff. https://byo.com/article/baltic-porter-techniques/

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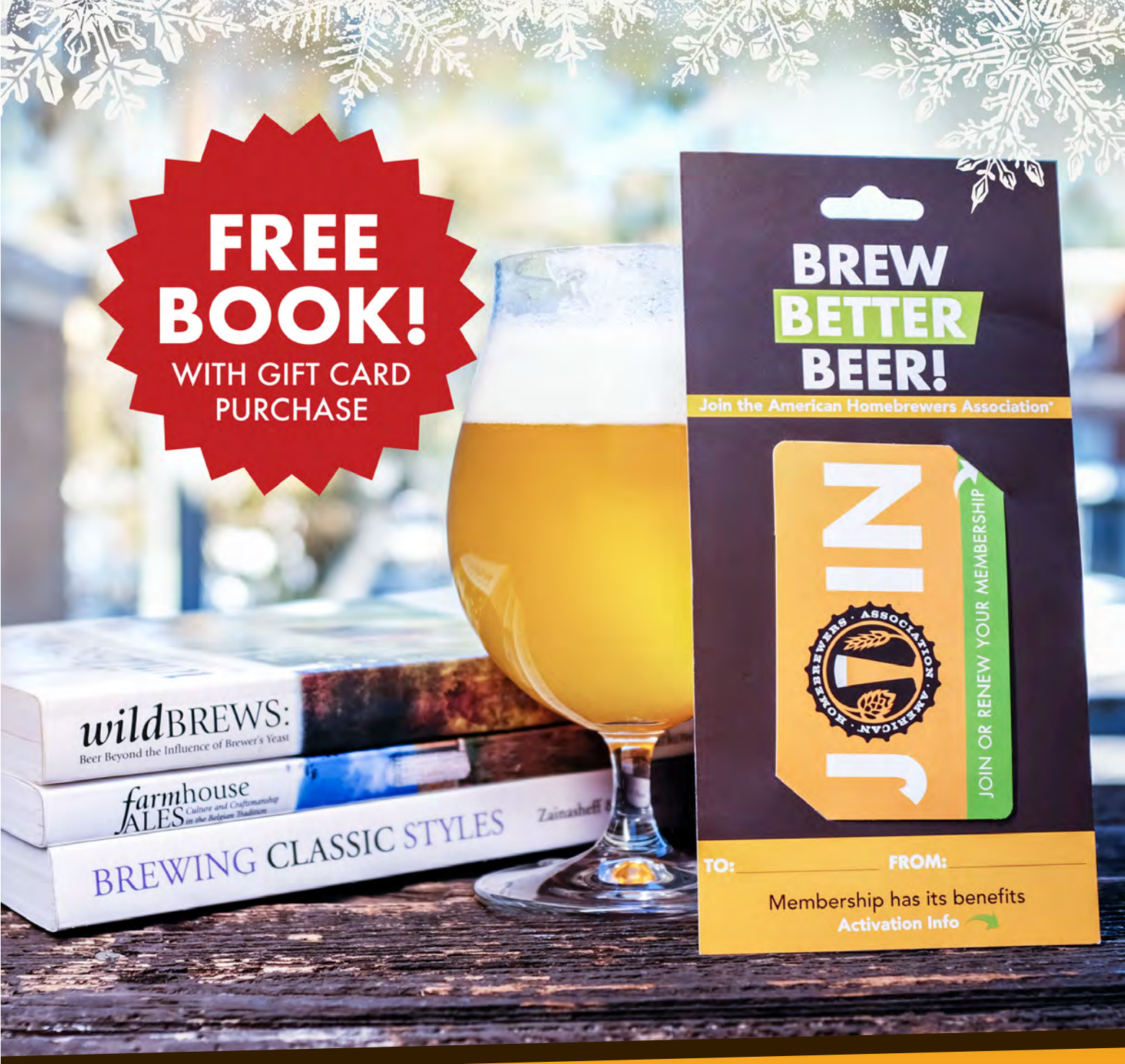

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MAIL

INDUCTION ELEMENT SIZE

I am just wondering if a 2100W induction plate is too small to do 10.5-gallon (40-L) brew-in-a-bag batches?

Darren Maney • *via Email*

Darren, we often get these types of questions about the required size of an induction heating element for various batch sizes, and the answer is tricky as it depends on a number of factors. To get into that, we passed your question on to Josh Weikert, who has written a couple of articles on brewing with induction burners for us over the years (most recently, "Induction Brewing" in the January-February 2018 issue of BYO*). Here's what he has to say:*

"A 2100W induction element is probably too small for the batch size you're looking at. It isn't so much that it couldn't boil that volume — with enough time, insulation, and diameter on the element you might get there — it's just that doing so would likely be prohibitively challenging. There are a lot of ways for this to fall short, compared to a 5-gallon (19-L) batch on a similar unit. I don't know any 10.5-gallon (40-L) batch brewers who use less than a 3000W unit. Having said that, if you can get the unit on a trial (so you can return it if it doesn't go well), give it a shot! I could certainly be wrong here. It's uncharted territory, and there are too many variables in the physics for me to state confidently that you can or cannot do it."

DRY HOPPING SCHEDULES

I just finished brewing the New England IPA recipe from the May-June 2017 "Style Profile" (available online at https://byo.com/article/neipa-style-profile/). It's my first homebrew and I'm excited to try it out! I have a question around the dry hopping and with doing a secondary fermentation. Below are the exact instructions from the recipe:

" Mix the dry hops and divide into three equal portions. The first portion gets added after two days of active fermentation. The second portion gets added at the end of fermentation. The third portion gets added three days after fermentation ends. Allow each dry hop addition to be in contact with the beer for two to three days, then remove."

contributors

Nick Rodammer began homebrewing in 2012 and hasn't looked back since. Nick is a past gold medalist in the National Homebrew Competition, has medaled in the U.S. Open Beer Championships, is a past presenter at the National Homebrew Conference, and has had technical research published by the American Homebrewers Association. Nick resides in Rockford, Michigan with his wife, Nicole, and three children, Ben, Britten, and James. He is heavily involved in the local homebrewing scene in nearby Grand Rapids, including serving as past President of the Brewsquitos Homebrewing Club, and founding the Beer City Pro-Am, a collaborative competition between local craft brewers and homebrewers.

In this issue, Nick stays in his home state to chronical the growth, beers, brewing techniques, and people behind Bell's Brewery, beginning on page 58.

Brandon Whalen is a Brewer at Rohrbach Brewing Company in Rochester, New York, who still finds time to continue his homebrewing hobby of 13 years. Before brewing professionally he was an award-winning homebrewer that spent most of his time paying the bills as a chef in Portland, Oregon. He studied brewing chemistry and fermentation science at the University of Oklahoma. At home, he enjoys experimenting with different ingredients, and focuses on both clean and sour beers. The homebrewery is currently filled with six wooden barrels of different varieties. Brandon is a BJCP certified beer judge, and is a part of the Upstate New York Homebrewers Association and 585 Brewers Collaborative.

Brandon makes his *BYO* writing debut in this issue by exploring the impact pH can have on your beer at every step in the brewing process, beginning on page 82.

Michael Tonsmeire is an award-winning homebrewer, certified beer judge, and all-around sour beer nerd. He blogs as The Mad Fermentationist (www.themadfermentationist.com), authored *American Sour Beers* (Brewers Publications, 2014), and has written *BYO*'s "Advanced Brewing" column since 2015. Michael's next adventure has just begun, as he and Scott Janish recently opened Sapwood Cellars in Columbia, Maryland. "I've had a wonderful time writing the 'Advanced Brewing' column these last four years. I wanted to thank my editors at *BYO* for letting me write about what I was interested in, and my father, Bob, for making my words better. I'll still write the occasional feature story, but going from a 40-hours-a-week desk job to working 60+ hours a week running a brewery requires compromise."

Read Michael's final "Advanced Brewing" column on recipe design ethos beginning on page 95.

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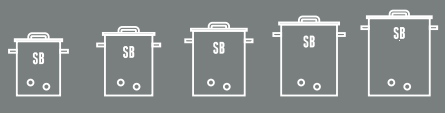

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MAIL

My first question is, should all of my dry hopping be done in the primary if I'm planning on transferring to a secondary? Also, if I should be adding the hops in a mesh bag, should I add something like marbles to help the hops sink? If so, are there special marbles you use so as to not alter the taste of the beer in any way?

Michael DeRenzo • *via Email*

BYO *Editor Dawson Raspuzzi responds, "First off, congratulations on your first homebrew, Michael! May this be the first of many batches of homebrew in your future! We'll let Gordon Strong, who wrote that recipe, share his thoughts on which hop additions should be made in primary fermentation vs. secondary, but as for your second question, if you are using hop pellets then there is no need for marbles to weigh them down. The pellets will break up and sink on their own. If you wanted to use marbles (the more common use for marbles is to fill space in the secondary fermenter to protect your beer from oxygen – as the marbles will take up space otherwise filled with air and push the beer up to the neck of the carboy) then glass marbles work well. Just soak them in your sanitizer solution prior to adding them to the carboy and they should be fine. I always bag large dry hop additions simply for ease of removing them. Otherwise, you will likely have to do an additional racking off the hops on the bottom – which adds more chance of oxygen exposure, contamination, and simply is more work. As for your first question, here are Gordon's thoughts on what he had in mind for his recipe."*

"It really depends on when the transfer is done from the primary to the secondary. The advice in the recipe holds true whether it's in a primary or secondary. I think it would be easier to transfer at the end of fermentation and do the second hop addition at the same time. But the transfer could also be timed to match the third addition. Depends on what the brewer normally does. If I were brewing this and using a secondary, I would add the first two additions in the primary and time it so the transfer was done at the time of the third addition. That way, I wouldn't have to remove the second addition and the third addition could already be in the secondary. But I'd use a mesh bag anyway to make it easier to separate the hops."

WRITE TO *BYO*

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

SEND IN THE CLONES!

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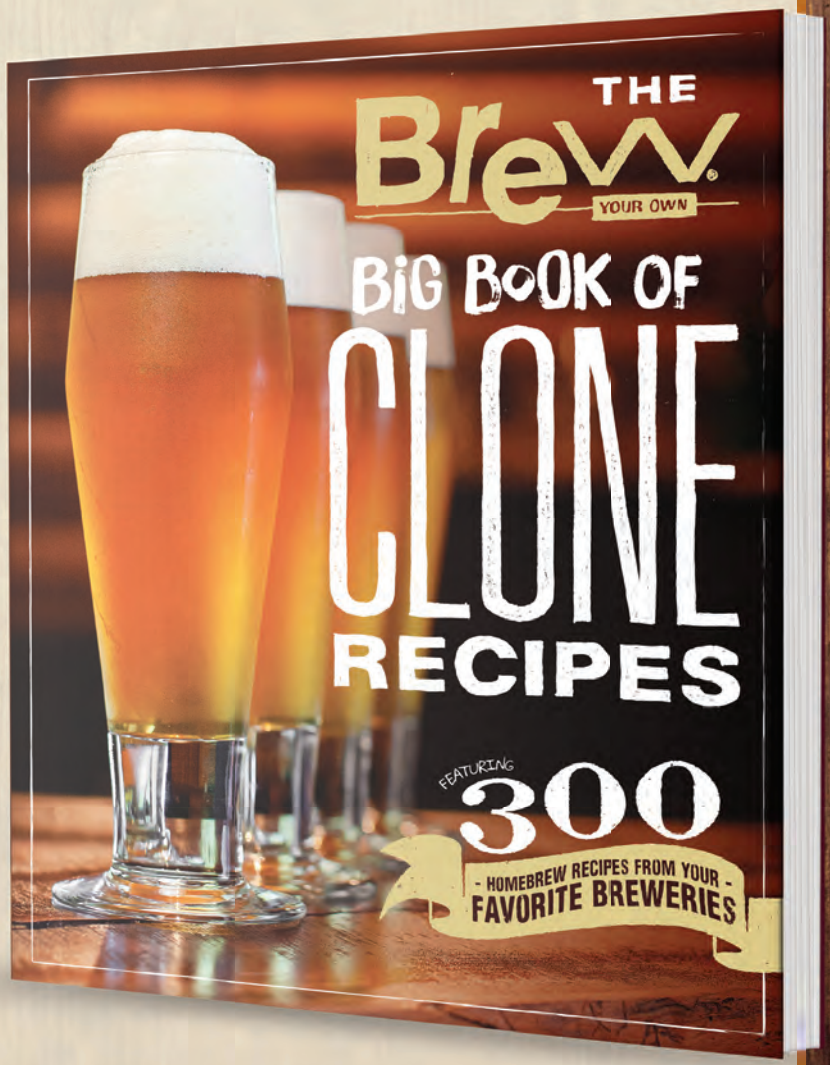
Whether you're looking to brew an exact replica of your favorite IPA or get some inspiration on a stout from the greats, this book is your new brewday planner.



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BEGINNER'S BLOCK

BY DAVE GREEN

EXTRACT YOURSELF FROM ALL-GRAIN

The popularity of all-grain brewing has surged in recent years. In this column I'm going to step outside the norm for Beginner's Block and talk more to the advanced brewers about simplifying their homebrew experience. Going back to the roots of homebrewing in many parts of the world . . . brewing with malt extract. By that I mean any batch of beer that utilizes malt extracts, it could be extract only, extract with grains, or partial mash batches of beer.

In 1999, a survey of *BYO* readers found that extract brewers represented 88% of *BYO*'s readership; only 12% of survey respondents identified themselves as exclusively all-grain brewers. By 2006, a similar reader study showed that those identifying themselves as all-grain brewers had grown to 38%. Fast-forward to 2018, and the number of readers identifying as all-grain homebrewers grew to 79%. Talk about a trend . . . in 20 years, all-grain brewing among our readers has gone from the minority to the majority. The American Homebrewers Association reports similar trends. According to their homebrew shop survey conducted in 2012, 64% of homebrewing purchases included malt extract. By 2018 that number has shrunk to 44%. But extract brewing is still homebrewing and should always be kept as a possibility by every homebrewer.

PROS VS. CONS OF USING MALT EXTRACTS

In my opinion the biggest advantage of extract brewing can be summed up in one word: Time. Sure, many Brew-In-A-Bag brewers will claim they're saving time, but no all-grain brewer can claim time savings like extract brewers. I'll go into the time-saving details later. Other big pros include: Better consistency, less equipment, less cleaning, less hassle, and less space. The equipment and consistency can be a great aid for beginner homebrewers while space can be a huge advantage for apartment brewers. The cleaning and hassle aspect is great if you have kids or are trying to multi-task with other things in your life.

The main cons of extract brewing I often hear revolve around the fact that malt extract is more expensive than bulk grain and that the base malt profile has been pre-determined for you. Expense is true, but consider the value of your time saved by not processing that grain into wort — no milling, no 60-minute mash, no cleaning the mash tun, hoses, pumps, etc. As for the beer's base malt profile, there is plenty of maneuverability. Would you like the beer drier? Add less malt extract and supplement with simple sugars. Enzymes are another possibility if you want very dry beer (see the "Brut IPA" article starting on page 48 for more information on this). Want more body? You can add unfermentables like maltodextrin or lactose or choose from a plethora of body-building specialty grains. There are also a fairly large variety of malt extracts available such as Maris Otter, Vienna, Munich, Pilsner, amber, pale, and many various dark extracts. Some manufacturers even provide the exact grist profile of the mash used to produce the malt extract.

ELIMINATE THE MASH?

The first obvious time-saving element is realized by eliminating the mash from your brew day. Even partial mash brewers will save time and effort since heating water for, say 2 lbs. (0.9 kg), is going to be much faster than several gallons of strike water. Partial mashes can be performed in a saucepan or small insulated water cooler on the side while water in the main brew pot is heating. For those recipes that don't require a mash, just steeping grains, the steeping process can be conducted while the water comes up towards a boil, but I'll always remove the grains when the water gets to 170 °F (77 °C).

ELIMINATE THE BOIL?

Boiling is optional, although at least a pasteurization step should be performed. That means that heat requirements can be greatly reduced and subsequent chilling can be hastened with water consumption reduced. Boiling is performed for three main reasons: Sanitation, reduced dimethyl sulfide (DMS) levels, and to add bitterness from hops. A pasteurization step would take care of sanitation, DMS is not an issue with malt extracts, and hops can still add some bitterness if enough are added. There is a caveat here, the isomerization process of alpha acids from hops will be minimal unless the wort is heated to near-boiling. So unless you can find some pre-isomerized hop extract, I would not suggest brewing, say, a German Pilsner with a firm bitterness using this no-boil technique. But a brewer could conceivably bring the water to 170 °F (77 °C) (with steeping grain if so desired), stir in the malt extract and hops and/or other spices, let sit for 15 minutes, then chill, transfer into fermenter, and pitch yeast — think zero-IBU IPAs here! You could conceivably have 5 gallons (19 L) of wort ready to be pitched in an hour depending on heating and chilling capabilities.

Unfortunately I hear it time and again from all-grain brewers: "I just don't have the time to brew." The reality is that you most likely do have time if you expand your range of brewing techniques to include brewing with malt extracts. Do yourself a favor and give extract a try. You may find that you end up extracting yourself from your exclusive all-grain brewing ways and brew more often as a result.

BYO SOCIAL MEDIA

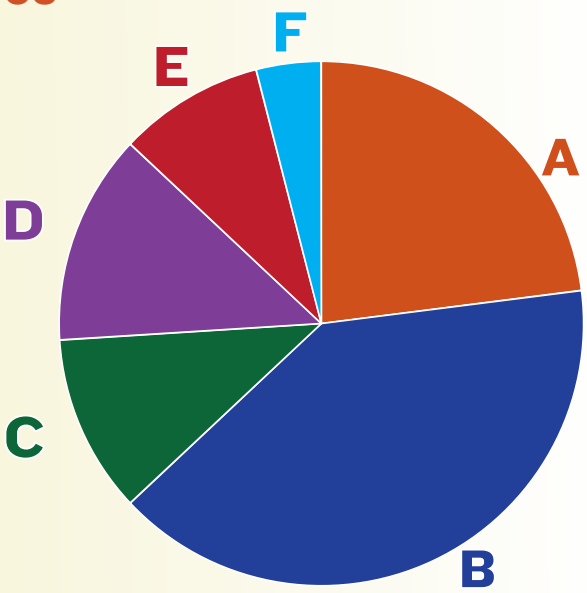
THE QUESTION OF THE DAY

"WHAT IPA STYLE APPEALS TO YOU THE MOST?"

We posed that question to our followers on Facebook, Twitter and Instagram:

**we added in f as an answer post-facto based on "write-in" results*

40% — B. firmer bitterness, clearer, strong American hopped examples
23% — A. softer, "juicier", hazy, strong American hopped examples
13% — D. traditional English style examples
11% — C. aromatic session IPA examples
9% — E. other (black IPA, white IPA, etc.)
4% — F. pass, thank you



CALENDAR

DECEMBER 1
PENNSYLVANIA HOMEBREW OPEN COMPETITION
Bellefonte, Pennsylvania

Organized by the State College Homebrew Club, the 4th annual Pennsylvania Homebrew Open will be accepting entries through December 1. This is a BJCP certified, AHA sanctioned competition and all entries need to be crafted at home by someone 21 years or older. You only need to register once online but can enter multiple beers and pay for the $8 entry fee online. Judging takes place on December 8 in Bellefonte, Pennsylvania. Brewers are not limited to one entry in each category but may only enter each subcategory once. The Best of Show judging will be determined by a Best of Show panel based on a second judging of the top winners. To learn more or to enter visit www.pahomebrewcomp.com.

DECEMBER 8
BIG BEERS, BELGIANS & BARLEYWINES HOMEBREW COMPETITION
Vail, Colorado

The Big Beers, Belgians & Barleywines Homebrew Competition is just one part of the 19th Annual Big Beers, Belgians & Barleywine Festival. A batch of the Grand Prize winner's recipe will be brewed and poured at Dry Dock Brewing, located in Aurora, Colorado. In addition, Falling Rock Taphouse will serve the beer during GABF week. The entry fee is $8 and three bottles are required per entry. Entries must be received by December 8. The festival, held January 10–12, 2019 also includes a brewmasters' dinner and seminars by some of the world's most innovative brewers. For more, visit www.bigbeersfestival.com.

DECEMBER 9
BIG BEER BONANZA HOMEBREW COMPETITION
San Antonio, Texas

Hosted by the San Antonio Ceveceros, in collaboration with Künstler Brewing, the Big Beer Bonanza entries start with an OG of 1.085 and go up from there. The winner of the competition will have the opportunity to brew their recipe on a pro system. Only one entry is allowed per person and there are guidelines on the recipe design so be sure to check with the event website prior to entering. Entries must be received by December 9 and judging takes place on December 11. All entries must be hobbyists 21 years or older. Three 22-oz. bottles must be submitted per entry and each entry will be judged by a panel of up to 25 members. For more information on entering your homebrew, visit www.eventbrite.ie/d/tx--san-antonio/beer-events.

BYO WHAT'S NEW?

CHUGGER X-DRY (XCPSS)

Brewers who utilize enclosed centrifugal magnetic impeller pumps (popular due to their heat and acidity tolerance) in their brewing system always run the risk of burning out their pump if they accidentally run the pump dry. Chugger Pumps has launched the first centrifugal magnetic impeller pump that can be run dry without causing major damage to the motor. Using USA-made, FDA-approved carbon bearings in the impeller means that homebrewers don't need to be quite so hypervigilant when the pump is running. Chugger doesn't recommend running the pump dry . . . but you can. Otherwise, this pump utilizes the same components that have made Chugger Pumps a standard in the homebrewing world. The Chugger X-Dry pump line starts at $160 (USD) for the inline model with ½" MPT connections. There are currently 3 models in the X-Dry line and more to come. To learn more or to purchase, visit www.chuggerpumps.com.

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REPLICATOR

BY MICHAEL BURY

DEAR REPLICATOR, When I moved from Vermont to California back in 2005, the one beer that I missed right away was Long Trail Ale. It's a beer that has never been available out here and I still feel nostalgic, for this was my first craft beer "love-affair." I've had it a few times since the move, when coming back to visit friends and family, and still enjoy it every time. Now that I've finally got all my gear lined up and ready to brew my first batch of homebrew, I figured this would be the perfect beer to try to mimic. Can you help a nostalgic fan out?

Chase Allstadt
Truckee, California

Thanks for the request Chase! I'm sorry that since your move from the East Coast to California you've only had a few chances to taste the deliciousness that Long Trail Brewing Company provides, but you're in luck while everyone else is in for a treat.

Long Trail Brewing Company had its humble start nearly 30 years ago in the Old Woolen Mill basement, but were called the Mountain Brewers. They were the second craft brewery to open in Vermont after Catamount Brewing Co. Their goal in Bridgewater Corners, Vermont was to brew an affordable, American-made alternative to the expensive European exports that dominated the shelves at that time. Their first response happens to also be their flagship beer: Long Trail Ale, an altbier. To keep the cost of production low and the value of sustainability high in the early days, they choose to recycle and reuse old Beck's and St. Pauli Girl bottles. Although the times have changed, Long Trail still believes in sustainable brewing practices including the use of recyclable aluminum cans and minimizing water consumption to be leaders in environmental stewardship.

Due to the Mountain Brewers success with Long Trail Ale and their connection with hikers of said trail (the original long-distance hiking trail in the United States), they decided to change the brewery's name and Long Trail Brewing Company was born! With continued success and a thirsty customer base (hiking burns a lot of calories after all), Long Trail had to say good-bye to their 8,000-barrel per year operation in the basement. So, they did what many of their customers did; they took a hike up the road in 1995 to establish a new base of operations where they currently reside.

Long Trail Brewing has been intimately involved with their community from the beginning. As they've grown, so too have their ambitions to give back. Every year they partner with local non-profit organizations to sponsor events like the Century Ride, which is a 100-mile bike ride fundraiser that benefits Vermont Adaptive Ski & Sports — an organization that promotes participation in various recreational activities, such as skiing, for those youth and adults with disabilities. They also created their Summer Fruit Series of beers, which sources the fruit from local, Vermont farmers in a sustainable manner. One example being their 2018 Maple Rhubarb Golden Ale. Finally, they also brew smaller batches of beer as fundraisers for different organizations. One is Trail Karma, a session IPA, which features a special blend of hops. Its proceeds go towards research efforts to find a cure for ALS (Lou Gehrig's disease).

Their brewhouse is also quite unique and has a bit of homebrewing roots in it. First off, it's partly engineered in-house and features a 60-BBL direct-fire propane kettle, unlike many modern brewhouses that feature steam-jacketed kettles. In fact, they do see extra caramelization during the boil akin to what many propane fueled homebrewers will get (my apologies to the induction and electric brewers out there). The second super interesting aspect of the brewery itself centers on the yeast. While they use a fairly common yeast as noted in the recipe, they've been continually cropping it for close to 30 years!!! According to Ian Harbage, who's one of the head brewers, they've never re-propagated it.

Long Trail Ale, which has won multiple awards at GABF, is considered an altbier with several unique twists to it. First off, you'll notice there is wheat malt in the grist, which helps provide additional body to the beer while maintaining its drinkability. Next up is the use of a relatively neutral English ale yeast in a German style of beer while performing the fermentation at the lower end of its temperature range. Finally, for authenticity, Long Trail ferments the beer under a back pressure of 8 psi (55 kPa). This will further reduce the characterful fermentation compounds such as esters that you get with many English ale yeast strains, but also can create additional diacetyl. Feel free to let the fermentation free rise for the last one-third of the fermentation (if you have a spunding valve that is the time to use it). For the rest of us, including myself, give-it-a-go without it and see what results you get. Alternatively, you could use a relatively clean German strain such as Wyeast German ale (1007) to attempt to mimic the fermentation character. With any luck, you should be able to brew an amazing facsimile of Long Trail Ale that may become a house staple, even in California.

LONG TRAIL BREWING CO.'S LONG TRAIL ALE CLONE

(5 gallons/19 L, all-grain)
OG = 1.052 FG = 1.016
IBU = 30 SRM = 14 ABV = 4.8%

INGREDIENTS

9 lbs. (4.1 kg) 2-row pale malt
1 lb. (0.45 kg) crystal malt (80 °L)
12 oz. (0.34 kg) wheat malt
1.6 oz. (45 g) chocolate malt
5.4 AAU Northern Brewer hops (60 min.) (0.6 oz./17 g at 9% alpha acids)
2.7 AAU Northern Brewer hops (30 min.) (0.3 oz./8.5 g at 9% alpha acids)
2.75 AAU Willamette hops (5 min.) (0.5 oz./14 g at 5.5% alpha acids)
Wyeast 1187 (Ringwood Ale) or White Labs WLP005 (British Ale) or Safale S-04 yeast
¾ cup corn sugar (if priming)

STEP BY STEP

Mill the grains, then mix with 3.4 gallons (12.8 L) of 166 °F (74 °C) strike water to achieve a single infusion rest temperature of 151 °F (66 °C). Hold at this temperature for 60 min. Mashout to 170 °F (77 °C).

Vorlauf until your runnings are clear before directing runnings to your boil kettle. Batch or fly sparge the mash to obtain 6.5 gallons (25 L) of wort. Boil for 60 minutes, adding hops at the indicated times left in the boil. At 15 minutes left in boil, add either Irish moss, Whirlfloc, other kettle fining agent of your choice to the wort.

After the boil, whirlpool for a couple of minutes and allow the wort to settle before rapidly chilling the wort to slightly below fermentation temperature, which is 66 °F (19 °C) for this beer. Pitch yeast.

Maintain fermentation temperature to avoid too many esters, which can easily occur with this strain. You may need a diacetyl rest for this strain so don't hesitate to raise the temperature of the fermentation at least 4 °F (2 °C) during the last third of fermentation. Bottle or keg the beer and carbonate to approximately 2.6 volumes.

LONG TRAIL BREWING CO.'S LONG TRAIL ALE CLONE

(5 gallons/19 L, extract with grains)
OG = 1.053 FG = 1.013
IBU = 30 SRM = 14 ABV = 5.2%

INGREDIENTS

5 lbs (2.27 kg) light dried malt extract
12 oz. (0.34 kg) crystal malt (80 °L)
8 oz. (0.23 kg) maltodextrin powder
1.6 oz. (45 g) chocolate malt
5.4 AAU Northern Brewer hops (60 min.) (0.6 oz./17 g at 9% alpha acids)
2.7 AAU Northern Brewer hops (30 min.) (0.3 oz./8.5 g at 9% alpha acids)
2.75 AAU Willamette hops (5 min.) (0.5 oz./14 g at 5.5% alpha acids)
Wyeast 1187 (Ringwood) yeast or White Labs WLP005 (British Ale) or Safale S-04 yeast
¾ cup corn sugar (if priming)

STEP BY STEP

Bring 6.5 gallons (25 L) of water to roughly 150 °F (66 °C). Steep the chocolate and crystal malts for 15 minutes before removing. Add the DME and maltodextrin, with stirring, before heating to a boil. Boil for 60 minutes, adding hops at the indicated times left in the boil. At 15 minutes left in boil, add either Irish moss, Whirlfloc, other kettle fining agent of your choice to the wort.

After the boil, whirlpool for a couple of minutes before rapidly chilling the wort to slightly below fermentation temperature, which is 66 °F (19 °C) for this beer. Pitch yeast.

Maintain fermentation temperature to avoid producing excess esters. You may need a diacetyl rest for this strain so don't hesitate to raise the temperature of the fermentation at least 4 °F (2 °C) during the last third of fermentation. Bottle or keg the beer and carbonate to approximately 2.6 volumes.

TIPS FOR SUCCESS:

This amber beer is all about balance without sacrificing either the depth of flavor or drinkability. For the ingredients to really shine, ensure that you're using the freshest versions of them possible. In addition, aim for gypsum and calcium chloride water additions to hit 247 ppm and 100 ppm, respectively. As is the case with most British ale yeasts, you'll probably pick up a bit of diacetyl, so don't be afraid to perform a diacetyl rest. When in doubt, microwave a beer sample for 30 seconds, which will volatilize any aromatics including 2,3-butanedione. BYO

BY DAVE GREEN

SPICING UP BEER

Learn ways to jazz up your beer

Some beer enthusiasts just shake their heads when they see a brewery turn out a beer that has been spiced up with non-traditional ingredients. But for the more adventurous craft beer-lover, they look forward to the experience like they would an ethnic dinner. If you're in the latter group, read on because we got two of the world's top culinary-inspired brewers to talk about ways to spice up your homebrew.

There are some great complementary pairings like nutmeg in dark beers, especially dark brews with cocoa and chocolate notes, and some really tropical peppers like fatali and habanero in fruit beers. Contrasting pairings like Belgian dubbel with star anise I have also seen work. Star anise, for me, is often used in very savory dishes, but I really liked it in a sweet dubbel. Go with those complementary pairings and it can really work, contrasting pairings can be hit or miss.

Adding whole bean coffee with green chili post-ferment is a really good combo. If you have just a single day of contact time, you can get a beer with a chili skin aroma and some of the really interesting nutty notes of whole bean coffee that is really amazing.

We did a beer called Stone San Diego Dry-Rub IPA that used dry-rub spices with a peachwood smoked malt and it reminded you of really tasty barbecue that has just enough dry-rub and smoke to give you that flavor in every bite, but not overpower. It used coffee, coriander, honey, and pasilla peppers, all ingredients I use in my dry-rub.

Top Chef Season 13 I made two 6-barrel batches of beer I was really proud of. The first was a traditional Belgian golden ale with 6 lbs. (2.7 kg) of tamarind in the mash, 3 lbs. (1.4 kg) of powdered ginger in the whirlpool, and 2.5 lbs. (1.1 kg) of jalapeño post-filter. The second was a take on a golden stout, which I called a red stout, with 30 lbs. (13.6 kg) of very red peeled beets, 6 lbs. (2.7 kg) of Dark Horse coffee roasters Ethiopian both in the mash, plus 6 lbs. (2.7 kg) of chocolate and 2 lbs. (0.91 kg) of Ras el Hanout in the whirpool. Ras el Hanout is a Mediteranean spice blend used in Moroccan cuisine. Both beers were really balanced and all the spices and vegetables really came out but nothing overpowered anything else. It was a ton of fun.

As much as it is used out there, coriander is one that is a little misunderstood. The amazing thing about that spice is that it can be sometimes floral, sometimes spicy, sometimes intensely cilantro, sometimes even woody, and it can substitute for a lot of other things. If you have a really floral batch, it can have amazing synergy with hoppy beers, if spicier, it can have some black pepper notes that are really interesting in barrel-aged Belgian beers. On the flip-side, I really can't stand cloves in beer. Yeast-derived clovey-flavors are fine, but the addition of cloves just so easily overpowers everything. I love to cook with fresh Masala and I always leave the cloves out. It just leaves the curry way too sweet otherwise.

Bench trials are a great technique that all brewers can utilize — it's how I developed Stone Tangerine Express IPA! Blending fruits and hops in a dozen brews and seeing what worked! Best way to do it in my mind is to add about 6 grams of a spice to a 22-ounce bottle of beer, cap, and then do the same with 1.5 grams. That is the rough equivalent of 0.5-lb. and 2-lbs./bbl respectively, giving you some different levels. Store cold for 3 days. Serve those with a no-spice control then blend together to achieve the, "baby bear" level of spice, getting it just right!

Go with those complementary pairings and it can really work, contrasting pairings can be hit or miss.

Steve Gonzalez started homebrewing in 1991 and brewed his first all-grain lambic-style beer in 1993. Steve began brewing craft beer professionally way back in 1995 in northern California. He currently manages the pilot brewery, barrel warehouse, cask ale program, and Stone Brewing Co.'s Napa, California brewing operation, developing such notable beers as Stone Tangerine Express IPA and Yardhouse/Aviation/Stone Liquid Compass Double IPA.

Andrew Bell has been with The Bruery since 2012. His job title is Innovation Manager for The Bruery, Bruery Terreux, and Offshoot Beer Co. Day-to-day responsibilities include recipe design and development, raw material evaluation and procurement, and managing their 3-bbl Pilot Plant and its 14 fermenters.

Also watch out for extracting spice tannins during the boil and adjust your hop bitterness accordingly.

When it comes to finding a good beer–spice combination, unless it is something small like a cask or a randall, we are almost always thinking of a final flavor profile for a cohesive concept. In other words we do not just make *"base beer with XX spice"* — instead we are looking to make a beer that tastes like horchata or a mojito or gingersnap cookies or even barbecue sauce (not one of the better ideas) among other things.

I have many favorite spicing combos. Coriander usually fits in well with most Belgian ales — especially at a threshold that is just below being able to identify it as a spice addition (or at least coriander specifically). Certain types of cinnamon at a certain level goes well with many dark and decadent styles (especially if they are barrel-aged) but can be quite polarizing at higher amounts (people have a very big tolerance range for cinnamon). While it might be debatable about whether it is a spice or not: We have a pretty nasty vanilla habit (spending-wise) and we use it very, very frequently. It really accents anything you want to taste perceived sweet or decadent. We use it almost 100% of the time we use cacao, and in many other applications where we are looking for "creamy" or "pastry-like" flavors. If there is one spice I've found I can't stand in beer, it is kaffir lime leaves — it just tastes like Windex/chemical to me at any level. I love it in Thai food, but hate it in beer. It also stains draft lines really badly (worse than chili peppers, lavender, and coffee, which are all offenders as well as far as tainting draft tubing).

Bench trials are something we perform regularly — especially with spices we do not use frequently. For the smallest trials we use purged growlers or crowlers to add ingredients to the beer, then seal and let it sit (cool/cold) for a week before trying. On a larger scale, we have "treatment kegs" as we call them, which are basically the Sabco homebrew brite tanks (aka a ½-bbl keg with a 4-in./10.2-cm tri-clamp removable spear). Beyond that we have a very extensive 3-bbl pilot system that we trial beers on before scaling to our bigger 30-bbl system. Here are some very important reminders:

1. Try to emulate the dosage rate, processing and most importantly contact time that you would do when scaled.
2. Keep notes or a database of what you've tried before and associate that dosage rate with an intensity scale.
3. You have to keep in mind that various beers are more delicate/robust bases than others (e.g. the spice rate for a barrel-aged imperial stout will be different than the dosage rate for a session-strength blonde ale).

The timing of a spice addition really depends on the beer, the concept, and the herb/spice. A lot of spices have volatile oils that can be blown off during the boil or fermentation — but many do not — so it is a bit of trial and error (or looking up what flavor compounds make up various spices). Usually if it is a more delicate spice, cold-side additions carry the flavor better, but more robust spices are fine late boil or in the whirlpool. You might even be able to get away with less spice using it hot side, but you might lose nuances from the spice. Also watch out for extracting spice tannins during the boil and adjust your hop bitterness accordingly.

Understanding that the flavors of different varieties of spice are not the same is key. As an example, "cinnamon" can come in many different varieties: Cassia, Korintje, Saigon, Ceylon, etc. and impart vastly different flavors. Some differences can be as stark as different types of peppers or hops or coffee or cacao origins. Think tomatoes in cooking — so many varieties that you do not use interchangeably let alone processing methods: Green, ripe/fresh, sun dried, canned, etc. Same thing with vanilla and its varietals and origins; then there is coriander, mint, sage, oregano, cardamom, even lavender — there can be huge differences in all of these.

I'll finish with one of the weirder, more esoteric beers we produced. We brewed the beer a couple years ago and melded dried candy cap mushrooms into an imperial stout — very cool maple-like character from the aromatic compound sotolon found in them. You won't know until you try! BYO

BY ASHTON LEWIS

HOP SHELF LIFE

Also: Keg-conditioning beer and planning a nano's cellar

Q I OFTEN FIND MYSELF BUYING HOPS BY THE POUND . . . OF LAST YEAR'S CROP. I FIND THESE HOPS STILL TO HAVE PLENTY OF AROMA AND CHARACTER AND OFTEN CAN FIND THEM DISCOUNTED. I VACUUM SEAL MY HOPS AND WILL USE FOR ANOTHER YEAR, SOMETIMES TWO. IS THERE A REASON I SHOULD BE BUYING THE NEW CROPS OR ARE LAST YEAR'S CROPS "GOOD NUFF" IN YOUR OPINION? ALSO, HOW LONG CAN PROPERLY STORED HOPS REMAIN FAIRLY FRESH?

LIZ PARK
BOSTON, MASSACHUSETTS

A This is a great question and brings up several things that need to be considered because hops do age when stored, and using hops that are past their prime for brewing is not the best plan for brewing great beer. Let's start with when hops are harvested and what the date on the package really means. Northern hemisphere hops are generally harvested in the month of September and Southern Hemisphere hops are generally harvested in March. When hops are harvested, they are quickly kiln-dried, baled, and put into storage. Most hop processors these days store hops cold to slow the aging process. Some brewers use these whole, compressed cones, but most use pelletized hops in the brewing process.

Hop processors typically want to process the current year's crop while the weather is cool, meaning that Northern Hemisphere hops harvested in 2018, for example, will all be pelletized by about March of 2019. In an effort of continual improvement, many newer processing plants are designed to shorten the pelletizing window to 3 months. Suffice to say, the freshest pellets available from the Northern Hemisphere start to debut in the early part of the year following harvest, and the freshest pellets from the Southern Hemisphere come into the market in late summer to early fall of the year they are harvested. This can be a little confusing, and it may seem like the freshest hops are "old" because the harvest date for Northern Hemisphere hops are always at least one year behind the brewing date.

What happens during hop processing is critical for hop freshness. Bales of cones are unpacked, put through a machine called a bale breaker, milled into a coarse grist, blended for consistency, pelletized into little cylinders, cooled, and then packaged into a bag. The goal in this process is to minimize heat during the pelletizing process and to pack the little pellets in a bag containing as little air as possible. Some processors use vacuum sealers and others use bags that are flushed with nitrogen gas. Barrier films, made using metal foils, are used for the bags because oxygen will gradually migrate from the atmosphere into the bag if the packaging film has no oxygen barrier properties. If you can see the hops in the bags on the shelves or in your home freezer, you are not looking at a barrier film. Look for hops packaged in foil bags if you want maximum shelf life.

One thing to note about packaging is how the package feels when massaged. At one time, nearly all pellets were vacuum packed and the packages were very hard, and a soft bag was a sign of a leaking seal or a punctured bag. However, vacuum-packed bags are more prone to damage because their firmness makes them relatively easy to puncture. Nitrogen-flushed bags are soft to the touch and are not as easy to

Using the best modern processing methods and barrier-film bags, hops can be stored for 3-5 years without substantial losses in brewing value.

Photos courtesy of BSG CraftBrewing

A hop pellet portioner allows processors to weigh out the pellets to ready them for packaging after they have been pelletized.

After sorting the hop cones from plant material, the hops are compressed into bales. The bales are split using a bale breaker machine pictured here.

damage. The point is that soft bags have become the norm.

All of this discussion is building up to the elephant in the room; shelf life. Hop processing facilities are geared to produce pellets for commercial breweries and most of this production goes into 5-kg, 10-kg, and 20-kg (11-lb., 22-lb., and 44-lb.) bags. Using the best modern processing methods and barrier-film bags, hops can be stored for 3–5 years without substantial losses in brewing value. But most of the hops sold to the homebrewing market have either been repackaged into smaller bags, often times with no barrier properties, or they have been packed into smaller bags at the processing plants using fillers that do not have all the bells and whistles of the high-capacity lines. In other words, hops sold into the homebrewing market are best used before the next crop of hops become available. And if you have the choice between buying repackaged hops that are sold in clear bags or hops packed by the processor in foil bags, opt for the latter.

Homebrewing is a hobby, and most homebrewers strive to brew the best beers possible. Most of us can buy beer for less than it costs to brew at home when all costs, including the value of free time, are considered. Buying last year's crop from the value aisle and repackaging using a home vacuum sealer seems like a thrifty option, but may not be the best place to reduce the cost of brewing. Thanks for the great question and hoppy brewing!

Q I WAS WONDERING HOW LONG I SHOULD BE LEAVING MY BEER IN THE KEG BEFORE I DRINK IT. I KNOW SOME PEOPLE FORCE CARBONATE AND DRINK WITHIN 24 HOURS BUT SURELY, THEY MUST BE DRINKING GREEN BEER. WHEN BOTTLING, I USUALLY ALLOW TWO WEEKS IN THE FERMENTER THEN AT LEAST TWO WEEKS IN THE BOTTLE BEFORE TASTING. SHOULD THE SAME RULE APPLY TO KEGGING AND WOULD THE BEER CONDITION BETTER IF THE KEG WAS LEFT AT CELLAR TEMPERATURE RATHER THAN BEING KEPT IN THE FRIDGE?

ANTHONY HOSKINS
STAVANGER, NORWAY

A Anthony, the short answer to your question is that it depends on when the beer was filled into your keg. In order to answer this question, a bit of background is required, so hang tight for a bit of review. There are many ways to go about managing the fermentation and aging process, but all methods share the same basic phases. Primary fermentation is generally quick, a bit raucous, especially when fermenting ales, and aromatic. This is when wort gravity falls from its original value at the onset of fermentation to a few ticks above the final gravity, yeast cells multiply and sometimes flow out of the fermenter along with carbon dioxide gas, hop and yeast aromatics, and bits of cold-break trub, and fermentation flavor compounds are synthesized. The young, sometimes rough, beer present in the fermenter at the end of primary is "green beer."

Prior to the ubiquitous use of the uni-tank process, green beer was racked into some sort of vessel for aging. Lager brewers typically would rack beer from the primary into a lagering vessel for flavor maturation, clarification, and carbonation. One of the most reliable methods to accomplish these various goals was to blend green beer from primary with a bit of actively fermenting beer, so-called kräusen named after the high kräusen stage of fermentation, and allowing this mixture to age in a closed vessel for a period of weeks to months. Kräusening is still used today to produce traditionally brewed lagers by brewers small and large.

Traditional ale brewers did not kräusen their cask-conditioned ales, but the process is similar in many respects. Green ale, priming sugar, finings, and oftentimes hops, go into casks where the mixture rests and matures. During a 1–2 week rest, the cask comes into condition as the priming sugar is consumed by yeast, yeast and haze material settle to the bottom of the cask with the aid of finings, and hop aromas from the dry hop addition infuse into the maturing ale.

> **Judge the outcome of your ferments by time, attenuation, and beer flavor before getting too caught up in comparing your brews to textbook graphs.**

At the end of both of these aging periods, the result was beer in a ready-to-drink state. Although these traditional methods are still used, a substantial volume of beer these days is fermented and aged in a single vessel, and the processes used for ale and lager brewing are often indistinguishable aside from the yeast strains employed

for fermentation and the times and temperatures used for the process. This means that beer can be fermented, carbonated, and aged in a single vessel, then transferred to a keg or bottle for easy storage and transport to the point of use. Not all brewers carbonate their beers in the fermenter, and a common variation on the uni-tank process is to move beer from the fermenter into a second vessel where the beer can quickly be carbonated before packing.

The point is that a quick carbonation process in a keg followed by immediate consumption is not necessarily synonymous with drinking green beer. If 3-day-old ale was racked into a keg before final gravity were achieved and before the beer had a proper diacetyl rest, immediately chilled, forced carbonated, and put on draft, then a pint of green beer would indeed be served; the missing portion of this abbreviated brewing process is beer maturation.

The old-school homebrewing norm is to ferment, age, and bottle with priming sugars for bottle conditioning. This method is greatly aided when flocculent yeast with good settling properties are used, and the maturation period can be conducted in the bottle provided sufficient aging times, healthy yeast, and moderate temperatures. Bottle conditioning is really just a variant of kräusening and cask conditioning. And of course, if your bottle is a bit larger in size, made of stainless steel, and referred to as a keg, this same process is named keg-conditioning.

If the keg in question, the one you just filled and are contemplating the merits of aging for a week or two versus tapping today, contains beer that was fermented to dryness, given a proper diacetyl rest, cooled to near 32 °F/0 °C and held for several days to improve beer clarity (or not if you are not after clear beer), and carbonated to the desired level, it can be consumed whenever. But if the keg in question was filled with green beer as soon as primary fermentation finished and is being held at moderate temperatures to allow for in-package maturation, then it should be treated like your bottle-conditioned beers.

HELP ME, MR. WIZARD

Q I AM PLANNING TO OPEN AN ALL-ORGANIC NANO BREWERY, MUTT LAB BREWING. THE SYSTEM I'M ENVISIONING IS ECONOMICAL, RELATIVELY SIMPLE AND PORTABLE. I'M ENVISIONING BREWING 6 BBLS OF WORT, SPLITTING INTO TWO DIFFERENT 3-BBL BATCHES OF WORT, AND FERMENTING IN NON-JACKETED, PORTABLE 3-BBL UNI-TANKS. I'LL ROLL THESE INTO THE COOL BOX FOR FERMENTATION, THEN TO THE COLD BOX FOR CONDITIONING AND SERVING.

THE DIVIDED COLD/COOL BOX IDEA YOU INTRODUCED IN THE JANUARY-FEBRUARY 2018 ISSUE'S "NANOBREWING" COLUMN SEEMS INCREDIBLY FLEXIBLE AND VERY APPEALING TO ME. I WANT TO ASK YOU ABOUT FERMENTING IN NON-JACKETED 3-BBL TANKS (WITHOUT COILS) AMBIENTLY IN THE COOL BOX. I'M REALLY HOPING THE SMALL VOLUME ALLOWS FOR SUFFICIENT TEMPERATURE REGULATION BUT I JUST DON'T KNOW. COULD YOU LEND ME SOME OF YOUR INSIGHT ON THIS?

JOHN HOOVER
MUTT LAB BREWING
SAN GABRIEL, CALIFORNIA

A The method of fermentation described above works with fermenters over a fairly wide range of sizes, mainly depending on the shape of the fermenter. The dissipation of heat from the fermenter into the air of the fermentation cellar (commercial lingo for a special room for fermentation and aging) is a function of surface area, temperature differential between the beer and the surrounding air, and the heat transfer coefficient of the fermenter walls.

A fairly extreme example of large, non-jacketed fermenters are the shallow, 100-BBL, open fermentation vessels used by Anchor Brewing for their Steam Beer fermentation. The wort for this beer is cooled below the maximum fermentation temperature and the fermentation allowed to rise in temperature over time. The peak fermentation temperature for beer fermented in non-jacketed vessels is a function of initial wort temperature, vessel shape, cellar air temperature, wort original gravity, and yeast strain. Although this method takes some time to dial in the process, reproducibility among successive fermentations can be achieved once a procedure is established.

There are a few key things to consider when using non-jacketed fermenters because you are giving up individual control over your fermentations. Here are a few pointers that I hope will be helpful for your nanobrewery:

Tip #1: Set your cellar temperature around the yeast you are using for the beer(s) currently being fermented. For example, if the goal is to keep the peak temperature less than 75 °F/24 °C, your cellar temperature should be set to a cooler temperature, probably around 68 °F/20 °C, and the wort should be cooled to about 61 °F/16 °C to achieve the fermentation temperature curve that works for the style(s) of beer being brewed. Beer styles like saisons benefit from warmer peak fermentation temperatures than do Scottish ales, so plan your brews accordingly and change the cellar temperature as required.

Tip #2: Buy a hygienic temperature probe and measure the temperature at different points within your fermenter. Uni-tank fermenters have short thermowells with an insertion length into the tank ranging from 6-12 inches, so most brewers really have no idea how warm their fermentations become during peak activity. This data gap and general lack of appreciation about the limitations of short thermowells, leads many brewers who use uni-tanks to believe that they have very consistent temperatures during fermentation; the fact is that there are temperature gradients within tanks from top to bottom and from the perimeter to the center. This means that using a probe to get a feel for what is happening within your tanks may lead you to believe your fermentation temperatures are too variable because much of the data about fermentation temperature is limited to where probes in uni-tanks are located. Judge the outcome of your ferments by time, attenuation, and beer flavor before getting too caught up in comparing your brews to textbook graphs.

Tip #3: Yeast management is important in all types of fermenters, but is especially important when fermenting in non-jacketed vessels. Minimizing flavors associated with yeast autolysis by periodically removing settled yeast from cone bottoms is a technique that definitely should be considered when using tanks without cooling. Yeast skimming is another method that could benefit these fermentations, especially when using top-cropping ale strains in open fermenters.

Tip #4: Don't force this technique on all beer styles. Beers fermented in non-jacketed vessels are likely to have different ester profiles than beers fermented in temperature-controlled tanks. So enjoy the cost savings of this method by knowing when to back off of certain styles. And you may find that some styles simply don't work well with this method.

Tip #5: Design beers around your brewery and let people know what you are doing. There is a marketing story about this method that may resonate with your pro-organic consumers; all beer was fermented in non-jacketed fermenters prior to modern times and this method has a throw-back feel to it. In an increasingly crowded market space, this sort of differentiation is terrific when the method adds its own notes to the beer. Own it and market it! BYO

Have you got a question or are you looking for advice in your homebrewery or nanobrewery? Send an email to wiz@byo.com and maybe it will appear in the next issue of BYO.

BY GORDON STRONG

OATMEAL STOUT

A beer once considered a health food

The main effect from oats is an increase in body and mouthfeel of beer, and often a certain smoothness of texture.

OATMEAL STOUT BY THE NUMBERS

OG:	1.045–1.065
FG:	1.010–1.018
SRM:	22–40
IBU:	25–40
ABV:	4.2–5.9%

Photo by Charlie A. Parker/Images Plus

I find it amusing to look at historical advertisements for beer, and to imagine how government regulators would look at them today. All sorts of bold claims used to be made, including the famous, "Guinness is Good for You." There was even a time when beer was marketed as health food. Oatmeal stout from England is one of the prime examples of that trend. Try doing that today . . .

Oats are a common cereal grain that is perhaps most famous as a warm breakfast cereal, especially for those looking to increase fiber in their diet. Oat bran was popular for a while due to health claims of lowering cholesterol, although it now is often shunned due to those with real or perceived gluten intolerance.

In brewing, oats are a starchy adjunct that can be added to the grist. Without enzymes, the oats need to be mashed along with malt. Sometimes oat malt can be found at your homebrew supply shop, and it is used in some beers (notably Maclay's Oat Malt Stout), but flaked or rolled oats are the more common form for brewing today. Simpsons Golden Naked Oats (GNO) are another form that brewers will find and is classified as a crystal malt.

Depending on the concentration, oats can add noticeable flavor to beer. However, the main effect from oats is an increase in body and mouthfeel of beer. Sometimes associated with a silky mouthfeel, they can be easier to use for some brewers than manipulating body and mouthfeel through mash control.

In the US today, I think oats are more likely to be found in a beer like New England IPA than in oatmeal stout, which is regarded as somewhat of a specialty or sometimes seasonal style by many consumers. Even in more traditional IPAs, oats can be used to add mouthfeel in a beer that is otherwise very dry.

The Beer Judge Certification Program (BJCP) places oatmeal stout in Category 16, dark British beer, as style 16B. Other members of this category are sweet stout, tropical stout, and foreign extra stout.

HISTORY

Oats have historically been used as an adjunct in brewing in Scotland and England for hundreds of years, but the development of oatmeal stout as a distinct type of beer was more recent. Oatmeal stouts originated in England in the late 1800s as part of a general market demand for "nourishing" or healthy beers, often marketed at invalids, nursing mothers, or others looking for some nutrition as part of their beer consumption.

The style followed the development of sweet stouts (also known as milk or cream stouts) but were not derived from them — oatmeal stouts do not typically contain lactose. Rather, they were both trying to address a similar market. Sweet stouts were certainly on the market first, however.

In later times, after the start of World War I at least, some breweries began exploiting the health link to the type of beer by only using a small portion of oats in a larger parti-gyled brew so they could legally call any product of the batch an oatmeal stout. There was no minimum amount of oats required to be in the grist. The time between the World Wars was the height of popularity for the style in England, but it eventually declined as part of the general shift away from darker beers in England and in the lowered gravities associated with taxation.

Michael Jackson wrote about the style in his books in the 1970s and 1980s, which helped generate new in-

terest. The beer importer and distributor Merchant du Vin convinced Samuel Smiths into reviving the style for export. This then caused it to be noticed more by the emerging American craft brewing industry, and it has now been revived as a popular style using a noticeable amount of oats.

The Samuel Smiths Oatmeal Stout remains a great example from the UK, while my favorite US version is Anderson Valley Barney Flats Oatmeal Stout. The style also helped launch several variants such as Founder's Breakfast Stout and its many progeny.

SENSORY PROFILE

Oatmeal stout is a dark, full-bodied, roasty, malty ale with a complementary oatmeal flavor. The sweetness, balance, and oatmeal impression can vary considerably. Some versions are dry and grainy, while others can be sweeter and fruitier. Some take after the original English versions, while others are hoppier and more American in character (in base malt and yeast profiles, at least).

As a type of stout, oatmeal stout should be dark (medium brown to black, often opaque). A thick, creamy, persistent tan to brown head is typical. The color of the beer and foam is suggestive of the ingredients used in the beer. Stouts also tend to be fuller bodied, and the oatmeal stout is no different. The oats can give the beer a smooth, silky, velvety, creamy texture. A moderate carbonation level keeps the beer from being too heavy. The alcohol level in ABV ranges from the low 4% to nearly 6%, but around 5% is fairly common. A bigger beer will feel heavy regardless of the attenuation, so this is often limited.

The aroma and flavor can be mild compared to other more aggressive stouts. A strong roastiness is rarely seen, but it often has a coffee-like character. The sweeter versions can suggest a coffee with cream impression. Esters can vary, with English versions often having higher levels. As Samuel Smiths is cited as a source, a little diacetyl is allowable since that is a characteristic of that brewery; however, most versions will not have diacetyl.

The oats can have a nutty or grainy quality, or can be more prominent.

OATMEAL STOUT

(5 gallons/19 L, all-grain)
OG = 1.063 FG = 1.018
IBU = 25 SRM = 42
ABV = 6.0%

INGREDIENTS

10 lbs. (4.5 kg) pale ale malt
1 lb. 4 oz. (567 g) flaked oats
12 oz. (340 g) crystal malt (80 °L)
10 oz. (283 g) chocolate malt (450 °L)
8 oz. (227 g) roasted barley (550 °L)
4 oz. (113 g) crystal malt (40 °L)
4 AAU UK Golding hops (60 min.) (0.75 oz/21 g at 5.3% alpha acid)
2 AAU UK Golding hops (30 min.) (0.75 oz/21 g at 5.3% alpha acid)
Wyeast 1318 (London Ale III) or Imperial Yeast A38 (Juice) or White Labs WLP066 (London Fog) or LalBrew New England yeast
¾ cup corn sugar (if priming)

STEP BY STEP

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

Mash the pale ale malt and oats at 154 °F (68 °C) for 60 minutes. Once conversion is complete, add the crystal and dark malts as well as the roasted barley, then begin to increase mash temperature to 168 °F (76 °C) using direct heat or infusion, and recirculate for 15 minutes before beginning the lauter process. Fly sparge with 170 °F (77 °C) water, collecting 6.5 gallons (25 L) of wort.

Boil the wort for 90 minutes, adding hops at the times indicated in the recipe. A kettle fining can be added near the end of the boil, but is not necessary.

Chill the wort to 64 °F (18 °C), aerate the wort with oxygen, pitch the yeast, and ferment until complete. Rack and package the beer, or rack and clarify the beer if desired with finings before packaging (prime and bottle condition, or keg and force carbonate).

OATMEAL STOUT

(5 gallons/19 L, partial mash)
OG = 1.063 FG = 1.018
IBU = 25 SRM = 42
ABV = 6.0%

INGREDIENTS

5.5 lbs. (2.5 kg) pale liquid malt extract
1 lb. 8 oz. (680 g) pale ale malt
1 lb. 4 oz. (567 g) flaked oats
12 oz. (340 g) crystal malt (80 °L)
10 oz. (283 g) chocolate malt (450 °L)
8 oz. (227 g) roasted barley (550 °L)
4 oz. (113 g) crystal malt (40 °L)
4 AAU UK Golding hops (60 min.) (0.75 oz/21 g at 5.3% alpha acid)
2 AAU UK Golding hops (30 min.) (0.75 oz/21 g at 5.3% alpha acid)
Wyeast 1318 (London Ale III) or Imperial Yeast A38 (Juice) or White Labs WLP066 (London Fog) or LalBrew New England yeast
¾ cup corn sugar (if priming)

STEP BY STEP

Use 2 gallons (7.6 L) of water in the brew kettle; heat to 154 °F (68 °C). Steep the pale ale and flaked oats in a mesh bag for 30 minutes at this temperature then add the crystal and dark malts and steep for another 30 minutes, trying to maintain temperature at 154 °F (68 °C) then remove and wash grains with 1 gal. (4 L) hot water. Top the kettle off to 6 gal. (23 L).

Turn off the heat. Add the malt extract and stir thoroughly to dissolve completely. You do not want to feel liquid extract at the bottom of the kettle when stirring with your spoon. Turn the heat back on and bring to a boil. Boil the wort for 60 minutes, adding hops at the times indicated.

Chill the wort to 64 °F (18 °C), pitch the yeast, and ferment until complete. Rack and package the beer, or rack and clarify the beer if desired with finings before packaging (prime and bottle condition, or keg and force carbonate).

Toasting the oats can enhance the nuttiness and toastiness and bring out oatmeal cookie-like perceptions. Darker grains bring more of a milk chocolate to coffee with cream quality. Bitterness is moderate so as to not dominate the malt. A light hop flavor is allowable but not always present. The finish is variable, and can range from medium-low to medium-high sweetness.

So the concept is basically to have stout-like qualities (dark roastiness) but with enough sweetness to support the oatmeal flavors. The brewer is free to interpret the style over a wide range, including the balance and the degree to which the ingredients represent an English or American heritage.

BREWING INGREDIENTS AND METHODS

As a British-derived style, oatmeal stout is made as an ale with simple methods. A single infusion mash is typical, often with a higher conversion temperature. English pale ale malt is a typical base, but modern American versions can opt for the less bready American base malt. Oats are added to the mash in the form of flaked or rolled oats (5 to 20% is common), which are pre-gelatinized. Oat malt can be used instead, but this ingredient can at times be hard to find so you may need to order as a special request from your supplier. Steel cut oats (non-gelatinized form) can be used but must be processed in a cereal mash first, a step most homebrewers don't want to do.

Chocolate malt, roasted barley, caramel malt or darker brewing sugars, and sometimes debittered roasted malts can be used for color and flavor. Simpsons GNOs can also be used as a portion of the crystal malt addition. Bittering hop additions are most common, although a light late hopping for flavor is acceptable. English varieties are often used (Golding, Fuggle, Challenger, etc.), although for bittering almost any hop could be used. I personally think citrusy varieties clash with the roasted malt profile so I would rather see those omitted.

English ale yeast can provide a subtle fruitiness or malt-forward profile, but clean and neutral American varieties can be used. I prefer the English strains, sticking with those associated with the classic producers (Samuel Smiths, Youngs) such as Wyeast 1318 (London Ale III).

I mentioned that sometimes the oats can be toasted to help remove some of the graininess and to develop more toasty and nutty notes. This was an idea I first saw explored in Randy Mosher's *Radical Brewing*. Although Randy recommends toasting the oats for a longer time in a warmer oven, I normally go for about 20 minutes in a 250 °F (121 °C) oven — enough for a light golden color — then let them air out for a few days before using.

The beer does not have a significant water-derived profile, so a relatively neutral source is recommended. Waters with up to a moderate carbonate level can be used, so long as the mash pH remains within its optimal range (about 5.1 to 5.3).

HOMEBREW EXAMPLE

My version is a bigger version of English examples, so I will use English ingredients where I can. The base malt is a pale ale malt, such as Maris Otter (I prefer Crisp). The dark malts and grains are chocolate malt and roasted barley (again, I like English versions such as Crisp or Thomas Fawcett). Crystal malts in the 40 °L and 80 °L ranges and a caramelly and dark fruit background flavor and balancing sweetness.

Quaker Oats – Old-Fashioned are what I normally use for oats, although flaked oats from the homebrew shop can also work well. I tend not to use quick oats as they are more highly processed and have less flavor. Rolled oats can be readily mashed, so I use those.

I want the oatmeal to be noticeable but not so dominant to make the beer seem overly grainy, so I am using about 9 or 10% oats. The combination of chocolate and roasted barley together in the 8 to 9% range is my sweet spot, with more chocolate being used than roasted barley. Again, I'm concerned about giving the beer too much of a biting quality from the grain.

> **"... sometimes the oats can be toasted to help remove some of the graininess and to develop more toasty and nutty notes."**

English Golding hops are used for about 25 IBUs of bitterness, which is enough to support the malt of the beer without distracting from the malt flavor. I'm targeting about a 6% beer, at the upper end of the range for the guidelines, so that it has a heartiness. The sweetness from the crystal malts also helps take the edge off any rough grainy notes.

I'll use a simple single infusion mash as the English use, in the 154 °F (68 °C) range for a bit more body and chewiness. As with many of my recipes, my technique of adding the dark malts and grains and crystal malts during the recirculation and sparging phases also helps control the harshness of dark grains. I like to recirculate for 15–20 minutes at 168 °F (76 °C) before slowly fly sparging. Be sure you are rinsing the dark grains and crystal malts for at least 30 minutes total to get the full effect of the color and flavor from those ingredients.

A good, malt-focused English yeast is appropriate for this style, and I like the Wyeast 1318 (London Ale III) for this purpose. The slightly fruitier Fullers-type yeasts (Wyeast 1968, White Labs WLP002) can also be used, but I like the 1318 yeast in darker, maltier styles. Ferment cool to keep the beer clean and let the malt be the star.

I like to keep this beer around during cool weather. It's not my first choice for a middle-of-winter fireside beer, but it does have a substantial feel that helps take the edge off a cool day. It's not really a health food, but if your exercise program includes doing 16 oz. curls, why not add this to your regime? BYO

2018 HOMEBREW HOLIDAY GIFT GUIDE

This holiday season give the gift of beer! Check out all of the great beer gear on the next few pages for some gift ideas for friends and family or make your own homebrew holiday wishlist...

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IMPROVE QUALITY & CONSISTENCY

by Brad Smith

Photo by Charles A. Parker/Images Plus

When I started brewing beer a little over 30 years ago, the craft beer revolution had not happened yet, and the selection of commercial beers was limited to small variations of the "American lager" style. One of my motivations entering homebrewing was the ability to make other styles of beer.

So when I got my first beer kit, I did exactly that — brewing a stout, then a honey ale, then a ginger ale, and many styles that at the time I had only read about in books and never tasted. To be fair, most of my early beers were not particularly good, and many were just above the threshold where I wanted to toss them out. But I kept on brewing; style, after style, after style.

Looking back on those early days in homebrewing, I can see now that I was working under a number of severe limitations. The quality of the ingredients we had in the late 80s was very poor – brown hops often stored loosely in plastic bags on the store shelf, yeast packets that were really just dried bread yeast, and malt extract that was produced mainly overseas and then canned and transported in hot containers for months at a time.

Even worse was the very limited information we had. Brewing knowledge was in its infancy, and few homebrewers knew how to estimate simple things like original gravity, color, or bitterness.

We also had no point of reference for the finished beers. Judging a finished beer was a black art. You could brew a Belgian abbey ale, but few of us had access to the real thing to compare it. Obvious flaws like spoiled or stale beer could be determined but we lacked the knowledge of other off flavors and even the lexicon of what to call them!

In spite of all these limitations, we brewed on. Looking back on the period, I see now that there was little I could do about the quality ingredients, or easily accessible brewing knowledge (which gradually improved), or even the lack of reference beers at the time. Despite all of this, there is one simple thing I could have done back then that would have greatly improved my beer: I could have brewed the same beer more than once!

Jumping around from style to

Photo courtesy of Shutterstock.com

I like to pre-measure ingredients and print out a brew sheet of the times for each addition and steps so brew day goes off without a hitch.

style was the single biggest mistake of my early brewing career. Brewing a recipe only once guarantees that the recipe will never get better.

THE ELEMENTS OF BETTER BEER

Fast-forward 30 years, and the homebrewing landscape has dramatically transformed. We now have high-quality fresh ingredients, access to equipment equal to that of a professional brewer, a vast store of knowledge, software and tools, and access to craft and imported beer of any style.

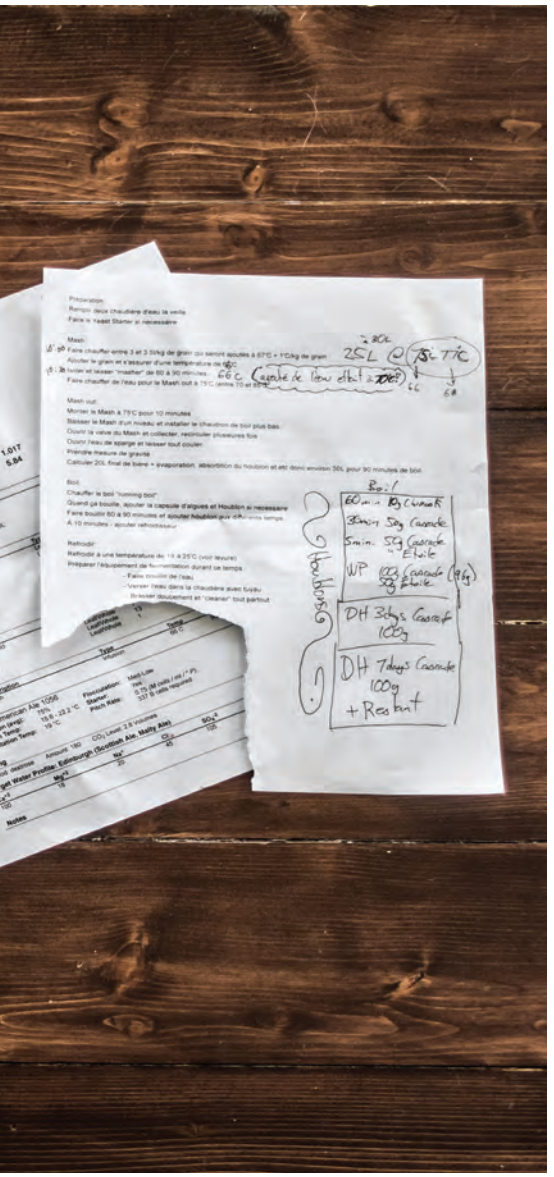
So what are the elements today necessary for creating the perfect beer in any style? I will argue that they have not changed much since the time when I started homebrewing, though our ability to create amazing beer at home has transformed dramatically:

Starting with a Good Recipe
This may sound obvious, but doing some homework up front to make sure you have a good starting point for your beer is critical. I'll cover shortly some of the resources available to you to get you started on solid footing.

Consistency in Brewing, Measurement and Quality Control
Consistency in your brewing is very important, particularly if you are looking to improve upon a recipe you have brewed before. Keep good records of each brew, measure simple things like volumes, gravities, and temperatures, and compare different batches of the same recipe.

Judging and Identifying Flaws
Even sophisticated pro brewers rely primarily on sensory evaluation or "tasting" to evaluate beer quality. Developing the critical ability to judge and evaluate your beer is crucial if you want to make it better. The best beer brewers are often the best beer judges, so developing the ability to identify off flavors is important.

Correcting Your Beer, and Brewing it Again
Being able to consistently brew, mea-



sure, track, and taste your beer are all important, but only if you can identify the root cause of an off flavor or imbalance and make a correction to either your recipe or process to brew it again.

STARTING WITH A GOOD RECIPE

Recipe design is a fascinating combination of art and science. While some brewers take a scientific approach, trying to match numbers, grain percentages, gravity, color, and bitterness, this is only part of the story. The other half is understanding the flavors that each ingredient contributes as well as how these flavors interact in complex ways to create the profile of the finished beer. You need to master both the art and the science of brewing to produce the best beer.

I find that while many brewers make efforts to study the scientific side of brewing, they sometimes do so at the neglect of the artistic side. Much like a cook needs to understand the flavor that simple ingredients like butter, oil, flour, milk, and spices contribute, a brewer needs to understand what flavors each grain, hop, and yeast variety contributes. I encourage you to take time doing sensory analysis on individual ingredients like hops and malt as well as brewing single malt and single hop (SMASH) beers to get a strong grasp on ingredients.

Fortunately, you rarely need to start with an entirely blank sheet of paper. The internet provides a wealth of information. For most styles of beer you can think of there are detailed style guides available that include color, gravity, alcohol content, bitterness, and ingredient guidelines. The most popular is the Beer Judge Certification Program (BJCP) style guidelines at BJCP.org. Many of these styles have characteristic ingredients you can target as well as specific yeast strains and even water profiles to use. Of course, *Brew Your Own* has been publishing its "Style Profile" column for more than 20 years, and all popular styles have been profiled, offering tremendous insight into particular author's approaches to these styles.

Researching recipes is another great way to develop your own. You can search books, magazines, websites, or online recipe databases for examples of the style you are targeting. In fact, the challenge now is no longer a dearth of recipe data, but instead sorting through the huge volume of recipes available.

One technique I like to use is to pick 10 or so recipes from trusted sources in the style I'm targeting and then compare them. What base grains does each use? What specialty malts? How do the grain bills compare percentage-wise? What hops and yeast varieties did they choose? You can then use this comparison to develop your own recipe, perhaps adding your own twist.

While a complete discussion of ingredient flavors and recipe design techniques is beyond the scope of this article, doing a bit of research on existing recipes and ingredients used for the style you are targeting should give you a solid starting point for your recipe.

CONSISTENT BREWING, MEASUREMENT, QUALITY CONTROL, REPEATABILITY

Once you have a solid starting recipe, the next step is to brew it! The goal here is not to create a "one-off" brew, but instead to use your best techniques so you can either reproduce your fantastic recipe or improve upon it if the beer is not exactly to your liking.

Large commercial breweries have quality control departments that measure and monitor every aspect of the brewing process looking for slight changes in ingredients, process, or outcome that might affect the finished beer. While these breweries use labs to evaluate these things, the vast majority of the data needed can be collected and monitored at the homebrew level.

Consistent Ingredients

Consistency in the process starts with your ingredients, so that is a very good place for you to start as a homebrewer. Commercial brewers carefully evaluate their ingredients before committing to a batch. Before you brew, sit down with the grains, hops, and yeast you plan to use and do some simple sensory analysis. Take notes so you can help connect the dots later to determine if you have any ingredient issues. Is the grain fresh? Did you properly crush it? Does it have any odd color, odor, moisture, or consistency issues? Does it smell and taste like it should?

Do the same with your hops. Dry rub a bit of the hops in your hands and bring it up to your nose. Does it have a fresh flowery aroma? Is there any discoloration or signs of moisture? Are there any odd aromas? This is a particularly important step, as more than once I've opened a package of hops to find it was not fresh and ar-

omatic – and it probably would have ruined my beer if my QC step was not used to reject the ingredient.

Check the date on your yeast package and make sure it is still viable. If working with liquid yeast I usually recommend using a starter as it can be more fragile than dry yeast. A good strong starter will give you a healthy yeast population when you pitch it.

A Consistent Process

Once you start brewing, the key is consistency in your brewing processes. Try to follow the same steps in the same way each time you brew so they literally become a habit. I like to print out a brew sheet of the steps to follow and times for each addition or new step in the mash and boil.

As you brew you need to take time out to measure. Pre-measure the ingredients so they are easy to add. Measure your volumes as you brew including water volumes, mash volume, pre- and post-boil volumes, and your volume into the fermenter. Measure your mash temperatures and fermentation temperature over time. If you have a pH meter, measure your mash pH, pH into the fermenter, and finished pH. Measure your gravity both pre-boil and your original gravity into the fermenter, remembering to adjust for temperature if working with hot wort.

Record these measurements along with your notes and observations. If you had a process problem like a missed mash temperature or you forgot to turn off the recirculation pump at a certain time, record it so you can figure out what impact it may have had. Detailed notes can really help in the judging and troubleshooting.

Also, over time you can start to compare batches of beer, which will help you identify inconsistencies in the process that may tie back to inconsistencies in the finished beer. At large breweries they term this "quality control" with the goal of making the same beer every time.

For a homebrewer, beer software or a simple spreadsheet can help you compare the same beer as it is brewed multiple times. Seeing the data you've collected side-by-side from batch-to-batch can really bring out trends, inconsistencies, or subtle changes in your process that may have helped or hurt your beer. Small changes in ingredients used or the brewing process can have a large impact on your finished beer.

You can even do some comparisons between different beer recipes to look at how consistent your mash temperature and volumes are, your brewhouse efficiency, yeast performance, and other brewing processes. While this may not be quite as useful as comparisons against the same recipe, it can help in finding issues with your equipment and processes.

Photo courtesy of Paul Peng Wang

We often say that "beer judges make the best brewers" simply because they are able to evaluate and identify imbalances and flaws in beer.

JUDGING AND IDENTIFYING FLAWS

We often say that "beer judges make the best brewers" simply because they are able to evaluate and identify imbalances and flaws in beer. As your brewing skills improve, you also need to consistently work on improving your skills as an evaluator of fine beer. In order to perfect a beer recipe over time, you need to be able to identify flaws and characteristics of

a beer.

The best way to improve your skills as a beer judge is to sit down with an experienced beer judge and sample some beers. This could be a BJCP certified judge at a competition, a professional brewer, or even just an experienced homebrewer from your club. Most experienced brewers are familiar with the major beer styles as well as imbalances and off flavors and will be able to help guide you. Sit down and sample a number of beers with them, first judging the beer yourself and then comparing notes with the experienced judge.

A second way to improve your skills is to simply sample great beers. The BJCP style guidelines have commercial examples listed for each of the major beer styles and you can purchase and sample these at home. Anytime you have a beer out at a craft brewery, restaurant, or homebrew meeting, you can continue to hone your skills by critically evaluating the beer and trying to identify flaws.

For the purpose of this article, I've broken beer flaws into two types. The first, which I've termed "imbalances" are simply a mismatch of flavor, carbonation, color, or other aspect of the beer. These can usually be remedied by altering the recipe slightly or perhaps making a small process change.

The second group of flaws, called "off flavors," cover the classic off flavors identified on the BJCP score sheet. These are terms that you should gain familiarity with as they are used in beer competition as well as by other brewers to identify certain flavors and flaws.

I'm a strong advocate of writing down your perceptions as you judge your beer. You can use the BJCP score sheet from BJCP.org that is used to score beers in competition or just a plain sheet of paper. Write down everything you can determine about your beer including the appearance, flavor, balance, carbonation, and overall impressions.

Imbalances in Beer

An imbalance in your beer is something in your recipe or process that makes the beer "not quite right." For example, you may have been shooting for a pale ale, but the beer came out too dark. Your big IPA may have fermented too well and now be closer to a double IPA. You may have a great, well-balanced beer flavor but the beer is flat with no carbonation. The nice thing about this type of imbalance is that it is relatively easy to correct.

Flavor imbalances are a bit more complex to identify and correct. Obvious flaws like a beer that is too bitter or too malty can be easily corrected, but problems like the wrong malt selection, too many specialty malts, using the wrong hop or yeast variety, and similar issues can be harder to pinpoint. While the beer may taste lackluster or just plain wrong, it can be difficult to figure out which of the ingredients caused the problem. This is why, as mentioned earlier, it is important to obtain an understanding of each ingredient.

Even if you can't pinpoint what exactly is off, it is worthwhile to do your very best to write down any imbalances you perceive and even general comments like "lacks depth" or "poor aroma" can be useful for your next iteration of the recipe.

Off Flavors

I've covered off flavors and their causes in a two-part series featured here in the pages of *BYO* (refer to the September 2016 and December 2017 issues of *BYO*). The BJCP recognizes 21 off flavors, which are discussed in depth in the previously mentioned articles, so I will not go into detail here. I will say, these are terms and flavors you as a brewer should become familiar with because it is absolutely critical to making your beer better. If you can't identify the flaws and imperfections in your beer it becomes very difficult to improve your recipe and processes.

BREW IT AGAIN!

After a long process of creating the perfect recipe, carefully selecting only the freshest ingredients, brewing and meticulously recording metrics on your brewing process, and then critically judging your beer, we come full circle — now it is time to brew it again!

I started this article with a story about how brewing a different beer every time never led to better beer. Only after I became interested in brewing the perfect pale ale or the perfect Irish stout did my beer start to measurably improve.

So sit down with your original recipe, your brewing notes, and your beer tasting notes and try to figure out what you could have done better? Perhaps a bit more color, another specialty grain to get more depth, a different yeast strain to get a cleaner finish, or even an entirely different hop variety?

Make those adjustments — ideally, limiting it to one or two adjustments per batch — and then brew the beer again. Measure, take notes, and critically evaluate the second beer. If it is close enough in time, you may even be able to compare the first and second finished beers side-by-side. Continue this process of improvement until you have a great beer recipe!

I've done this with several different styles now and many of these have become my "house" recipes — the beers I brew again and again and always keep on hand for guests to enjoy.

Along the way you will certainly learn to be a better brewer, a better beer judge, and hopefully have some great beers to share with your friends and family. BYO

RELATED LINKS:

• Sensory evaluation is essential to brewing your best homebrews. Stone Brewing Co.'s Quality Assurance Supervisor Rick Blankemeier discusses how to set up a proper off flavors panel at home in this story available to digital members: https://byo.com/article/figuring-out-off-flavors/

• The better beer taster you are, the better brewer you have the potential to become. That doesn't necessarily mean you need to become a BJCP judge, doing so is a great learning experience. For digital members, learn what goes into becoming a BJCP judge: https://byo.com/article/beer-judge

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Tall Tales

by Kristen Kuchar

Photo courtesy of Brewtography Project

Breaking into a male-dominated hobby

Brewster, brewess, alewife — call these women what you will, but historians tell us that females were the original brewers, starting 4,000 years ago in Mesopotamia, and possibly even earlier. Even throughout the 1700s, brewing beer was part of a woman's daily to-do list. It wasn't until brewing became more of a commercial industry that it was then considered a man's job and, unfortunately, a man's drink.

"As beer became more commercial, and widely available as packaged goods, taverns became more male-centric, and the image of the beer drinker became more that of the working man," says Nancy Rigberg, co-owner of Home Sweet Homebrew in Philadelphia. "Bars were less welcoming to women, relegating them to the 'ladies entrance.'"

Even though female brewers and brewery employees are steadily increasing in the last decade and women craft beer enthusiasts are in abundance, homebrewing still remains a male-dominated activity.

The American Homebrewers Association (AHA) says women make up only 13 percent of their membership. (Although, they believe it's closer to 25 percent, with male members brewing with a female significant other.) The owner of HomebrewAcademy.com estimates his audience is only 7 percent women. So we ask, why aren't more women homebrewing?

Many point to marketing as the culprit to a lack of participation amongst women. Millie Shamburger, American Homebrewers Association Business Programs Coordinator, says beer has been consistently marketed

Photo by Karin Higgins/UC-Davis at Sudwerk Brewing Company

to men with sexist advertising for a long time. "The image of the bearded, beer-bellied males, or women just as the props in commercials, takes time to break down," says Shamburger.

Besides the advertising clearly geared towards men, some attribute the lack of women pursuing the hobby to not having a welcoming experience in the homebrew community, whether it being at a local store or a homebrew club. There could also be hesitation if a woman feels she doesn't have support or someone to talk to about homebrewing, says Jeanne Burns, Vice President of DC Homebrewers.

Whatever the reason for the lack of diversity in homebrewing, there is a plethora of steps to be taken to bridge the gap.

Photo courtesy of Denise Ratfield

Denise Ratfield, director of the International Women's Collaboration Brew Day, speaking on women in brewing.

THE PART HOMEBREW STORES PLAY

The journey for many homebrewers starts at the store, which could be a pivotal moment for any newbie. While it's generally Business 101 – treat all of your customers with respect — unfortunately some stores have fallen short of this in the past. Homebrew stores need to welcome a woman (and all customers) in the shop without talking down to her or trying to impress her with knowledge, Shamburger says. "Don't assume that a woman who comes into the shop is shopping for a spouse or isn't knowledgeable about homebrewing," she says.

Her advice continues with, "Don't brush them off if a guy comes in to buy stuff, too. Don't assume that women want to make 'chick beers.' And, if they want to make a fruit beer, don't assume it's because they don't like other beers."

Homebrew stores need to be authentic in their support of women, says Denise Ratfield, Director of the International Women's Collaboration Brew Day (IWCBD). "Shop owners, ask yourself: Is your store a friendly environment to all who walk in or shop online? Are your staff engaging female consumers the same as they do men?" Ratfield says. "Word of mouth goes a long way. A customer will tell others about how great or dismal their experience was at the store."

The Editor-in-Chief and Owner of HomeBrewAcademy.com, Billy Broas, suggests one thing homebrew stores can do is create how-to videos and other content that feature women. "It's not a man's hobby for any reason other than men seem to be attracted to it," he says.

Brewmented, a homebrew store in Longmont, Colorado, changed the playbook to create an entirely different shop experience for all, including women. "Staffing is a huge part of making women feel more comfortable," says Co-Owner Bill Campbell. He hired Kitty Vant, a female homebrewer with a decade of experience in the industry, as the store's general manager as well as other enthusiastic female staff. "Some women may feel more comfortable approaching another woman with their questions," Vant says.

Vant not only manages the store, but she also teaches women-only how to brew courses right in the store at no cost. "I've noticed women-only classes are really social," Vant explains of a recent event. "Women seemed more comfortable here and quickly introduced themselves to each other." Overall, she describes the experience as a truly positive event.

The importance of women-only courses, ideally taught by a woman, is echoed amongst both men and women in the craft beer industry. It takes away some of the potential intimidation that some women may feel and allows for a more welcoming environment to ask questions and meet fellow female homebrewers.

But Campbell isn't stopping there. The entire space and atmosphere of the store isn't of the traditional homebrew shop and is meant to appeal to not only women, but all first-time homebrewers. "The hope is for the store to be a destination and a place to gather," Campbell explains. "Not just a place to buy ingredients."

The large, bright, clean space is home to ample seating in the back along with several local taps, including their own brews. This allows for shoppers to grab a beer and have no rush while browsing. Besides a beginner's women's-only brew course, there's also a free women's-only intro to all-grain brewing class. In addition to the classes, they've hosted bands for live music, speakers on the

history of beer, and beer and cheese pairings. These events draw people in who may not have otherwise visited a homebrew store, Campbell explains. Vant opts to keep the tap list eclectic so she can help anyone who comes in navigate to a style that suits her or his palate.

Anne Duany Whyte, Owner of Vermont Homebrew Supply, has added activities to keep children busy so entire families can take part in the shopping experience. "We are a small store. We keep a crate of toys for the little brewers. It helps to give mom and dad time to put a recipe together and chat," she says.

Megan Henslick, co-owner of Renegade Brewing Supplies in Turlock, California with her husband Luke, says that while women deserve attention from staff, they don't appreciate feeling like a gimmick or an oddity when they walk into a homebrew store. "I once had the opportunity granted to me to brew on a commercial system as long as the brewery could market the beer as 'brewed by a woman for women,'" says Henslick. "I did not like the experience, and I do my best to not make other women feel as I did," Henslick says.

She is trying to increase her female customer base, which is at 5 percent, by offering free advice and classes as well as open forums on her social media outlets. They let anyone, whether a customer or not, bring their beer in for troubleshooting.

For Jennifer Misfeldt, co-owner of Patriot Homebrew Supply in Elkhorn, Nebraska, it's important for her to spread the word on the female homebrew community in her store. She posts flyers in the store of any nearby women brewing events and contests as well as readily shares the information for the local women-only homebrew club to any females that come into the store. Even though only 10 percent of her customers are female, she is all about creating an even playing field for anyone in the store. "When a couple walks into the store, I make sure that our dialog includes the woman in attendance, and I make the assumption they are a part of the process at home, too," Misfeldt says.

Janna Williams, Co-owner of CO BREW in Denver, says the opportunity for people to brew on-site has allowed several groups of women to give homebrewing a whirl, including bachelorette parties, girls' night out, professional networking events, and more. The store is currently participating in the Women-Only Craft Brewery Tour, organized by Laura Bruns at Factotum Brewhouse. "This is an exciting opportunity for women who are interested in craft beer to meet with the female owners of several breweries to hear their stories and ask questions," Williams says. She says that brewing beer, just like starting any other hobby, can be intimating. To ease this anxiety, Williams offers free tools on her store's website, such as recipe calculators, conversion charts, and substitution lists,

Photo by Karin Higgins/UC-Davis at Sudwerk Brewing Company

The number of women participating in brewing programs at UC-Davis has been on the rise.

which is beneficial to all newcomers, regardless of sex.

Women-only classes and events have shown to be successful in expanding the hobby to women, but sexism in the hobby — whether intentional or not — will take time to break. And it isn't just new customers — female storeowners often experience it firsthand, and are doing what they can to change it.

"Don't assume the woman working in the store doesn't know anything about brewing. I encounter this all the time. Folks walk in, look at me, my husband or my son, and direct the questions to them. It doesn't take long for this to be rectified, but sexism in brewing is very real. Younger men are just as guilty as older men. And sadly, women make the same assumptions when they walk in," says Whyte. "Side note: No one ever asks my husband if he brews. I get asked quite often."

CREATING A COMMUNITY

Making women feel comfortable in the world of homebrewing doesn't stop at the store. Homebrew clubs also play an integral role in creating a positive experience for both existing and new female homebrewers.

A great example of a group doing it right is the Washington DC Homebrewers, who created the subgroup HOPS (Homebrew Outreach and Participation Sisterhood). The goal is to help educate women about homebrewing and to build a community of women homebrewers, says Jeanne Burns, committee co-chairperson. "It was created with the hopes of increasing women's participation in a hobby dominated by males," says Burns.

It's not just about creating a separate space for women, but clubs should also focus on making the existing co-ed space more welcoming. "I feel that mentorship by women that have been homebrewing awhile can be a great way to encourage those ladies that are just starting out," Burns adds.

Clubs could consider allowing a membership to include the entire home, which can encourage participation among spouses as well. The Bloatarian Brewing League, a Cincinnati-based club, does just that.

Another idea for clubs is to invite women brewers or women in the industry to speak at club meetings. Or take a page from events like Queen of Homebrew and SheBrew to create a female-only homebrew competition.

The advice to male club members is if you see a new female face, or any new face for that matter, introduce yourself and say hello. Invite a female friend to come along to see if homebrewing is something that interests her. To existing female club members, bring along a friend and consider taking on a mentorship role to newcomers.

IT STARTS AT THE TOP

The female participation in brewing programs at UC-Davis has been on the rise in recent years. Melissa Marbach, the Professional Brewing Programs Representative at UC-Davis feels this increase is in part due to a slow but steady acceptance of women in the industry as a whole.

"I attribute the interest to the explosion of the craft brewing industry and the women who blazed a trail for those of us who came after. Because of these women, it's clear that the brewing industry has space for both males and females," Marbach says.

AHA's Shamburger says women seeing more professional brewers at their local breweries and more women working in the industry can create more female curiosity in brewing on their own.

"The more we can see images of women in brewing roles, in real life with craft beer, brewing at Big Brew, attending club meetings, being in leadership positions, the more chance we have of pulling more women in," she says.

The advice to breweries is include photos of your female employees on social media and marketing pages. If there aren't women in brewing, production, and leadership positions, consider why that is. Highlighting women in professional roles at a brewery can lead to more women in homebrewing.

Besides on a professional level, it's important for a tap room and a beer bar's environment to be an unpretentious, relaxed environment, which sadly oftentimes it is not. Shamburger advises brewery and bar management to talk to the staff about paying equal attention to men and women.

Make sure your servers aren't making assumptions about a woman's beer preference. If a woman is new to craft beer, don't just suggest a "girl beer." Find out what flavors she usually enjoys, such as coffee, wine, chocolate, sweet drinks, and so on. Show your taproom's diversity in the photos you post to social media.

The rise of female-focused beer events and organizations also creates

a step in the right direction for women in homebrewing and in the craft beer industry as a whole.

FemAle Brew Fest features breweries from around the country that are either owned or run by women or have women in a production role, such as a brewer, cellar woman, or a quality role. Along with the breweries, the event also features a female DJ and female-led bands.

Founder of the event, Frances Antonio-Martineau, is thrilled that the fest grew from 15 breweries last year to 26 in its second year. "I think that just like any male-dominated industry, there is always an intimidation factor that goes into play. But with organizations like the Pink Boots Society and events like FemAle, it is shining a light on the women doing amazing things in the industry," Antonia-Martineau says. Just in the last couple of years of producing the festival, she has seen a number of women not only drinking more beer but also showing an interest in getting into the industry.

International Women's Collaboration Brew Day is another empowering event that encourages women to brew. It started as a way to raise awareness of women brewers in the industry and bring beer to female consumers. The goal is to get women together to brew and encourage an exchange of ideas and camaraderie. The day skyrocketed with annual participants not only all over the United States, but in Iceland, South Africa, and beyond. Denise Ratfield said that the day didn't only impact professional women in the industry, but caught on amongst female homebrewers, too.

"We had women posting from their kitchens, garages, and backyards, brewing solo and with their friends," says Ratfield. "It was a natural progression to include homebrewers as official participants and encourage their growth."

While there are plenty of stories of people focusing on a female's male counterpart when walking into a homebrew store or assuming a woman prefers wine, generally, the brewing community is a good one to join. Female homebrewer Alesandra Woolley says while she definitely feels outnumbered as a woman, she doesn't feel excluded.

"Whenever we attend homebrew competitions or events, there are certainly fewer women than men, but the amount of women attending these types of events grows every year," she says.

For the women out there, hesitant to get started in homebrewing, there's no better time than now. With countless great homebrewing books, online resources, and homebrew stores being more responsive than ever, you can start creating your own masterpiece. Seek out your local women's homebrewing group or other women in existing co-ed groups. "Seek out other women at homebrew clubs," Burns says. "Although largely outnumbered, we are there!" BYO

Brut IPA

THE NEW "NEW" BEER STYLE

by Vito Delucchi

When you think of San Francisco you might think of the Golden Gate Bridge or maybe those old Rice-A-Roni commercials. For me, having grown up in San Francisco, "The City" has always been a hotbed for free thinking and creativity, with a great culinary culture to boot. After all, my parents grew up in the "hippie" generation and my grandparents owned two local restaurants. But I digress, this article is not about what San Francisco is known for, but rather a new addition to the city's fabled culture — brut IPA.

The City by the Bay has a long history of beer drinking. This is the home of Steam Beer after all, and to quote the late, great Anthony Bourdain, it's "a two-fisted drinking town." When I first heard about an emerging beer style that was rooted in San Francisco, I was immediately intrigued. My first introduction to brut IPA came while discussing Beer Judging Certification Program (BJCP) styles with homebrewing friends. The conversation was centered around the sweeping popularity of New England IPAs (NEIPAs). Someone mentioned this new "new" beer style called "brut IPA." As it was described to me, I was reminded of everything I loved about old school West Coast IPAs — super dry and clean with hops as the focal point. I didn't actually taste one until a few weeks later. Sadly, it wasn't that pleasing and suffered from diacetyl.

Having moved out of San Francisco many years ago to start my family in the East Bay, it was several months before I could finally make my way into the city to try Social Kitchen and Brewing's brut IPA (where the style was created). It was amazingly effervescent and refreshing, yet left my palate dry thanks to the addition of amyloglucosidase (or AMG for short), and wanting to take another sip. With little to no malt character, it was a great canvas to showcase the hops. I picked up notes of stone fruit and big tropical juicy aromas. Needless

Photos by Vito Delucchi

Social Kitchen and Brewery in San Francisco invented and popularized the style of brut IPA.

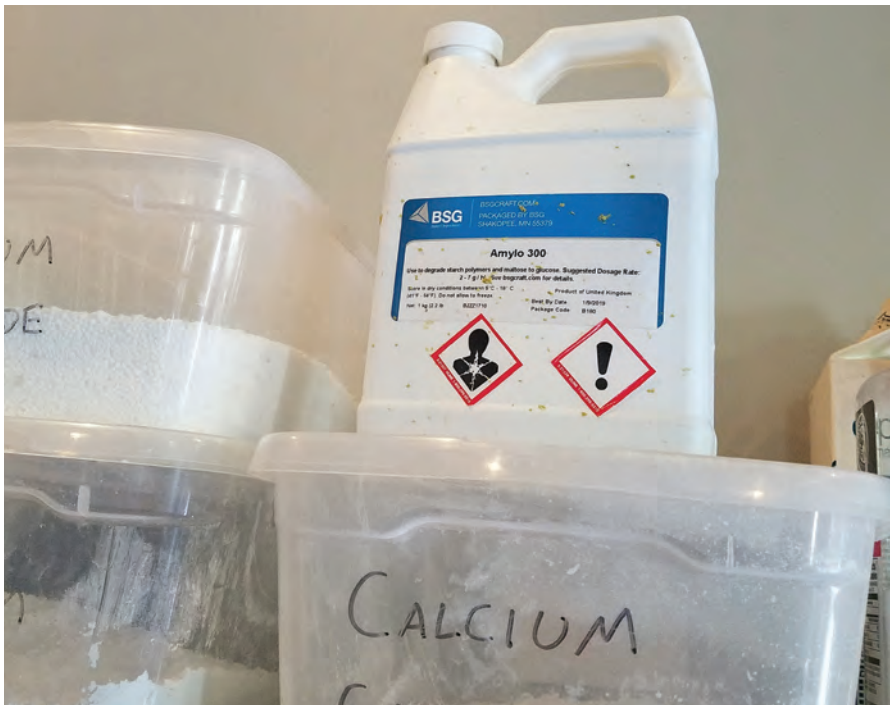
to say, it won me over and my inner homebrewer chi lit up. I wanted to brew one myself!

Immediately, I was back to talking over the style with other homebrewers (common theme, be social!) and the next thing I know I'm mashing in after work with my friend and fellow homebrew club member Max Brown. We exchanged a few text messages that week and came up with a recipe. The style was still fairly new and our experience with enzymes was very limited. We used alpha-amylase, which comes in powder form and is available at most homebrew supply stores. At the time this was the only enzyme we were familiar with. Whenever I'm brewing, and especially when it's something new, I like to split my batch and experiment, so we tried adding more of the amylase enzyme in fermentation on 5 gallons (19 L) of the split 10-gallon (38-L) batch, in addition to adding it in the mash for both batches.

The batch turned out great and was very tasty, but with a slight difference in final gravity. The batch that we used the amylase enzyme in both the hot and cold side finished at 1.004, while the one with the enzyme only in the mash finished at 1.007. By the time our first iteration of brut IPA was done, we had both put in more hours researching enzymes and learned what Social Kitchen was actually using was amyloglucosidase, sold commercially as Amylo 300. Later on, while doing research for this article, I discovered this particular enzyme comes from a fungus (*Aspergillus niger*) found on certain fruits and vegetables. But let's not get ahead of ourselves.

Max and I were on our second batch, and now we were equipped with the correct enzyme. For this batch we included the AMG when we added our dry hops, just before primary fermentation was complete. Nothing could stop us now, right?

A D-Bomb, that's what could stop us! This batch initially tasted good, but after a week or so it showed signs of diacetyl (we should have performed a forced diacetyl rest) and ultimately became a dumper. But it did finish at 1.000 final gravity — yay! We eventually figured out that if you're going to use the AMG enzyme on the cold side, do it as early as possible and perform a longer than normal diacetyl rest. Ideally you can just add it in the mash, which removes the risk of creating a diacetyl bomb since the enzyme will be denatured in the boil. But I have never been able to achieve 1.000 final gravity using it this way. Perhaps a longer mash would do the trick?



Amyloglucosidase (or AMG), avialable commercially as Amylo 300, is the secret to making a dry brut IPA as it can hydrolyse sequentially both α-1,4 and α-1,6 glycosidic bonds.

On the topic of AMG enzyme, now is probably a good time to share some information about it. As previously mentioned, it is derived from the fungus *Aspergillus niger*. Similar to the alpha-enzyme, it's used to convert non-fermentable sugars into fermentable sugars by working on the non-reducing ends of starch chains and dextrins. The key difference is AMG can hydrolyse sequentially both α-1,4 and α-1,6 glycosidic bonds. It can be used in the mash, the wort pre-boil, or in fermentation. According to the documentation, it works optimally at a temperature range of 131–144 °F (55–62 °C) and a pH range of 5.4–5.6 in the mash. The Amylo 300 documentation mentions use in the fermentation and maturation process, but doesn't give any recommended temperatures or pH ranges when used in these steps. From experience, I know it also works great at ale fermentation temperatures when added directly to the fermenter.

By this point I was obsessed with brut IPAs, and had been talking about them at work (MoreBeer!) quite a bit, so I started working on a homebrew recipe kit. At the time we did not have the AMG enzyme in stock, so we decided to bring in Ultra Ferm from White Labs, which comes in a packaged down 10 mL homebrew size. Previously I had been using Amylo 300 with a recommended dosage rate (rough numbers) of 0.1 to 0.5 mL per pound (0.2 to 1 mL per kg) of grain in the mash and 0.03 to 0.15 per gallon (0.07 to 0.3 mL per L) of liquid in fermentation. White Labs is diluting it for ease of application on smaller homebrew volumes. Since MoreBeer! sells both extract and all-grain kits and the White Labs documentation at the time only mentioned using it in the mash, the experimentation continued. Thankfully, it was now on the clock instead of at home after hours. We tried adding the enzyme (entire 10 mL vial of Ultra Ferm) at different points in the brewing process, and found the best way to finish

at 1.000 final gravity was to add it at the same time you would pitch your yeast. This not only made for a great extract recipe, but also simplified the process and made using the enzyme more approachable for novice brewers. Find the final recipe (to be released in the near future) at right.

We posted pictures on social media of our enzyme experiments throughout the testing process, and soon after *Brew Your Own* reached out about writing an article on the topic of brut IPAs. I was both honored and, quite frankly, scared to death. I get nervous talking in front of my own brew club, let alone writing an article for an internationally circulated magazine. But I knew I had some resources to draw from. Matt Sager, my good friend and the Head Brewer at Danville Brewing Company, was getting ready to brew their first brut IPA. I know the folks over at Barebottle Brewing Company in San Francisco from one of their homebrew competitions, and they even brewed my winning recipe. They had also brewed two or three brut IPAs that I enjoyed. Of course, if I was going to commit to writing an article on the subject, it would be really nice to talk with the very man (Kim Sturdavant) who invented the style. I found Kim's email on Social Kitchen's website and shot him a message. He graciously agreed and with that I felt confident I could pull it off.

In my 9 years of homebrewing, one thing that has resonated very deeply with me is the brewing community! For the most part, be it amateur or professional, we all share the same love, and that's not just the San Fran hippie in me talking. I think we can all attest to that, no matter where we're from. Anyway, not being a journalist, I didn't know how to approach this. My thought was to sit down with each brewer and ask them a series of questions about Brut IPAs. Questions that, as a brewer, I would and have asked before. Every one of them was super willing to sit down and share their thoughts, processes, and recipes with me. Without further adieu I give you the pro's take on that new "new" brut IPA style.

MOREBEER! JUICY BRUT

(5 gallons/19 L, all-grain)
OG = 1.053 FG = 1.000
IBU = 37 SRM = 4 ABV = 6.8%

INGREDIENTS

10 lbs. (4.5 kg) 2-row pale malt
1 lb. (0.45 kg) Carapils malt
10 mL White Labs Ultra Ferm amyloglucosidase
5.8 AAU Mosaic® hops (60 min.) (0.4 oz./11 g at 11.5% alpha acids)
6.9 AAU Mosaic® hops (5 min.) (0.6 oz./17 g at 11.5% alpha acids)
8.5 AAU Amarillo® hops (0 min.) (1 oz./28 g at 8.5% alpha acids)
12 AAU Citra® hops (0 min.) (1 oz./28 g at 12% alpha acids)
11.5 AAU Mosaic® hops (0 min.) (1 oz./28 g at 11.5% alpha acids)
1 oz. (28 g) Citra® hops (dry hop)
1 oz. (28 g) Mosaic® hops (dry hop)
1 oz. (28 g) Amarillo® hops (dry hop)
½ tsp. yeast nutrient (10 min.)
½ Whirlfloc tablet (10 min.)
GigaYeast GY001 (NorCal Ale #1) or Wyeast 1056 (American Ale) or White Labs WLP001 (California Ale) or Safale US-05 yeast
⅞ cup corn sugar (if priming)

STEP BY STEP

Mill the grains and dough-in targeting a mash of around 1.25 quarts of water to 1 pound of grain (2.6 L/kg) and a temperature of 149 °F (65 °C). Hold the mash at 149 °F (65 °C) for 45 minutes. Vorlauf until it runs clear, then sparge slowly with 170 °F (77°C) water, collecting wort until the pre-boil kettle volume is reached.

Total boil time is 60 minutes with hop additions at 60 and 5 minutes left in boil. Add Whirlfloc and yeast nutrient with 10 minutes left in the boil. At flameout, add whirlpool hops and whirlpool for 10 minutes. Chill the wort to 67 °F (18 °C) and aerate thoroughly. Pitch yeast and 10 mL vial of White Labs Ultra Ferm. Add dry hops when gravity is around 1.020 and then perform a diacetyl rest. Cold crash and carbonate the beer.

MOREBEER! JUICY BRUT

(5 gallons/19 L, extract with grains)
OG = 1.053 FG = 1.000
IBU = 37 SRM = 4.5 ABV = 6.8%

INGREDIENTS

5.5 lbs. (2.5 kg) Briess Golden Light dried malt extract
1 lb. (0.45 kg) Carapils malt
10 mL White Labs Ultra Ferm amyloglucosidase
5.8 AAU Mosaic® hops (60 min.) (0.4 oz./11 g at 11.5% alpha acids)
6.9 AAU Mosaic® hops (5 min.) (0.6 oz./17 g at 11.5% alpha acids)
8.5 AAU Amarillo® hops (0 min.) (1 oz./28 g at 8.5% alpha acids)
12 AAU Citra® hops (0 min.) (1 oz./28 g at 12% alpha acids)
11.5 AAU Mosaic® hops (0 min.) (1 oz./28 g at 11.5% alpha acids)
1 oz. (28 g) Citra® hops (dry hop)
1 oz. (28 g) Mosaic® hops (dry hop)
1 oz. (28 g) Amarillo® hops (dry hop)
½ tsp. yeast nutrient (10 min.)
½ Whirlfloc tablet (10 min.)
GigaYeast GY001 (NorCal Ale #1) or Wyeast 1056 (American Ale) or White Labs WLP001 (California Ale) or Safale US-05 yeast
⅞ cup corn sugar (if priming)

STEP BY STEP

Put crushed Carapils into a large nylon mesh bag. Put the bag into the heating water and remove when the water reaches 170 °F (77 °C), allowing about 30 minutes to do so. Remove the grain bag and continue to heat the water to a boil. Turn the heat off and stir in dried malt extract. When completely dissolved, turn the heat back up and bring to a boil.

Total boil time is 60 minutes with hop additions at 60 and 5 minutes left in boil. Add Whirlfloc and yeast nutrient with 10 minutes left in the boil. At flameout, add whirlpool hops and whirlpool for 10 minutes. Chill the wort to 67 °F (18 °C) and aerate thoroughly. Pitch yeast and 10 mL vial of White Labs Ultra Ferm. Add dry hops when gravity is around 1.020 and then perform a diacetyl rest. Cold crash and carbonate the beer.

Social Kitchen And Brewery

Kim Sturdavant: *Head Brewer at Social Kitchen, started with them in 2012. Before that he worked at Marin Brewing Company for more than five years. He has won two Great American Beer Festival gold medals (2015 & 2017) with his MR. KITE'S - English Pale Ale. He is the creator of the brut IPA style.*

HOW DID YOU COME UP WITH BRUT IPA?

I was using the amyloglucosidase enzyme in our Triple IPA as a strategy to not use dextrose. The goal there was to try and lighten the body and cut the sweetness out. I then got the idea to use it in a standard IPA and try to make a sparkling wine-inspired hybrid IPA. The two main points were to be ultra dry and as light in color as possible. After thinking about it for about a year or so, I finally squeezed it into the schedule. Over the course of that year I honed the concept in my mind. I wanted the hops be tropical and also have a diesel, resinous hop character; not grassy, earthy or piney. I also thought I would add an adjunct to it to get the color even lighter.

WHAT DO YOU THINK CHARACTERIZES THE STYLE?

I think it's being as dry as possible, very light colored, and lots of hop flavor and aroma. No caramel or other grain flavor should be present.

WHAT DO YOU FEEL ARE KEY INGREDIENTS IN BREWING A BRUT IPA?

Pilsner malt, adjuncts like flaked rice and corn. Of course, the amyloglucosidase enzyme and big tropical and resinous hops. A good yeast nutrient as well.

WHAT SPECIAL TECHNIQUES ARE INVOLVED IN BREWING A BRUT IPA?

I think it's mainly the application of the amyloglucosidase enzyme. Meaning at what point you can add it to the process and make sure it has time to work on the starches. That is a big reason I encourage people to use a yeast nutrient as well, so it gives the yeast more than just glucose to feed on.

At this point in time I think adding the enzyme on the hot side is the key because you denature the enzyme during the boil. Adding it during fermentation lets the enzyme keep chewing away and can lead to off flavors like diacetyl. I also feel it degrades the hop flavor and aroma when applied during fermentation. Once I moved it to the hot side I feel it has led to a better overall finished product. Although I have not got any of these later batches to finish at zero Plato (1.000 specific gravity), I know a few brewers that are getting down to zero using the enzyme on the hotside and am confident I can achieve that in my own brewery as I experiment more. My batches have been finishing at 0.8 Plato (1.003 specific gravity), which is still pretty darn dry, but more importantly they are very dry in perception and taste great.

WHAT LESSONS HAVE YOU LEARNED FROM SUCCESSES OR FAILURES IN DEVELOPING YOUR BRUT IPA RECIPE?

I think the main one is being suspi-

cious the enzyme is consuming hop oils. I have also found these beers have had very bad head retention. So in my recipe I developed a trick that accounts for that (adding a small amount of dried malt extract in the boil after the enzyme has been denatured). I haven't had any diacetyl, or VDKs (vicinal diketones) in my batches. But I know many brut IPAs have struggled with that.

I have recently discussed with some other brewers who are getting down to a specific gravity of zero with application in the mash and basically the things they were doing that I wasn't was stirring more, resting longer, and using cooler sparge water. It extends the brew day, but at the end of the day, I really think hot side application of the enzyme is the way to go.

In my latest brut, I used enzyme in the kettle while lautering and fired my kettle up so that by the time I was full I was just reaching 150 °F (66 °C) . . . it dried down to 0.2 °Plato (1.001 SG), which is perfect.

Another note is that I've noticed other brewers preferring the beer finishing between 0.0 and 0.5 °Plato (0 and 1.002 SG) rather than negative (which has happened). So it's not necessarily all about finishing as dry as possible, just dry enough to be well distinguished from a West Coast IPA and also really tasty.

WHAT DO YOU THINK THE FUTURE HOLDS FOR THE BRUT IPA STYLE?

I don't think it will reach the NEIPA status because no style has ever taken off like that before. I'm starting to think it will become a recognized BJCP style. It's clearly distinct enough as a style and I think that is a testament to becoming a recognized style. I think people will and already have been adding fruits and botanicals to make it more wine-like. I know people have added grapes. As long as it's still an IPA then it fits the brut IPA style. I encourage people to use enzyme in other styles as well. I think that could lead to some very interesting new beers.

SOCIAL KITCHEN AND BREWERY'S PUTTIN ON THE SPRITZ CLONE

(5 gallons/19 L, all-grain)
OG = 1.053 FG = 1.001–1.003
IBU = 24 SRM = 3 ABV = 6.8%

INGREDIENTS

6 lbs. (2.7 kg) Gambrinus Pilsner malt
3.75 lbs. (1.7 kg) flaked corn
5 oz. (142 g) acidulated malt
1 lb. (0.45 kg) rice hulls
0.5 lb. (0.22 kg) golden dried malt extract
6 mL Amylo 300 (amyloglucosidase enzyme)
3.5 AAU El Dorado® hops (15 min.) (0.25 oz./7 g at 14% alpha acids)
21 AAU El Dorado® hops (0 min.) (1.5 oz./43 g at 14% alpha acids)
6 oz. (170 g) El Dorado® hops (dry hop)
2 oz. (57 g) Mosaic® hops (dry hop)
½ tsp. yeast nutrient (15 min.)
½ Whirlfloc tablet (15 min.)
White Labs WLP051 (California Ale V) or Wyeast 1272 (American Ale II) or Mangrove Jack's M36 (Liberty Bell Ale) yeast
1 cup corn sugar (if priming)

STEP BY STEP

Mill the grains and dough-in with the rice hulls targeting a mash of around 1.25 quarts of water to 1 pound of grain (2.6 L/kg) and a temperature of 142 °F (61 °C). Add amyloglucosidase enzyme to mash and hold the mash at 142 °F (61 °C) for about 60 minutes or until enzymatic conversion is complete. Sparge slowly with 160 °F (72 °C) water (this will allow the mash to remain around 145 °F/63 °C and let the AMG continue to work while lautering), collecting wort until the pre-boil kettle volume is 7 gallons (26.5 L). Once you reach a boil, mix in 0.5 lb. (0.23 kg) of DME. Total boil time is 60 minutes, adding hops, Whirlfloc, and yeast nutrients as indicated. At the end of the boil, turn off heat, add the hops and whirlpool for 20 minutes. Chill the wort to 65 °F (18 °C), aerate thoroughly, and pitch yeast. Yeast cells needed are about 185.1 billion. As the fermentation nears completion, add the dry hops. Bottle or keg and carbonate as usual.

SOCIAL KITCHEN AND BREWERY'S PUTTIN ON THE SPRITZ CLONE

(5 gallons/19 L, partial mash)
OG = 1.053 FG = 1.001–1.003
IBU = 24 SRM = 3 ABV = 6.8%

INGREDIENTS

4.25 lbs. (2 kg) Pilsen dried malt extract
1 lb. (0.45 kg) Pilsen malt
1 lbs. (1.7 kg) flaked corn
5 oz. (142 g) acidulated malt
0.5 lb. (0.22 kg) golden dried malt extract
6 mL Amylo 300 (amyloglucosidase enzyme)
3.5 AAU El Dorado® hops (15 min.) (0.25 oz./7 g at 14% alpha acids)
21 AAU El Dorado® hops (0 min.) (1.5 oz./43 g at 14% alpha acids)
6 oz. (170 g) El Dorado® hops (dry hop)
2 oz. (57 g) Mosaic® hops (dry hop)
½ tsp. yeast nutrient (15 min.)
½ Whirlfloc tablet (15 min.)
White Labs WLP051 (California Ale V) or Wyeast 1272 (American Ale II) or Mangrove Jack's M36 (Liberty Bell Ale) yeast
1 cup corn sugar (if priming)

STEP BY STEP

Heat 8 qts. (7.5 L) of water to about 153 °F (67 °C). Place crushed grains in a muslin bag and submerge in the water. Stir in the Pilsen dried malt extract and stir to dissolve, then add the AMG. The temperature should stabilize around 142 °F (61 °C). Hold this mash at 142 °F (61 °C) for 60 minutes. Remove the grains and place in a colander to wash the grains with 4 qts. (3 L) of hot water. Top up the kettle to 5.5 gallons (24.6 L) and stir in the 0.5 lb (0.23 kg) of DME. Total boil time is 15 minutes. Add hops, Whirlfloc, and yeast nutrients as indicated. Follow the remainder of the all-grain instructions.

Danville Brewing Co.

Matt Sager: Head Brewer at Danville Brewing Co. in Danville, California. BJCP National Rank Judge. Won a Bronze medal at the 2017 Great American Beer Festival for his Chux Double IPA.

DESCRIBE YOUR FIRST ENCOUNTER WITH A BRUT IPA?

I first tried the style at a pouring event last year. The brewer explained he used "enzymes and Champagne yeast." I was really excited to try it, but it turned out to be a pretty big diacetyl bomb. A few weeks later I tried another one from a different brewery and it had diacetyl as well. At that point I was underwhelmed by the style and a little scared to attempt brewing one, since it seemed to be prone to developing diacetyl. It did inspire me to learn more about the style, though.

WHAT DO YOU THINK CHARACTERIZES THE STYLE?

Now I have had a few that I really liked. The ones that have piqued my interest are hop flavor-forward and aroma-forward while letting bitterness take a back seat. Very little if any caramel malt, and even though this is a hop-forward style I feel it should have a balance of malt complexity. Even if it's on the lower end, I want something there. Dry as a bone, obviously, with some fruity esters. As for hop characteristics, I think of piney, fruity, and citrus variations and a little dank doesn't hurt either.

WHAT DO YOU FEEL ARE KEY INGREDIENTS IN BREWING A BRUT IPA?

I want a backbone of a good-quality Pilsner malt because I like that little touch of sweetness you can get from Pilsner malt. Then some flaked corn and flaked oats. I like the flavor that flaked corn provides and the bit of body you get from flaked oats. Also, some acidulated malt for pH adjustments. As for type of hops, I am looking at Citra®, Mosaic®, and some Southern Hemisphere hops.

WHAT SPECIAL TECHNIQUES ARE INVOLVED IN BREWING A BRUT IPA?

For my typical IPAs I like a sulfate to chloride ratio of 2:1. For this style in particular, though, I am not looking to showcase bitterness, so I am pulling back on the sulfate and going with a balance of 1:1. I am mashing super low in the 145-146 °F (63 °C) range to maximize conversion. On the subject of conversion, I added the amyloglucosidase enzyme in the mash tun. If I were to add the enzyme late in fermentation I would allow for a secondary diacetyl rest. I think that was where some of the bruts that I have tried went sideways.

For this beer I also implemented a hop stand and recirculate through the heat exchanger, after the boil, to lower the wort temperature to 180 °F (82 °C).

WHAT LESSONS HAVE YOU LEARNED FROM SUCCESSES OR FAILURES IN DEVELOPING YOUR BRUT IPA RECIPE?

Considering this is the first time I am brewing this style, I am taking lessons from all of my past beers. Basically, I am approaching this the same way I did when developing my hazy beer, which is hop-flavor and aroma forward and low on bitterness. As well as session IPAs where you want to pack as much flavor as possible into a beer that would otherwise be considered fizzy hop water.

WHAT DO YOU THINK THE FUTURE HOLDS FOR BRUT IPA STYLE?

I don't know if it will reach the same level and demand we see with the haze craze. I think that a lot of brewers are still experimenting with recipe design and process at this point. But that's the beauty of brewing — that spirit of experimentation. Who knows, in a couple of years we might see it added to the BJCP style guidelines. Until then, regardless if it catches on, it's a fun new style that I am enjoying learning about and brewing.

DANVILLE BREWING CO.'S BRUTUS CLONE

(5 gallons/19 L, all-grain)
OG = 1.049 FG = 1.000
IBU = 31 SRM = 3 ABV = 6.4%

INGREDIENTS

8.5 lbs. (3.85 kg) Weyermann extra premium pale Pilsner malt
12 oz. (340 g) flaked corn
6 oz. (170 g) flaked oats
3.2 oz. (91 g) acidulated malt
3.1 mL Amylo 300 (amyloglucosidase enzyme)
18 AAU Citra® hops (hop stand) (1.5 oz./43 g at 12% alpha acids)
17.3 AAU Mosaic® hops (hop stand) (1.5 oz./43 g at 11.5% alpha acids)
2 oz. (57 g) Citra® hops (dry hop)
2 oz. (57 g) Mosaic® hops (dry hop)
2 oz. (57 g) Idaho 7® hops (dry hop)
½ tsp. yeast nutrient (10 min.)
½ Whirlfloc tablet (10 min.)
White Labs WLP001 (California Ale) or Wyeast 1056 (American Ale) or Safale US-05 yeast
⅞ cup corn sugar (if priming)

STEP BY STEP

Mill the grains and dough-in targeting a mash of around 1.25 quarts of water to 1 pound of grain (2.6 L/kg) and a temperature of 145 °F (63 °C). Add 3.1 mL amyloglucosidase enzyme to mash and hold the mash at 145 °F (63 °C) for 45 minutes. Vorlauf until it runs clear, then sparge slowly with 170 °F (77°C) water, collecting wort until the pre-boil kettle volume is reached.

Total boil time is 60 minutes, with no boiling hops. Add Whirlfloc and yeast nutrient with 10 minutes left in the boil. Drop temperature of wort to 180 °F (82 °C) and add the whirlpool hops. Chill the wort to 67 °F (18 °C) and aerate thoroughly. Pitch rate is 1,000,000 cells per mL per degree Plato. Add dry hops when gravity is around 1.015 and then perform diacetyl rest. Cold crash and carbonate the beer to around 2.7 volumes of CO_2.

DANVILLE BREWING CO.'S BRUTUS CLONE

(5 gallons/19 L, partial mash)
OG = 1.049 FG = 1.000
IBU = 31 SRM = 4 ABV = 6.4%

INGREDIENTS

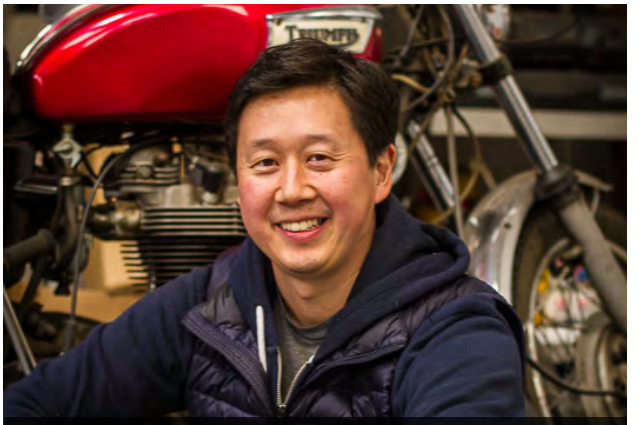
4.25 lbs. (2 kg) Pilsen dried malt extract
1 lb. (0.45 kg) Pilsner malt
12 oz. (340 g) flaked corn
6 oz. (170 g) flaked oats
3.2 oz. (91 g) acidulated malt
3.1 mL Amylo 300 (amyloglucosidase enzyme)
18 AAU Citra® hops (hop stand) (1.5 oz./43 g at 12% alpha acids)
17.3 AAU Mosaic® hops (hop stand) (1.5 oz./43 g at 11.5% alpha acids)
2 oz. (57 g) Citra® hops (dry hop)
2 oz. (57 g) Mosaic® hops (dry hop)
2 oz. (57 g) Idaho 7® hops (dry hop)
½ tsp. yeast nutrient (10 min.)
½ Whirlfloc tablet (10 min.)
White Labs WLP001 (California Ale) or Wyeast 1056 (American Ale) or Safale US-05 yeast
⅞ cup corn sugar (if priming)

STEP BY STEP

Heat 8 qts. (7.5 L) of water to about 156 °F (69 °C). Place crushed malts and grains in a muslin bag and submerge in the water. Stir in the dried malt extract and stir to dissolve, then add the Amylo. The temperature should stabilize around 145 °F (63 °C). Hold this mash at 145 °F (63 °C) for 45 minutes. Remove the grains and place in a colander to wash the grains with 4 qts. (3 L) of hot water. Top up the kettle to 5.5 gallons (24.6 L).

Total boil time is 10 minutes, with no boiling hops. Add Whirlfloc and yeast nutrient at the start of the boil. After the boil, drop temperature of wort to 180 °F (82 °C) and add the hop stand hops. Chill the wort to 67 °F (18 °C) and aerate thoroughly. Pitch rate is 1,000,000 cells per mL per degree Plato. Add dry hops when gravity is around 1.015 and then perform diacetyl rest. Cold crash and carbonate the beer to around 2.7 volumes of CO_2.

Barebottle Brewing Company



Lester Koga: *Has been brewing for 10 years now and opened Barebottle Brewing Co. on July 15, 2016 with other Co-Founder, Mike Seitz. "It was all about creating a life around what we love — which is creating beer, making beer, and making it a profession."*

DESCRIBE YOUR FIRST ENCOUNTER WITH A BRUT IPA?

My first brut IPA was Kim's beer. I had heard the rumblings around the city and I popped into Social Kitchen to try one for myself. It was dry, crisp, effervescent, and very refreshing. I ended up reaching out to Kim after that and told him I was interested in learning about making a brut IPA. He let me bring my whole staff over and he spent time with us going over the process, etc.

WHAT DO YOU THINK CHARACTERIZES THE STYLE?

I think there are several factors, one is being incredibly dry, i.e. very little residual sugar. It should finish at or near zero Plato. To what differentiates, in my mind, the brut to the traditional West Coast IPA is it uses all the modern, really hot hops like Citra®, El Dorado®, Mosaic®, Galaxy, etc. With a really clean, dry malt character.

WHAT DO YOU FEEL ARE KEY INGREDIENTS IN BREWING A BRUT IPA?

Keep it dry and keep it hoppy. We at Barebottle bastardize as many things as we can. I know most people would not think about making a hazy brut IPA. But for us, that was taking who we are and adapting this brut IPA philosophy and putting our spin on it. So we kind of took our hazy IPA grain bill and wanted to see what body it would add. One thing I noticed with

brut IPAs is they are so dry I wondered what would add more dimension to them. I wondered what cereal grains or yeast I could add to a brut IPA and would the enzyme chew through the yeast ester.

WHAT SPECIAL TECHNIQUES ARE INVOLVED IN BREWING A BRUT IPA?

So for us, adding the enzyme is definitely a special technique. We have tried three different ways now. First we added once the beer was at terminal gravity and that was with White Labs 001 (California Ale) yeast. The second one we did was BRUTS Lee and we added it around day 8 or 9, so a couple degrees before terminal gravity. On this most recent one (Mt. Brutus) we added it on day four of fermentation. One thing to remember with this style is to watch out for diacetyl, because you are restarting fermentation when you add the enzyme.

WHAT LESSONS HAVE YOU LEARNED FROM SUCCESSES OR FAILURES IN DEVELOPING YOUR BRUT IPA RECIPE?

So managing diacetyl would be number one to look out for. This is a new style and new way of brewing, so experimenting is so critical and it's also the fun part. Your choices will depend on what kind of brut IPA you want to brew — we wanted to bring that stone fruit character. Could we make a hazy stone fruit IPA that finishes at or around zero gravity? That has been my personal challenge.

WHAT DO YOU THINK THE FUTURE HOLDS FOR THE BRUT IPA STYLE?

I think, ultimately, it depends on the drinker. The consumer is the one who decides if the style will be as popular as the NEIPA. They are the ones who decide how popular it will be. I feel like the dryness factor is the number one arching of the style. It's meant to be effervescent and dry.

Ultimately, the fun of the challenge is looking at trends and innovating on them.

BAREBOTTLE BREWING CO.'S MT. BRUTUS CLONE

(5 gallons/19 L, all-grain)
OG = 1.050 FG = 1.000
IBU = 61 SRM = 3.5 ABV = 6.6%

INGREDIENTS

9 lbs. 12.8 oz. (4.3 kg) 2-row malt
8 oz. (227 g) rolled wheat
3.2 oz. (91 oz.) flaked corn
0.32 mL Amylo 300 (amyloglucosidase enzyme)
25.2 AAU El Dorado® hops (0 min.) (1.75 oz./49 g at 14.4% alpha acids)
21.2 AAU Mosaic® hops (0 min.) (1.75 oz./49 g at 12.1% alpha acids)
4 oz. (113 g) Citra® hops (dry hop)
2 oz. (57 g) Mosaic® hops (dry hop)
2 oz. (57 g) El Dorado® hops (dry hop)
½ tsp. yeast nutrient (10 min.)
½ Whirlfloc tablet (10 min.)
GigaYeast GY054 (Vermont IPA) or White Labs WLP095 (Burlington Ale) or LalBrew New England yeast
⅞ cup corn sugar (if priming)

STEP BY STEP

Mill the grains and dough-in targeting a mash of around 1.25 quarts of water to 1 pound of grain (2.6 L/kg) and a temperature of 149 °F (65 °C). Hold the mash at 149 °F (65 °C) for 45 minutes. Vorlauf until it runs clear, then sparge slowly with 170 °F (77°C) water, collecting wort until the pre-boil kettle volume is reached.

Total boil time is 60 minutes, with no boiling hops. Add Whirlfloc and yeast nutrient with 10 minutes left in the boil. After the boil, turn off heat, add hops, and whirlpool for 30 minutes. Chill the wort to 67 °F (18 °C) and aerate thoroughly.

Pitch rate is 1,000,000 cells per mL per degree plato. Add 0.32 mL Amylo 300 when gravity is around 1.011 and then perform a diacetyl rest. Add dry hops when gravity is around 1.000. Cold crash and carbonate the beer to around 2.7 volumes of CO_2.

BAREBOTTLE BREWING CO.'S MT. BRUTUS CLONE

(5 gallons/19 L, partial mash)
OG = 1.050 FG = 1.000
IBU = 61 SRM = 3.5 ABV = 6.6%

INGREDIENTS

4.5 lbs. (2 kg) extra light dried malt extract
1 lb. (0.45 kg) 2-row malt
8 oz. (227 g) rolled wheat
3.2 oz. (91 oz.) flaked corn
0.32 mL Amylo 300 (amyloglucosidase enzyme)
25.2 AAU El Dorado® hops (0 min.) (1.75 oz./49 g at 14.4% alpha acids)
21.2 AAU Mosaic® hops (0 min.) (1.75 oz./49 g at 12.1% alpha acids)
4 oz. (113 g) Citra® hops (dry hop)
2 oz. (57 g) Mosaic® hops (dry hop)
2 oz. (57 g) El Dorado® hops (dry hop)
½ tsp. yeast nutrient (10 min.)
½ Whirlfloc tablet (10 min.)
GigaYeast GY054 (Vermont IPA) or White Labs WLP095 (Burlington Ale) or LalBrew New England yeast
⅞ cup corn sugar (if priming)

STEP BY STEP

Heat 3 qts. (3 L) of water to about 161 °F (72 °C). Place crushed malts and grains in a muslin bag and submerge in the water. The temperature should stabilize around 149 °F (65 °C). Hold the mash at 149 °F (65 °C) for 45 minutes. Remove the grains and place in a colander to wash the grains with 3 qts. (3 L) of hot water. Top up the kettle to 5.5 gallons (24.6 L).

Total boil time is 60 minutes, with no boiling hops. Add Whirlfloc and yeast nutrient with 10 minutes left in the boil. After the boil, turn off heat, add hops, and whirlpool for 30 minutes. Chill the wort to 67 °F (18 °C) and aerate thoroughly.

Pitch rate is 1,000,000 cells per mL per degree plato. Add 0.32 mL Amylo 300 when gravity is around 1.011 and then perform a diacetyl rest. Add dry hops when gravity is around 1.000. Cold crash and carbonate the beer to around 2.7 volumes of CO_2.

Photos courtesy of Bell's Brewery

FOR WHOM THE BELL'S POURS

5 Classic Clone Recipes & Brewing Tips from a True Midwest Craft Beer Pioneer

by Nick Rodammer

For many homebrewers, it all started with a kit. For Larry Bell, the founder and President of Bell's Brewery, one of the oldest craft breweries east of the Mississippi River, it was no different when he started homebrewing in early 1980. His first kit was comprised of a can of malt extract and a 5-pound (2.3-kg) bag of sugar. That may sound foreign to the modern day homebrewer, but at that time, resources on homebrewing were scarce. "At that time, there just weren't a lot of homebrewers," Larry mused when speaking of his early days in the hobby. "Those first few kits were basic bucket brews; I don't even know if any hops were involved."

As this recollection illustrates, Bell's Brewery, like many other breweries who started in that era, came from very humble beginnings. Since then, it has transformed into the seventh largest craft brewery in the United States over its 35-year history, producing 464,000 barrels of beer in 2017. The spirit of homebrewing was a major influence on Bell's in its earliest days of operations, and despite its now much larger scale, continues on in the present.

THE BEGINNING

Eventually, Bell moved on from those first basic kits, and after seeking out where to find better homebrewing supplies, started brewing all-grain batches within his first year as a homebrewer. In the true homebrewing spirit, seeking to control variables with limited resources, Bell recalled

a time shortly after he began making all-grain batches where his roommate (and landlord) approached him about why his bedroom window was open in February. "He had a wood stove to heat the house that kept the other rooms too hot, and the basement was too cold, so I needed to keep the window open so my stout wouldn't ferment too hot," Larry recalled.

As Bell's hobby became more serious, he decided to open the Kalamazoo Brewing Company in 1983, which at that time was only a homebrew supply store that was open around 10 hours per week. Not only did this allow him to turn his hobby into a small business, it allowed him to buy his homebrewing ingredients wholesale. At this time, Bell's personal homebrewing hobby began to resemble more of a business as well. After opening the shop he developed a relationship with the owner of the Kalamazoo Spice Extraction Company (now known as Kalsec). Kalsec was a big player in developing hop products, and began to pay Larry to do test batches with their hop extracts and oils.

While running the shop and doing the experiments with Kalsec, Bell continued to brew up to 20 gallons (76 L) of homebrew per week, and to make ends meet and continue to fund his brewing, began selling his beer to friends for $10/case. Eventually though, it became obvious that this practice, which wasn't exactly legal, wouldn't be sustainable. However, the exact moment that inspired Bell to begin the process of taking his brewing operation commercial came late one Saturday night. "I heard a knock on the door, and I knew I'd been selling to people I don't know, and thought that might be it." That knock ended up being from friends who were in a band about to leave town, who wanted to buy some of his cream stout. That scare was enough to convince him to write to the federal government the next day to find out what he needed to do to obtain a commercial brewery license. The initial response, however, wasn't what he had hoped to hear back. "The letter was very discouraging," Bell stated.

Starting out as a homebrewer in 1980, Larry Bell has contributed significantly to the craft beer revolution in the United States after opening Bell's Brewery nearly 35 years ago.

The letter went on to warn him that "this is a very capital intensive business and you need a lot of expertise to do this," he recalled.

Despite the initially discouraging response, Bell was able to eventually get his brewery licensed, and Bell's began selling beer commercially in the fall of 1985. The small operation produced 135 barrels in its first year, starting out on a brewhouse that was centered around a 15-gallon (57-L) soup kettle and a fermentation cellar using plastic drums. Bell was eventually able to find larger kettles but still operated on a 1-bbl, three-vessel system for Bell's first five years of operation, the last year of which 1,000 barrels of beer were produced. "We were in many ways commercial homebrewers," Bell recalled when discussing some of their techniques.

For those first few years, the small staff at Bell's shared all responsibilities, whether that would be brewing, washing bottles, labeling, or whatever else needed to be done. Bell relied on self-distribution at first, and drove all over the state of Michigan to find new accounts to buy his beer. At the same time, money was tight and financing was hard to come by. To keep the doors open, Bell obtained a number of loans from friends, acquaintances, and investors to keep Bell's operating. By the time the 1990s rolled around, Bell was still unable to obtain traditional bank financing, and instead took out additional personal loans (collectively amounting to nearly half a million dollars) to purchase the brewery's first legitimate commercial brewhouse, a 15-barrel system, and later, a 30-barrel system to go with it.

With newfound capacity and capitalization, Bell's continued to grow throughout the 1990s, and in 1993 became the first brewery in the state of Michigan to open its own on-site pub, the Eccentric Café, which allowed it to serve beer by the glass for the first time since Prohibition. The Café has grown over the years as well, and now includes a concert venue, outdoor beer garden, and full service restaurant.

THE 2000s

By the early 2000s, continued growth was beginning to push Bell's toward maximizing the capacity at its downtown Kalamazoo brewery, and further expansion at this landlocked property would be difficult. To support continued growth, plans were made to open a second brewery that would allow for growth not only in the near term, but long term as well. While this alone would represent a major step for Bell's, it would also introduce them to John Mallett, Bell's current Director of Operations, who would be a key piece in taking Bell's from a small regional brewery producing around 30,000

Top: *The Bell's Comstock brewery opened in 2003 with a 50-barrel brewhouse and space to grow. In 2012 a 200-barrel brewhouse was added.*
Bottom Left: *Tours of the brewery are offered, and special beer releases such as Hopslam always bring large crowds to the tasting room.*
Bottom Right: *John Mallett, Director of Operations, has been a major force behind the quality and growth of Bell's Brewing.*

barrels of beer per year, to a national player that would rank among the largest in the country.

For those who have been around the brewing industry for any appreciable amount of time, John Mallett needs no introduction. He's one of the foremost brewing experts in the craft beer industry. Notably, he's the author of *Malt: A Practical Guide from Field to Brewhouse* from Brewers Publications. He was also a founding member of the Hop Quality Group, has served on the technical committee of the Master Brewers Association of America for over a decade, and has been an extended faculty member of the Siebel Institute for nearly 25 years.

Like many though, Mallett got his start in the brewing industry at the very bottom, while living in Boston as a college student studying chemical engineering in 1986. An interest in the early East Coast craft beer scene got Mallett interested in the idea of working in the industry, and the first job he took was with Commonwealth Brewery in Boston, working in the kitchen at the brewpub. Not long after, a job opened up in the brewery and, despite it meaning a pay cut, he jumped at the chance to take it. Before long he rose to Head Brewer, but after three years, elected to leave to enroll in the brewing program at

Siebel Institute. After graduating, he took a job as Brewmaster with Old Dominion Brewing Co. in Virginia.

After a five-year stint there, which saw Old Dominion grow tremendously, Mallett decided to start his own company, SAAZ Brewing Equipment and Services in 1995. SAAZ would specialize in brewery capital projects, literally helping build breweries all over the country — some of which were large enough to make more than 1 million barrels of beer per year. This proved to be a successful business for him, and is what prompted a call from Larry Bell in 2001. It was through this initial engagement that Mallett was offered the opportunity to stay on as the new brewery's Director of Operations, a title he has held ever since. This proved to perhaps be the most important hire Larry Bell would make, as Mallett is frequently credited as a major force that pushed Bell's to the next level in terms of quality and process improvement.

The new Comstock brewery, seven miles from the original, opened in 2003 with the 50-barrel brewhouse that is still in use today, and enough cellar space to double capacity compared to what was possible at the Kalamazoo brewery alone. However, the new facility was built with growth in mind, and over the next several years, the facility saw multiple expansions, which included the addition of a brand new 200-barrel brewhouse in 2012 and a canning line in late 2013.

Further expansions to the Comstock brewery over the last few years will allow production of up to 1 million barrels per year, which will support Bell's growing presence nationally, where they now reach 40 states, including adding new markets in New England and Colorado in 2018.

Despite the growth Bell's was experiencing in their core business, Larry had for years debated opening a brewery in Michigan's Upper Peninsula. After finding the right property, Upper Hand Brewery, which is a division of Bell's but its own entity and brand, began producing and selling beer in 2014 out of a brand new brewery in Escanaba. Upper Hand is unique in that it is only available in the Upper Peninsula, Northern Wisconsin, and Minnesota, and its portfolio — including beers such as Upper Peninsula Ale, Escanaba Black Beer, and Yooper Ale — have been designed and branded specifically for this market.

BELL'S LINEUP

You don't grow like Bell's has over its 35-year history without developing a strong set of core brands. In general, Bell's has thrived by producing a portfolio of well-balanced, high-quality beers that appeal to a wide range of drinkers, though innovation has remained a hallmark of the brewery's philosophy ever since its founding. Bell's first flagship brand was its Amber Ale, a beer that is still sold year-round today. In the 1990s, IPA had not yet become the phenomenon that it is today, and Amber Ale offered a malty, flavorful alternative to the mass-marketed adjunct lagers that made up the majority of the options for the average beer drinker. "There's no doubt Amber Ale carried the brewery in the late 80s and early

Along with fermentation tanks, the brewery in Comstock also has significant cellar space for barrel-aging beers, such as their popular Bourbon barrel aged Black Note, an 11.2% ABV stout that is a blend of Expedition Stout and Bell's Special Double Cream Stout.

90s," Bell recalled. While Amber Ale is not the brewery's flagship beer any longer, it has remained popular, and is still Bell's third best-selling brand.

Another popular beer, Solsun, an American wheat ale, appeared for the first time in 1991. This spring and summer seasonal featuring Saaz hops and a slightly fruity aroma and flavor quickly became another one of Bell's most popular offerings. However, a trademark dispute with Cerveceria Cuauhtémoc Moctezuma, makers of the Mexican lager Sol, led Bell's to rename the beer Oberon in 1997, a name that has remained for the past 20 years. Oberon has remained another standout brand for Bell's, and remains a staple on store shelves during the spring and summer, especially in its home state of Michigan where its arrival each spring is met with midnight release parties and reminds craft beer drinkers that spring has arrived. Despite availability in most markets only stretching from March through September, only one beer in the Bell's portfolio sells more than Oberon.

As many know, the introduction of Bell's current flagship and best-selling beer, Two Hearted Ale, is really what helped make Bell's the national player it is today. This iconic American IPA first appeared in 1997 and featured the little known (at the time) Centennial hop. As American beer drinker's love affair with IPAs grew in the 2000s, Two Hearted Ale's popularity grew along with it, enough so that it presently comprises roughly half of the total production at Bell's. More on the history of Two Hearted Ale is included in the sidebar on page 69.

It is not just these core brands that have defined the brewery however, as Bell's boasts numerous other seasonal or specialty beers that have in some cases achieved cult status amongst craft beer drinkers. Debuting in 2004, Hopslam — a massive 10% ABV double IPA made with honey — uses seven different hop varieties but features a heavy handed dry hopping of Simcoe®. This beer is released once per year in January, which per Mallett, is to ensure that it gets to consumers as fresh as possible.

On the opposite end of the spectrum, Bell's is no stranger to brewing dark beers. Its two year-round offerings include Kalamazoo Stout, an American-style stout that utilizes the historic ingredient brewer's licorice, and Porter, which was first brewed in 1987. Perhaps a fan favorite of Bell's dark beers, however, is Expedition Stout, a 10.5% ABV imperial stout that has not only medaled two times at the Great American Beer Festival (GABF) when fresh, but has also taken home three medals in the aged beer category at GABF (the 1995 vintage took home a silver medal in the "Strong Ale" category that year, and a gold in the "Aged Beer" category 16 years later!). While a Bourbon barrel aged version of Expedition Stout was released for the first time in 2016, Bell's most popular Bourbon barrel aged beer remains Black Note. This 11.2% ABV stout, which is a blend of Expedition Stout and Bell's Special Double Cream Stout, does not have a set release schedule, and is only produced in small quantities.

While Bell's portfolio is vast, it does illustrate the range at which the brewery can produce world-class beers. Its Octoberfest Beer is considered by many to be one of the best domestic-made examples of the Märzen style, and its Quinannan Falls lager, which like Hopslam is generously dry-hopped with Simcoe®,

BELL'S BREWERY'S TWO HEARTED ALE CLONE

(5 gallons/19 L, all-grain)
OG = 1.065 FG = 1.011
IBU = ~60 SRM = 7 ABV = 7%

Two Hearted Ale is one of the defining American-style India pale ales. This beer is bursting with aromas ranging from pine resins to grapefruit notes from the use of 100% Centennial hops.

INGREDIENTS

11 lbs. (5 kg) 2-row pale malt
3.25 lbs. (1.5 kg) pale ale malt
0.5 lb. (0.23 kg) caramel malt (40 °L)
12.5 AAU Centennial hops (45 min.) (1.25 oz./35 g of 10% alpha acids)
12.5 AAU Centennial hops (30 min.) (1.25 oz./35 g of 10% alpha acids)
3.5 oz. Centennial hops (dry hop)
White Labs WLP001 (California Ale) or Wyeast 1056 (American Ale) or Safale US-05 yeast
¾ cup corn sugar (if priming)

STEP BY STEP

Heat 19.6 qts. (18.6 L) of strike water to 163 °F (73 °C). Mix with grains, the mash should stabilize at about 150 °F (66 °C). Hold at this temperature for 60 minutes, then raise temperature to mash out at about 168 °F (76 °C) either by infusion of boiling water, decoction, or other means. Vorlauf until wort runs clear then begin the sparge process. Collect approximately 7 gallons (25.6 L) and bring to a boil. Total boil time is 75 minutes, adding hops as indicated.

After boil is complete, turn off the heat, add the final hop addition, then give a long stir to create a whirlpool. Let wort settle for 10 minutes, then chill the wort to 68–74 °F (20–23 °C). There should be about 5.5 gallons (21 L) of wort in your fermenter. Top fermenter up with cold water if you are short. Aerate wort and add yeast. Place your fermenter in a temperature-stable place that is in the 68–74 °F (20–23 °C) range. On day five of fermentation, add the dry hops addition. Bottle or keg after 3 days on dry hops.

BELL'S BREWERY'S TWO HEARTED ALE CLONE

(5 gallons/19 L, extract with grains)
OG = 1.066 FG = 1.012
IBU = ~60 SRM = 7 ABV = 7%

INGREDIENTS

6.6 lbs. (3 kg) light liquid malt extract
2.5.lbs. (1.13 kg) light dried malt extract
0.5 lb. (0.23 kg) caramel malt (40 °L)
12.5 AAU Centennial hops (45 min.) (1.25 oz./35 g of 10% alpha acids)
12.5 AAU Centennial hops (30 min.) (1.25 oz./35 g of 10% alpha acids)
3.5 oz. Centennial hops (dry hop)
White Labs WLP001 (California Ale) or Wyeast 1056 (American Ale) or Safale US-05 yeast
¾ cup corn sugar (if priming)

STEP BY STEP

Place crushed grains in a muslin bag and steep in 1 gallon (4 L) of water at 160 °F (71 °C) for 20 minutes in your brew pot. Remove the grains and fill up your kettle to 3.5 gallons (13 L) of water. Bring to a boil and then remove kettle from heat and add malt extracts. Stir until dissolved and return kettle to heat and boil for 45 minutes. Add hops as indicated in the instructions.

When the boil is complete, chill the wort to 68–74 °F (20–23 °C). Fill your sanitized fermenter with 2 gallons (8 L) of cold water and transfer chilled wort to fermenter. Top fermenter up to 5.5 gallons (21 L) with cold water. Aerate wort and add yeast. Place your fermenter in a temperature-stable place that is in the 68–74 °F (20–23 °C) range. On day five of fermentation, add the dry hop addition either directly into the fermenter or by transferring beer on top of dry hops in a secondary fermenter. Bottle or keg after fermentation after 3 days on dry hops.

BELL'S BREWERY'S OBERON CLONE

(5 gallons/19 L, all-grain)
OG = 1.056 FG = 1.012
IBU = 30 SRM = 5 ABV = 5.8%

Oberon is a wheat ale fermented with Bell's Brewery's signature house ale yeast, mixing a spicy hop character with mildly fruity aromas, often causing many to assume there is an addition of fruit or spices. The addition of wheat malt lends a smooth mouthfeel, making it a classic summer beer. Oberon is one of Bell's best-selling beers, even though it's only available from March-August each year.

INGREDIENTS

6 lbs. (2.7 kg) 2-row malt
6 lbs. (2.7 kg) white wheat malt
8 oz. (0.23 kg) Munich malt
8 oz. (0.23 kg) Carapils® malt
3.5 AAU Hersbrucker hops (60 min.) (1 oz./28 g at 3.4% alpha acids)
3.5 AAU Hersbrucker hops (30 min.) (1 oz./28 g at 3.4% alpha acids)
2 oz. (56 g) Saaz hops (0 min.)
White Labs WLP001 (California Ale) or Wyeast 1056 (American Ale) or Safale US-05 yeast
¾ cup corn sugar (if priming)

STEP BY STEP

Heat 17.3 qts. (16.4 L) of strike water to 165 °F (74 °C). Mix with grains, the mash should stabilize at about 152 °F (67 °C). Hold at this temperature for 60 minutes, then raise temperature to mash out at about 168 °F (76 °C) either by infusion of boiling water, decoction, or other means. Vorlauf until wort runs clear then begin the sparge process. Collect approximately 6.5 gallons (24.6 L) and bring to a boil. Total boil time is 60 minutes, adding hops as indicated.

After boil is complete, turn off the heat, add the final hop addition, then give a long stir to create a whirlpool. Let wort settle for 20 minutes, then chill the wort to 68–74 °F (20–23 °C). There should be about 5.5 gallons (21 L) of wort in your fermenter. Top fermenter up with cold water if you are short. Aerate wort and add yeast. Place your fermenter in a temperature-stable place that is in the 68–74 °F (20–23 °C) range. Bottle or keg after fermentation is complete.

BELL'S BREWERY'S OBERON CLONE

(5 gallons/19 L, extract with grains)
OG = 1.056 FG = 1.012
IBU = 30 SRM = 5 ABV = 5.8%

INGREDIENTS

6.6 lbs. (3 kg) wheat liquid malt extract
1 lbs. (0.45 kg) wheat dried malt extract
0.5 lb. (0.23 kg) Munich malt
0.5 lb. (0.23 kg) Carapils® malt
3.5 AAU Hersbrucker hops (60 min.) (1 oz./28 g at 3.4% alpha acids)
3.5 AAU Hersbrucker hops (30 min.) (1 oz./28 g at 3.4% alpha acids)
2 oz. (56 g) Saaz hops (0 min.)
White Labs WLP001 (California Ale) or Wyeast 1056 (American Ale) or Safale US-05 yeast
¾ cup corn sugar (if priming)

STEP BY STEP

Place crushed grains in a muslin bag and steep them in 1 gallon (4 L) of water at 160 °F (71 °C) for 20 minutes in your brew pot. Remove the grains and fill up your kettle to 3.5 gallons (13 L) of water. Bring to a boil and then remove kettle from heat and add malt extracts. Stir until dissolved and return kettle to heat and boil for 60 minutes. Add hops as indicated.

When the boil is complete, chill the wort to 68–74 °F (20–23 °C). Fill your sanitized fermenter with 2 gallons (8 L) of cold water and transfer chilled wort to fermenter. Top fermenter up to 5.5 gallons (21 L) with cold water. Aerate wort and add yeast. Place your fermenter in a temperature-stable place that is in the 68–74 °F (20–23 °C) range. Bottle or keg after fermentation is complete.

TIPS FOR SUCCESS:

The recommended yeast strains in this recipe will get homebrewers close to the taste of Oberon, but because Bell's house yeast is proprietary, the only way to use the same strain is to culture it from a fresh Bell's beer. On their website, Bell's offers these directions for culturing yeast:

- Refrigerate your bottle or can of beer for one week. Make sure you have a nice slurry on the bottom. Two to three bottles or cans will yield better results.
- Open bottle or can and sanitize the lip with a flame. NOTE: You may also want to spray sanitizer on and around the cap before opening.
- Gently pour the beer into a glass, leaving the sediment (yeast) in the bottle or can.
- Swirl the sediment/yeast in the bottle and re-flame the lip.
- Pour sediment into a sanitized container.
- Grow your yeast using a stepped starter – start with 75ML (about ⅓ of a cup) of wort, then let ferment for two to three days. Then add an additional 750ML of wort and let ferment an additional two to three days.

BELL'S BREWERY'S AMBER ALE CLONE

(5 gallons/19 L, all-grain)
OG = 1.056 FG = 1.012
IBU = 30 SRM = 13 ABV = 5.8%

The beer that helped build Bell's, Amber Ale features both toasted and sweet caramel notes, balanced with herbal and citrus hop aromas. Capped by a clean bitterness, it's incredibly versatile with food, but very tasty on its own.

INGREDIENTS

9.5 lbs. (4.3 kg) North American 2-row pale malt
2 lbs. (0.91 kg) Munich malt (10 °L)
8 oz. (0.23 kg) caramel malt (40 °L)
8 oz. (0.23 kg) caramel malt (120 °L)
8 oz. (0.23 kg) Victory® malt
5 AAU Cascade hops (45 min.) (1 oz./28 g at 5% alpha acids)
4.5 AAU Fuggle hops (30 min.) (1 oz./28 g at 4.5% alpha acids)
4.5 AAU Fuggle hops (15 min.) (1 oz./28 g at 4.5% alpha acids)
1 oz. (28 g) Cascade hops (0 min.)
White Labs WLP001 (California Ale) or Wyeast 1056 (American Ale) or Safale US-05 yeast
¾ cup corn sugar (if priming)

STEP BY STEP

Heat 17.3 qts. (16.4 L) of strike water to 165 °F (74 °C). Mix with grains, the mash should stabilize at about 152 °F (67 °C). Hold at this temperature for 60 minutes, then raise temperature to mash out at about 168 °F (76 °C), either by infusion of boiling water, decoction, or other means. Vorlauf until wort runs clear then begin the sparge process. Collect approximately 6.5 gallons (24.6 L) and bring to a boil. Total boil time is 60 minutes, adding hops as indicated. After boil is complete, turn off the heat, add the final hop addition, then give a long stir to create a whirlpool. Let wort settle for 5 minutes.

Chill the wort to 68–74 °F (20–23 °C). There should be about 5.5 gallons (21 L) of wort in your fermenter. Top fermenter up with cold water if you are short. Aerate wort and add yeast. Place your fermenter in a temperature-stable place that is in the 68–74 °F (20–23 °C) range. Bottle or keg after fermentation is complete.

BELL'S BREWERY'S AMBER ALE CLONE

(5 gallons/19 L, extract with grains)
OG = 1.056 FG = 1.012
IBU = 30 SRM = 13 ABV = 5.8%

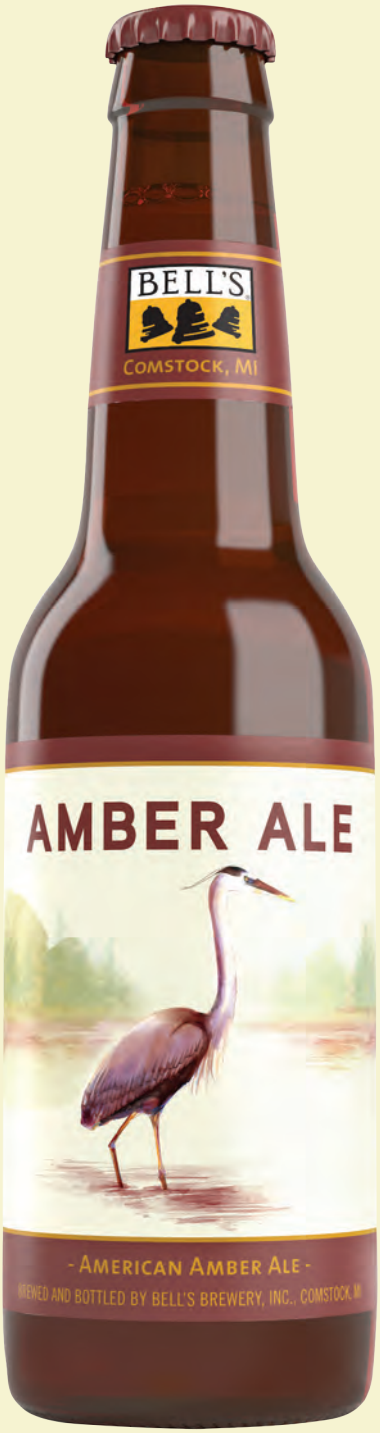
INGREDIENTS

3.3 lbs. (1.5 kg) light liquid malt extract
3.3 lbs. (1.5 kg) Munich liquid malt extract
1 lbs. (0.45 kg) light dried malt extract
8 oz. (0.23 kg) caramel malt (40 °L)
8 oz. (0.23 kg) caramel malt (120 °L)
8 oz. (0.23 kg) Victory® malt
5 AAU Cascade hops (45 min.) (1 oz./28 g at 5% alpha acids)
4.5 AAU Fuggle hops (30 min.) (1 oz./28 g at 4.5% alpha acids)
4.5 AAU Fuggle hops (15 min.) (1 oz./28 g at 4.5% alpha acids)
1 oz. (28 g) Cascade hops (0 min.)
White Labs WLP001 (California Ale) or Wyeast 1056 (American Ale) or Safale US-05 yeast
¾ cup corn sugar (if priming)

STEP BY STEP

Place crushed grains in a muslin bag and steep them in 1 gallon (4 L) of water at 160 °F (71 °C) for 20 minutes in your brew pot. Remove the grains and fill up your kettle to 3.5 gallons (13 L) of water. Bring to a boil and then remove kettle from heat and add malt extracts. Stir until dissolved and return kettle to heat and boil for 45 minutes. Add hops as indicated. After boil is complete, turn off the heat, add the final hop addition, then give a long stir to create a whirlpool. Let wort settle for 5 minutes.

Chill the wort to 68–74 °F (20–23 °C). Fill your sanitized fermenter with 2 gallons (8 L) of cold water and transfer chilled wort to fermenter. Top fermenter up to 5.5 gallons (21 L) with cold water. Aerate wort and add yeast. Place your fermenter in a temperature-stable place that is in the 68–74 °F (20–23 °C) range. Bottle or keg after fermentation is complete.



BELL'S BREWERY'S HOPSLAM ALE CLONE

(5 gallons/19 L, all-grain)
OG = 1.086 FG = 1.010
IBU = 65+ SRM = 7 ABV = 10%

Starting with six different hop varieties added to the brew kettle and culminating with a massive dry hop addition of Simcoe® hops, Bell's Hopslam Ale possesses the most complex hopping schedule in the Bell's repertoire.

INGREDIENTS

11 lbs. (5 kg) 2-row malt
5.5 lbs. (2.5 kg) pale ale malt
0.5 lb. (0.23 kg) caramel malt (40 °L)
12 oz. (0.34 kg) honey (0 min.)
10 oz. (285 g) corn sugar (0 min.)
2.3 AAU Crystal or Mt. Hood hops (45 min.) (0.5 oz./14 g at 4.5% alpha acids)
6 AAU Mosaic® hops (20 min.) (0.5 oz./14 g at 12% alpha acids)
2.3 AAU AAU Glacier or Fuggle hops (20 min.) (0.5 oz./14 g at 4.5% alpha acids)
10 AAU Centennial hops (15 min.) (1 oz./28 g at 10% alpha acids)
6 AAU Mosaic® hops (5 min.) (0.5 oz./14 g at 12% alpha acids)
2.3 AAU AAU Glacier or Fuggle hops (5 min.) (0.5 oz./14 g at 4.5% alpha acids)
2 oz. (56 g) Amarillo® hops (0 min.)
0.5 oz. (14 g) Crystal or Mt. Hood hops (0 min.)
4 oz. Simcoe® hops (dry hop)
White Labs WLP001 (California Ale) or Wyeast 1056 (American Ale) or Safale US-05 yeast
¾ cup corn sugar (if priming)

STEP BY STEP

Heat 22 qts. (21 L) of strike water to 163 °F (73 °C). Mix with grains, the mash should stabilize at about 149 °F (65 °C). Hold at this temperature for 70 minutes, then raise temperature to mash out at about 168 °F (76 °C) either by infusion of boiling water, decoction, or other means. Vorlauf until wort runs clear then begin the sparge process. Collect approximately 7 gallons (24.6 L) and bring to a boil. The gravity of the wort at this point should be 1.068. Supplement with more corn sugar or less if your gravity is off.

Total boil time is 75 minutes, adding hops as indicated. After boil is complete, turn off the heat, add the corn sugar, honey, and final hop addition, then give a long stir to create a whirlpool. Let wort settle for 15 minutes.

Chill wort to 68–74 °F (20–23 °C). There should be about 5.5 gallons (21 L) of wort in your fermenter. Top fermenter up with cold water if you are short. Aerate wort and add yeast. Place your fermenter in a temperature-stable place that is in the 68–74 °F (20–23 °C) range. On day five of fermentation, add the dry hops addition. Bottle or keg after 3 days on dry hops complete.

BELL'S BREWERY'S HOPSLAM ALE CLONE

(5 gallons/19 L, extract with grains)
OG = 1.086 FG = 1.010
IBU = 65+ SRM = 7 ABV = 10%

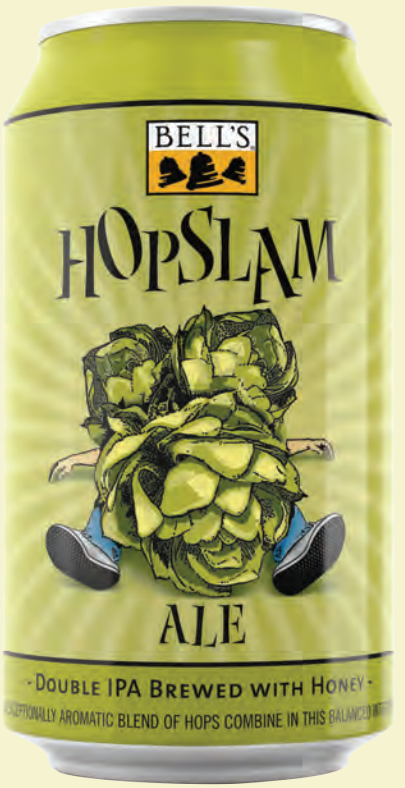
INGREDIENTS

6.6 lbs. (3 kg) light liquid malt extract
4 lbs. (1.8 kg) light dried malt extract
0.5 lb. (0.23 kg) caramel malt (40 °L)
12 oz. (0.34 kg) honey (0 min.)
10 oz. (285 g) corn sugar (0 min.)
2.3 AAU Crystal or Mt. Hood hops (45 min.) (0.5 oz./14 g at 4.5% alpha acids)
6 AAU Mosaic® hops (20 min.) (0.5 oz./14 g at 12% alpha acids)
2.3 AAU AAU Glacier or Fuggle hops (20 min.) (0.5 oz./14 g at 4.5% alpha acids)
10 AAU Centennial hops (15 min.) (1 oz./28 g at 10% alpha acids)
6 AAU Mosaic® hops (5 min.) (0.5 oz./14 g at 12% alpha acids)
2.3 AAU AAU Glacier or Fuggle hops (5 min.) (0.5 oz./14 g at 4.5% alpha acids)
2 oz. (56 g) Amarillo® hops (0 min.)
0.5 oz. (14 g) Crystal or Mt. Hood hops (0 min.)
4 oz. Simcoe® hops (dry hop)
White Labs WLP001 (California Ale) or Wyeast 1056 (American Ale) or Safale US-05 yeast
¾ cup corn sugar (if priming)

STEP BY STEP

Place crushed grains in a muslin bag and steep in 1 gallon (4 L) of water at 160 °F (71 °C) for 20 minutes in your brew pot. Remove the grains and fill up your kettle to 3.5 gallons (13 L) of water. Bring to a boil and then remove kettle from heat and add malt extracts. Stir until dissolved and return kettle to heat and boil for 45 minutes. Add hops as indicated.

When the boil is complete, add the honey, corn sugar, and final hop addition, then give the wort a long stir to create a whirlpool. Let wort settle for 10 minutes. Chill the wort to 68–74 °F (20–23 °C). Fill your sanitized fermenter with 2 gallons (8 L) of cold water and transfer chilled wort to fermenter. Top fermenter up to 5.5 gallons (21 L) with cold water. Aerate wort and add yeast. Place your fermenter in a temperature-stable place that is in the 68–74 °F (20–23 °C) range. On day five of fermentation, add the dry hop addition either directly into the fermenter or by transferring beer on top of dry hops in a secondary fermenter. Bottle or keg after fermentation is complete.



BELL'S BREWERY'S QUINANNAN FALLS CLONE

(5 gallons/19 L, all-grain)
OG = 1.057 FG = 1.009
IBU = 45 SRM = 4 ABV = 6.3%

Quinannan Falls is a dry-hopped India pale lager that possesses a crisp, dry bitterness you would expect from a German Pilsner, but the use of highly aromatic Simcoe® hops from the Pacific Northwest evoke the fragrant pine forests that inspired this summer seasonal beer from Bell's.

INGREDIENTS

12 lbs. (5.4 kg) Pilsner malt
1 lb. (0.45 kg) Carapils® malt
13 AAU Simcoe® hops (45 min.)
(1 oz./28 g at 13% alpha acids)
6.5 AAU Simcoe® hops (15 min.)
(0.5 oz./14 g at 13% alpha acids)
1.5 oz. (43 g) Simcoe® hops (dry hop)
0.5 oz. (14 g) Saaz hops (dry hop)
Imperial Yeast L13 (Global) or
Wyeast 2124 (Bohemian Lager) or
White Labs WLP830 (German Lager)
or Saflager 34/70 yeast
¾ cup corn sugar (if priming)

STEP BY STEP

Heat 17.3 qts. (16.4 L) of strike water to 163 °F (73 °C). Mix with grains, the mash should stabilize at about 150 °F (66 °C). Hold at this temperature for 75 minutes, then raise temperature to mash out at about 168 °F (76 °C) either by infusion of boiling water, decoction, or other means. Vorlauf until wort runs clear then begin the sparge process. Collect approximately 7 gallons (26.5 L) and bring to a boil. Total boil time is 90 minutes, adding hops as indicated.

After boil is complete, turn off the heat then give a long stir to create a whirlpool. Let wort settle for 10 minutes, then chill the wort to 48–58 °F (9–14 °C). There should be about 5.5 gallons (21 L) of wort in your fermenter. Top fermenter up with cold water if you are short. Aerate wort and add yeast. Place your fermenter in a temperature-stable place that is in the 48–58 °F (9–14 °C) range. On day five of fermentation add the dry hop addition. Conduct a diacetyl rest when fermentation subsides by raising the fermentation temperature to around 70 °F (21 °C) for a couple of days.

Once terminal gravity has been reached, transfer to a secondary fermenter for lagering to get it off the yeast. Place the beer in a refrigerator or cold fermentation chamber to get the beer as cold as possible without freezing. Allow at least two weeks for the lagering period. Bottle or keg after fermentation is complete.

BELL'S BREWERY'S QUINANNAN FALLS CLONE

(5 gallons/19 L, extract with grains)
OG = 1.057 FG = 1.009
IBU = 45 SRM = 4 ABV = 6.3%

INGREDIENTS

6.6 lbs. (3 kg) Pilsen liquid malt extract
1.5 lbs. (0.68 kg) Pilsen dried malt
extract
0.5 lb. (0.23 kg) Carapils® malt
13 AAU Simcoe® hops (45 min.)
(1 oz./28 g at 13% alpha acids)
6.5 AAU Simcoe® hops (15 min.)
(0.5 oz./14 g at 13% alpha acids)
1.5 oz. (43 g) Simcoe® hops (dry hop)
0.5 oz. (14 g) Saaz hops (dry hop)
Imperial Yeast L13 (Global) or
Wyeast 2124 (Bohemian Lager) or
White Labs WLP830 (German Lager)
or Saflager 34/70 yeast
¾ cup corn sugar (if priming)

STEP BY STEP

Place crushed grains in a muslin bag and steep in 1 gallon (4 L) of water at 160 °F (71 °C) for 20 minutes in your brew pot. Remove the grains and fill your kettle to 3.5 gallons (13 L) of water. Bring to a boil and then remove kettle from heat and add malt extracts. Stir until dissolved and return kettle to heat. Boil for 45 minutes, adding hops as indicated.

Chill wort to 48–58 °F (9–14 °C). Aerate wort and add yeast. Place your fermenter in a temperature-stable place that is in the 48–58 °F (9–14 °C) range. On day five of fermentation add the dry hop addition. Conduct a diacetyl rest when fermentation subsides by raising the fermentation temperature to around 70 °F (21 °C) for a couple of days.

Once terminal gravity has been reached, transfer to a secondary fermenter for lagering to get it off the yeast. Place the beer in a refrigerator or cold fermentation chamber to get the beer as cold as possible without freezing. Allow at least two weeks for the lagering period. Bottle or keg after fermentation is complete.

was one of the earliest examples of a brewery aggressively hopping a pale lager with hops more typically found in an IPA. On the sour and wild side of things, Oarsman is a year-round tart wheat ale that is Bell's spin on the Berliner weisse style, while the small-batch Wild One, a mixed culture sour brown ale featuring *Brettanomyces*, is a local favorite aged in oak foeders.

BREWING THE BELL'S WAY

When discussing Bell's brewing philosophy with Mallett, he talked about the importance of being transparent as a brewery, though not necessarily in the traditional sense of the word. "Ideally somebody should pick up a pint of beer and see all the way back to the farms. We put an emphasis on high-quality raw materials, and simple, natural processing."

Consistency was another hallmark that Mallett hit on, and how the drive to create a consistent product drives process improvement at the brewery. The interplay between process and ingredients illustrates much of the philosophy of how beer is made at Bell's. "There are components that come from ingredients, and those that come from process," Mallett told me. "I could give you the recipe for Two Hearted and tell you to use these hops and this amount of them, and you will not get the same result." Innovation has also long been a hallmark at Bell's, which isn't just about creating the next big style. "Innovation involves everything from raw materials to designing recipes, to also designing the process by which we will make new beers," said Mallett.

MALT

Most of Bell's beers start with a domestic base malt, though the brewery frequently blends base malts to arrive at the profile they are looking for in specific beers. Base malts are sourced from a number of maltsters, including Briess and Rahr. Certain beers also require sourcing European malts, notably their Octoberfest Beer, which has a malt bill made entirely from Durst Malz in Germany. Specialty malts are popular with the Bell's brewing staff, as a number of beers utilize them to deliver their signature profiles. Briess Caramel malts are used in many of the core brands, but notably, numerous staff members I spoke to went out of their way to espouse their love for Simpsons crystal malt, specifically, their "50/60" variety, now marketed as Medium Crystal malt.

Mallett has noted that one of the most important factors when it comes to their malt is the relationships they've developed with their maltsters, which lends to the philosophy of being involved in the entire supply chain cycle for their raw materials. "We are having conversations with our maltsters about variety, process, and expectations," he noted. "If they understand what's important to us, they can drive their malt to what we're looking for." Going further, Bell's even evaluates the varieties of barley that eventually turn into the malt that it uses in its beers. "The flavors and attributes that malt expresses are absolutely linked to the barley variety that is grown. If you don't have control over those varieties, malts may get pushed in a direction that we don't want to go." Bell's takes the technical evaluation of their barley seriously, and as Mallett noted, "attributes such as low total protein and soluble protein, low alpha amylase and moderate beta glucan may be more important to us than color."

HOPS

When it comes to hops, it all starts with Centennial at Bell's, being the sole hop in Two Hearted Ale. As the biggest brewery buyer of Centennial hops in the world, Bell's sources Centennial from numerous sources, including large brokers, but also from specific growers. All of the Centennial that Bell's purchases come as baled whole flower hops. "We go out to the growers to rub and assess the hops, and have a multi-point scale that we use to assess what Centennial at Bell's should taste like," Mallet described. The bales of hops that Bell's eventually buys are then aggregated to a single pelletizing facility, where Bell's creates a blend of the various bales of Centennial they have selected from the different growers and brokers, which then get pelletized. This ensures that the Centennial going into Two Hearted Ale is the exact Centennial that Bell's chooses during their hop evaluation each year, and provides consistency over the hundreds of thousands of pounds of Centennial Bell's will use annually.

Beyond Centennial, Bell's utilizes a number of New World hops in many of its brands, including its newest

Two Hearted Ale

Two Hearted Ale is undoubtedly one of the most popular craft beers in America. Voted the best beer in America by members of the American Homebrewers Association in 2017 and 2018, it is one of the quintessential examples of a Midwestern IPA, and perhaps the most attempted clone recipe ever by homebrewers. While IPAs have gone through what seems like an endless and ongoing evolution over the past 20 years, Two Hearted Ale has remained true to its original formulation, yet still stands the test of time. However the history of Two Hearted Ale dates back nearly 30 years, and at first, it wasn't an IPA at all.

The beer's name references the Two Hearted River located in Michigan's Upper Peninsula, a popular recreational fishing destination, as the beer's label featuring a trout pays homage to. The first rendition of Two Hearted Ale came after Larry Bell met a hop grower hailing from Wisconsin in the late 1980s. They eventually decided to do business, and Bell's Brewery contracted for a few hundred pounds of Wisconsin-grown hops. Now, while the hop growing industry has seen resurgence over the past few years outside the Pacific Northwest, including in Wisconsin, this was virtually unheard of in the 1980s. Nonetheless, Two Hearted Ale was born. Bell described the first version as a pale ale with the "two hearts" of the beer being English malt and Wisconsin-grown hops. Two Hearted Ale v1.0 hung around for a little while, but was eventually discontinued, as the brewery focused on other brands.

Fast forward about a decade and Two Hearted Ale v2.0 was born in 1997, when brewer Rob Skalla developed a recipe for an IPA single-hopped with Centennial hops. While Centennial is one of the most popular hops on the market now, at that time it was virtually unknown, and wouldn't be widely grown for several years. The beer initially didn't have a name, but Two Hearted was already a registered brand, and the brewery decided to revive it for the new IPA.

While IPA now dominates the craft beer marketplace, and beers with new hop varieties are common, this wasn't always the case. At the turn of the 21st century, IPA was still a niche style and hadn't yet taken the craft beer industry by storm. Two Hearted Ale's makeup of a virtually unheard of new hop and use of aggressive dry hopping made it uncommon among beers across the country at the time, and was definitely not typical of what most Midwestern breweries were doing. There's no doubt Bell's was taking a risk bringing Two Hearted Ale back to market.

While the beer grew slowly before becoming a phenomenon, it was an instant hit with the hopheads of that era. In 1999, the first year it was brewed, an unofficial competition to crown the best IPA in America dubbed the Alpha King challenge was formed as a companion to the Great American Beer Festival. That first year there were 10 entries, 9 from breweries on the West Coast, and Two Hearted Ale from Bell's. As you can probably guess, Two Hearted took the crown that first year, and the rest is history for America's best-selling IPA nearly twenty years later.

Sales of the flagship beer have grown every year, and it now comprises roughly half of the annual production for Bell's. In an era where craft beer consumers are constantly seeking out beers with new flavors, Two Hearted Ale was ahead of the curve and one of the first IPAs to gain wide popularity. That Two Hearted continues to be one of the most popular beers in America despite the various shifts in IPA over the past two decades reinforces its place as one of the most iconic craft beers ever made.

year-round offering, Official, a Wheat IPA that is double dry hopped with Mosaic®, Citra®, Azacca®, Amarillo®, and El Dorado® hops. Beyond American varietals, Bell's is also a heavy user of many traditional European-grown varieties, with Mallett specifically noting that Oberon owes part of its profile to a spicy bouquet attributed to these hops.

Bell's also likes to play with newer varieties, including hops from emerging growing markets such as its home state of Michigan. Bell's is an active supporter of public hop breeding programs, which develop varieties that any grower can plant. "I do think brewers overall have a vested interest in having public varieties," Mallett noted when discussed these breeding programs. "There has been a resurgence of brewer interest through efforts of organizations like the Hop Research Council, the Hop Quality Group, the Brewers Association, and the USDA."

YEAST

Bell's house ale yeast strain is a proprietary strain that has been used since the 1980s, and is used to ferment the vast majority of the brewery's lineup. While not available commercially, it has characteristics similar to many American ale strains, but remains distinctive enough to have a character that makes it unique. Mallett noted its ease of use, ability to flocculate well, and ability to express hops as some of the strain's strongest attributes. Mallett specifically credits their house yeast as a contributor to the great aroma from Two Hearted. "(Two Hearted has) this great rose and fruit character that likely can be credited to yeast activity."

One key part of Bell's process for most brands is to allow some live yeast to remain in the can or bottle after packaging. "Having viable yeast in some of our beers adds a positive flavor contribution, and aids in scavenging oxygen and shelf stability," Mallett outlined.

Another benefit to homebrewers is that because viable yeast can be found in cans and bottles, if done correctly, it can be cultured and brewed with on a homebrew scale. I've found fresh cans or bottles of Oberon work very well for this purpose. And the neatest part for homebrewers is that not only is it possible to culture Bell's yeast, they actually encourage and help homebrewers do it by including instructions of how to do it on its website at https://www.bellsbeer.com/news/how-culture-bell-s-house-yeast-bottle-bell-s-beer. If you aren't able to culture out of a can or bottle, a clean American ale strain with good attenuation is a reasonable substitute if trying to clone one of their beers.

The same house lager yeast is used for lager-style beers, while a number of other yeasts are used for specialty beers, including a Belgian ale strain in the seasonal Winter White Ale. Bell's does employ *Lactobacillus* to sour some of its tart beers, including the year-round Oarsman as well as newer offerings such as Larry's Latest Sour Ale — a dry hopped, kettle soured beer. While each of these beers employs *Lactobacillus* for souring, the techniques do vary. Bell's employs a *Lacto* reactor, where wort is held in a tank housed near the brewhouse with *Lactobacillus*, then blended in with clean wort until each beer's target acidity is met. This results in a beer with a lower pH and noticeable lactic sourness. This technique was inspired by the traditional German technique for

2017 Bell's Homebrew Competition winner Steve Vroegop brews his Damson Plum Crisp Saison at Bell's original brewery in downtown Kalamazoo. Bell's brewer (far right) Pat Tkacz assists.

Bell's Homebrew Competition

In 2010, Bell's Brewery held its first homebrewing competition. Each year since, the competition kicks off in early fall with a day-long expo, where lucky homebrewers can win prizes and talk to a variety of homebrew vendors who attend the event. The expo also is where competition entrants, who begin to line up early in the morning, sign up to pick up 5 gallons (19 L) of free wort made on the 15-bbl brewhouse at the original Bell's brewery in downtown Kalamazoo. The only stipulation in the competition is that homebrewers create a beer using that wort, though additional ingredients can be added during the brew day.

Past winners have come from a number of styles including saisons and farmhouse ales, IPAs, and beers featuring ingredients such as coffee, habanero peppers, and various fruits. The judging is conducted by a diverse collection of Bell's staff members from all over the company, including brewing and cellar staff to those working in the corporate office and retail areas. Each year, the winner is announced at All Stout's Day, an annual event held on All Saints Sunday in early November, where Bell's fills their taps at the Eccentric Café with nothing but stouts, some of which may not be available at any other time of the year.

I spent time with the Bell's staff this fall and chronicled a day in the life of this competition, which starts in the wee hours of the morning.

12:00 a.m. – Brewers Zeke Bogan, Pat Tkacz, and Chris Walsh arrive at the brewery to begin brewing two 15-barrel batches of wort for homebrewers who will arrive later that day. The 30 barrels of wort they produce will be distributed to homebrewers starting in just 13 hours.

12:41 a.m. – The first batch begins to be mashed in with 1,200 pounds (544 kg) of Michigan-grown barley, malted into a pale ale style malt for Bell's by Briess Malting. This grain bill is one of the largest done on this brewhouse each year.

2:20 a.m. – The mash and vorlauf for Batch 1 is complete, and the first runnings begin to be transferred to the boil kettle.

3:49 a.m. – The sparge on Batch 1 begins.

5:53 a.m. – Following sparging, the wort begins its 20-minute boil. While no hops, finings, or nutrients are added, this does sterilize the wort and prepare it for storage until homebrewers begin brewing with it once they get home.

5:59 a.m. – More than an hour before sunrise — and five hours before the event officially kicks off — homebrewer Brian Stevens is the first person in line to sign up for the competition.

6:25 a.m. – Batch 2 begins to mash in with another 1,200 pounds (544 kg) of Michigan pale malt.

7:15 a.m. – The sun begins to rise over downtown Kalamazoo. By now the line has gotten a bit longer, but is still at less than 10 people.

7:47 a.m. – After boiling, being transferred to the whirlpool and then run through the brewery's heat exchanger, all of Batch 1 is now resting in the fermenter, where it will begin to be distributed to homebrewers in just over five hours.

8:51 a.m. – Sparging begins on Batch 2.

9:30 a.m. – Jess Caudill, Technical Support Manager at Imperial Organic Yeast, is the first vendor to arrive for the Homebrew Expo. Jess traveled all the way from Portland, Oregon to talk to homebrewers about Imperial and to hand nearly 200 free samples of their yeast strains to homebrewers who sign up for the competition.

10:42 a.m. – Batch 2 begins its 20-minute boil.

11:00 a.m. – A line of more than 100 homebrewers begins to enter the Eccentric Café to sign up for the annual competition. While they wait to pick up their wort, they will have the opportunity to talk to a number of homebrew vendors including Coldbreak Brewing Equipment, StirStarters, Imperial Organic Yeast, the American Homebrewers Association, and several local homebrew clubs. They will also have a chance to check out a full table of raffle prizes ranging from hops and malt to various equipment including a Blichmann HellFire burner. They can also sample from the Eccentric Café's full tap list, including last year's winning competition beer, Damson Plum Crisp Saison, from homebrewer Steve Vroegop.

12:30 p.m. – Bell's General Store Operations Manager David Curtis begins to announce the rules to the competition participants. The raffle also commences, as several dozen homebrewers head home with a prize when their ticket is called.

12:34 p.m. – After a boil, whirlpool rest, and transfer to the fermenter, Batch 2 is ready to go with 26 minutes to spare. The original gravity of both batches came in at 1.065, a few points higher than expected.

1:00 p.m. – After 7 hours of waiting, the very first homebrewers in line file back to the brewery floor to fill their carboys, kegs, and buckets with 5 gallons (19 L) of free wort that will be turned into countless different recipes for the homebrew competition. Groups of homebrewers will head down to the brewery every 10 minutes until each has picked up their wort.

2:28 p.m. – The last of 172 homebrewers to sign up for the competition receives their wort, and the Bell's brewing staff begins to wrap up what will end up being nearly a 15-hour shift. Homebrewers now have seven weeks to brew, ferment, and package their beer to ready it for judging, which takes place the last week of October.

creating sauergut (i.e. sour wort), though Bell's does it for different reasons and on a much larger scale.

WATER

Bell's brewing water is drawn from the Kalamazoo County municipal water system, which is sourced from a collection of deep groundwater wells. Bell's does sand and carbon filtration to its water as it comes into the brewery. Mallett describes the water as having good calcium but some alkalinity, so the brewery adjusts as needed with water salts to hit the desired profile for each of their beers.

BELL'S TODAY

Quality control has always been a core principle for Bell's, and continues to be to this day. The brewery employs a full-time microbiologist and team of chemists who operate an on-site lab, running each beer through a variety of tests to ensure that it is fit for sale. A robust sensory panel tastes each batch multiple times to check for off-flavors or other inconsistencies. Brewery packaging technology ensures steady shelf life, as I myself observed a real-time dissolved oxygen sensor on a canning run with parts per billion readings in the low single digits. It is readily apparent Bell's takes QC very seriously and has invested significantly to do it at a world class level.

In another nod to continue driving its core principle of innovation, one of the newest additions to Bell's brewing operations is a dedicated pilot brewing program, led by longtime brewer and current Brewing Innovation Manager Andy Farrell. This new addition to the Comstock brewery is centered around a new 12.8-barrel pilot brewhouse, which was specifically designed to be a smaller version of the brewery's larger 50- and 200-barrel brewhouses. This ensures that new beers brewed on the pilot system will be scalable to larger production volumes. The new pilot program also has its own dedicated brewery cellar, with fermenters also designed as scaled down versions of the larger tanks in the Comstock brewery. Several oak foeders are also in place for fermenting and aging mixed culture and sour

The brewhouse in Bell's Comstock production brewery.

ales. The pilot brewery also has its own bottling line, capable of filling standard 12-oz. (350-mL) bottles as well as 25-oz. (750-mL) bottles. Both Mallett and Bell noted excitement with this new venture, with Larry mentioning that some really interesting new beers would be coming out of this new extension of the brewery in late 2018.

While Bell's has come a long way since its very humble beginnings, the homebrewing spirit that existed at the beginning still shows today. Since 2010 Bell's has hosted its own homebrewing competition, with the winning homebrewer getting to both scale their recipe up and brew it at the original downtown Kalamazoo brewery, as well as participate in the GABF Pro-Am competition (more details about the competition are included in the sidebar on page 71). The Bell's General Store, located in the same building as the downtown brewery and Eccentric Café, remains the premier homebrew supply stop for Kalamazoo and surrounding southwest Michigan. Bell himself even was a keynote speaker at the 1990 AHA National Homebrew Conference, where he shared advice and lessons learned for aspiring homebrewers looking to open their own brewery, just a few years after doing so himself. Even in the present day, Bell still speaks fondly of the place homebrewers have in craft beer culture. "Homebrewers are really the minor leagues of craft beer," he stated. Bell also noted that he enjoys what the presence of homebrewers brings to the Eccentric Café before or after they stop in the General Store to grab equipment or ingredients. "I think having homebrewers around lends to some of the culture of the bar, it brings that extra added focus to the beer," he noted.

With new breweries opening at a more rapid pace than ever before, many of which are the product of homebrewers going pro, I asked Bell what his one piece of advice would be for new entrants into the commercial market. "The thing that's going to separate the men from the boys is quality," he stated, an unsurprising answer from a brewery that preaches it in everything it does.

At its core, though, while Bell's has continued to support the homebrew community, the spirit of homebrewing has in many ways influenced the company through its journey from tiny startup to a nationally recognized brand. John Mallett may have put it best when crediting much of the brewing culture at Bell's to the example Larry Bell set when he founded the company 35 years ago. "He exemplifies the creative and free spirit of homebrewing, and that's what Bell's has been all along, and will continue to be." BYO

HOME MALTING

by Jon Stika

It's easier than you may think!

Before I became a homebrewer back in 1992, I'd been involved in agriculture for a couple of decades. I began my journey in agriculture by working on a dairy farm in Wisconsin (which included an introduction to beer). But, it was not until I began learning how to make beer that I actually understood what malt and hops were and how they were used in making my favorite fermented beverage. I knew that barley was the basis for making malt and knew how barley was grown, but knew little of the mysterious process of turning barley into malt and malt into beer. Being trained as a scientist, I dove into the technical aspects of transforming barley into malt and learned of the complex bio-chemical progression that occurs as barley sprouts. I also began to understand how the malting process is managed to produce high-quality malt. It was then that I asked myself, "Why couldn't I make malt at home?"

After realizing that I already had most of the equipment I would need to make malt, I began my hands-on learning by making my first batch of barley malt in 1999. This learning process naturally included a few mistakes along the way, but I eventually became proficient at making barley and wheat malt and have been doing so ever since.

BENEFITS OF HOME MALTING

There are a number of reasons why you might wish to invest the time and effort in making your own malt. For me, it is a combination of the personal satisfaction of taking my homebrewing hobby to the next level by making the main ingredient myself, as well as the lower cash cost of homemade malt vs. commercial malt. Since I can get locally-grown barley or wheat by bartering or purchasing it for the cash-grain price at a small fraction of the price of malt, I can make malt very inexpensively. This is especially true when you factor in the cost of shipping if the malt isn't purchased locally. Another reason to make your own malt is to be able to source ingredients locally, rather than having them made and shipped in from afar. So whether you want to take more pride in the beer you brew, save a

Photo courtesy of Shutterstock.com

Photo by Jon Stika

Turn over the grain twice daily to untangle the rootlets (acrospires) during germination.

few bucks, or just reduce your carbon footprint, making your own malt can bring more fulfillment to your efforts as a homebrewer.

ACQUIRING BARLEY OR WHEAT

The first step in making barley or wheat malt is securing the grain in its natural condition that has not been processed in any way that would affect the ability of the kernels to sprout. Where I live in western North Dakota, there are thousands of acres of barley and wheat grown every year. Whenever I need some of either grain, I simply talk to some of my farmer friends and trade them a few bottles of homebrewed beer for the grain that I wish to make into malt. These farmers are particularly excited to later get some beer back that is made from their own grain. In the United States, Idaho, Montana, and North Dakota are the top three barley producers. Colorado, Wyoming, Minnesota, Washington, Pennsylvania, Oregon, and Arizona also grow appreciable amounts of barley. If you live in one of these states, you may be able to track down a grower and offer them some homebrewed beer or cash for barley. Your local county extension agent or conservation district may be able to help you locate farmers that grow barley or wheat in your area (the USDA and American Malting Barley Association also publish malting barley acreage statistics).

Regardless of where you live in the world, it is worth exploring the possibility of sourcing locally-grown barley or wheat. If finding a local grower isn't feasible, there are retail seed or feed dealers that may be able to supply you with what you need. A third option for those with space for a garden or field is to grow your own grain (see sidebar on page 80).

If you are unable to find a local grower, then a local farm supply, livestock feed, or agricultural seed supplier may be able to provide you with a bag of barley for roughly half the price of a similar amount of malt. Make sure that the barley or wheat seed is whole (not milled, flaked, or otherwise processed) and is not treated with fungicide (as is sometimes the case with grain destined for planting as seed) unless you plan to plant the grain to grow your own crop. If you live in a big city that does not have any local farm suppliers, an organic or natural foods retailer may be able to supply you with some whole barley or wheat (sometimes referred to as "berries") that are still in their natural state. And, of course, there is always the Internet and online retailers to turn to, however shipping costs may make this less appealing. Johnny's Selected Seeds of Winslow, Maine, sells small quantities of spring wheat and spring barley varieties suitable for malting.

MAKING BARLEY OR WHEAT MALT

Malt is simply any grain that has been sprouted to the point where enzymes become available within the seed to prepare to convert stored starch into sugar, and kilned to stop germination and preserve enzymes. When that

kernel of grain is planted in the soil, the sugars produced from the stored starch are used to feed the growing plant until it can conduct photosynthesis. During malting, the growth process of the sprouting seed is halted by drying to preserve the starch and enzymes so we can store the resulting malt until we are ready to re-activate the enzymes in a warm water mash to gelatinize the malts' starches, then convert the starch to sugar to produce sweet wort.

There are three basic steps to making malt: Steeping, germination, and drying (kilning). Making malt at home only requires small increments of time spread out over several days, and very little specialized equipment. I make malt 9 lbs. (4 kg) at a time because that's how much grain fits on two big roasting pans that I use for sprouting the grain, and that amount will also fill all the racks of my food dehydrator that I use for the drying process. The method and equipment that you use for controlling air movement and temperature during the drying process is typically the limiting factor of the amount of grain you will be able to malt at a time. I have found that a food dehydrator is the best way to do this at home.

The first step of malting grain (in this case, barley) is to allow the seed to soak up enough water to come to life and begin to grow. In order for barley seeds to begin to sprout, they must first absorb a considerable amount of water — the goal is for the seeds to be about 45–50% moisture. The seeds need to be steeped in cool (approximately 50 °F/ 10 °C), hard (or at least not softened) water for about eight hours, then drained and allowed to rest for eight to ten hours in a cool (50–70 °F/10–21 °C) place, and then steeped in water again for another eight hours. Since the seeds you are sprouting are little living embryos, they also should not be deprived of oxygen for very long. Oxygenating the water that the grain is steeped in is beneficial to the sprouting grain, so splashing the cold water into the bucket of grain will help dissolve some oxygen into the water. If possible, it is even better to bubble air into the water during the steeping process with an aquarium pump and tubing suited for that purpose.

After the second steeping period, the water is again drained away and the grain spread out in shallow pans or other flat surface. In order to continue sprouting, the grain must be kept cool and moist and turned twice daily prevent the sprouts from getting too warm as that can increase the potential for mold to develop.

After the water has been drained away from the now sprouting grain for the second time, I immediately spread the moist grain about ¾-inch (2-cm) deep on shallow roasting pans or baking sheets and then loosely cover the pans with plastic food wrap to help hold in moisture. When the grain needs to be turned, the pan can be uncovered, the grain disentangled and sifted between your fingers, moistened by misting or sprinkling water on it, and the pan of grain covered with plastic wrap again to continue sprouting.

The tiny white rootlets (acrospires) will emerge from the embryo end of the seed and the shoot will grow starting from that same end of each grain. It's important to keep turning over the grain twice daily during germination to untangle the rootlets. The shoot of barley will grow under the husk of the seed while the roots will grow out away from the seed. In order to track the growth of the shoot of barley, you will need to carefully cut the husk open on sample kernels and observe how long the shoot is relative to the kernel itself. The barley or wheat is fully "modified" when the shoot is very nearly the full length of the kernel of grain. Proper modification will usually take 3–5 days from the time that the grain was removed from the final steeping water and spread on the pans. The "smear test" is a simple way to determine if modification is complete. To perform the smear test, simply start at the end of the kernel where the roots are protruding and attempt to smear the kernel between your thumb and index finger. Any unmodified part of the kernel will not be soft enough to smear into a starchy paste and indicate that the grain should be allowed to sprout for a bit more time.

Once the malt has shoots that are as long as, or longer than, the kernel and/or passes the smear test, it needs to be carefully dried to stop the sprouting process and preserve the starch and enzymes at their best.

To make standard pale malt, "green" (still moist) fully modified

Photo by Jon Stika

After the water has been drained away from the now sprouting grain for the second time, I immediately spread the moist grain about ¾-inch (2-cm) deep on shallow roasting pans or baking sheets and then loosely cover the pans with plastic food wrap to help hold in moisture.

sprouts must be dried with care at temperatures less than 125 °F (52 °C) until the raw malt has dried down to 10% moisture or less (at which point the malt will be hard and crunchy). I dry my malt in a food dehydrator at 100–125 °F (38– 52 °C) for 10 hours, then raise the temperature to 140–160 °F (60–71 °C) for eight hours. This staged drying process preserves the enzymes while driving off the grassy flavors and excess moisture from the malt. At this point I rub the malt over a sieve (a wire mesh strainer works well) to remove the dried rootlets. This cleaned and dried malt now requires a final toasting or "curing" to develop bready/toasty flavors desired in the finished malt and resulting beer.

Curing (a part of the kiln cycle — where the term "kilning" refers to all of the heating steps that happen on the malt kiln) can be accomplished in a standard kitchen oven. I spread my dried malt about a ½-inch (1.3 cm) deep on baking sheets and place them in a 185 °F (85 °C) oven for six hours. After the malt has been kilned it should be allowed to cool to room temperature and then stored in a cool (room temperature or cooler), dry place in a sealed container that prevents the malt from absorbing moisture from the air and excluding pests.

MAKING SPECIALTY MALTS

Once you master making standard pale malt you may want to explore the world of specialty malts. Many specialty malts are "special" because they are kilned at different temperatures and lengths of time than standard pale malt, roasted in a heated drum to achieve darker colors and stronger flavors, or they are mashed to convert starch to sugar with the kernels intact and then roasted to form caramel or "crystal" malt.

The lighter non-caramelized specialty malts can be made by taking kiln-dried malt and kilning them for a different amount of time and at different temperatures than you would for pale malt. Pilsner malt differs from pale malt in that the malt is kilned for three hours at 158–176 °F (70–80 °C) to produce a malt that is lighter in color and flavor than pale malt. Munich malt is kilned at 183 °F (84 °C) for three hours, Aromatic malt is kilned at 195 °F (90.5 °C) for three hours.

A darker non-caramelized specialty malt, such as chocolate malt, can be made by taking kiln-dried malt and roasting it on pans in the oven at 400 °F (204 °C) for 40 to 50 minutes. Roasting malt above a temperature of 300 °F (149 °C) should be done with care and frequent monitoring. At higher temperatures, the malt can change from toasted to burned in minutes. By experimenting with different time and temperature profiles, you can create your own "house" dark specialty malt that may be a bit lighter or darker than standard chocolate malt.

Caramelized specialty malts are made by converting starch to sugar (as would typically be done in a standard mash) with the kernels intact instead of crushed. There are a couple approaches for home maltsters to make caramelized malts. The first method involves placing raw, undried malt in a dish with a well-fitting lid and holding it at a temperature between 140–160 °F (60–71 °C) for two hours to allow the enzymes to convert starch to sugar. The "stewed" malt is then spread out on an open cake pan or baking sheet and toasted at 250 °F (121 °C) until it is browned to the color desired. The second method of making caramelized malt is to mix uncrushed standard pale malt (homemade or purchased) at a rate of one quart (1 L) water to one pound (0.45 kg) malt and follow the same procedure described above.

The longer the malt is kilned, the darker and more caramelized the sugars will become. Cara-Pils, Cara-Vienne, Cara-Munich, Special-B, and crystal malt are, from lightest to darkest, the various types of caramelized malts typically used by brewers. The flavor of these caramelized malts range from sweet to nutty as the malt is toasted from lighter to darker in color.

Photo by Jon Stika

Once fully modified, I dry my malt in a food dehydrator at 100–125 °F (38– 52 °C) for 10 hours, then raise the temperature to 140–160 °F (60–71 °C) for eight hours.

SUMMARY

Whether you are interested in simply making some of your own caramel malt from commercial pale malt, or feel the need to make a variety of malts from grain you grew yourself, becoming a home maltster will give you a better understanding of what it takes to brew beer. I have a certain fascination with doing things in my brewing process from scratch, the way folks had to be able to do so in the early history of brewing beer. Growing my own grain and making my own malt gives me a connection with the brewers of old and a satisfaction that I did it all myself from the ground up.

Photo courtesy of Wikipedia

Growing and harvesting barley or wheat

Growing your own barley or wheat to use to make malt is no more difficult than growing anything else in your garden. Since the majority of readily available malting barley varieties are sown in the spring, I suggest that is the best way to go if you want to grow your own for most of North America.

While malt could be made from practically any variety of barley, there are several varieties that have been bred for making quality brewing malt. According to the American Malting Barley Association, major malting varieties of barley grown in the US and Canada include six-row types of; Celebration, Innovation, Lacey, Legacy, Quest, Thoroughbred, and Tradition. Two-row types recommended are AAC Synergy, ABI Voyager, AC Metcalfe, CDC Copeland, Charles, Conlon, Conrad, Endeavor, Expedition, Explorer, Harrington, Hockett, Merit 57, Moravian 37, Moravian 69, ND Genesis, Newdale, Pinnacle, Propino, Scarlett, and Wintmalt. The designation of six-row and two-row comes from the habit of how the florets are arranged on the pedicel (the head of grain at the top of the stalk), creating the appearance of six-rows or two-rows of seeds in each head. Charles, Endeavor, Wintmalt, and Thoroughbred are varieties of winter barley that are sown in the fall, then resume growth in the spring. All other varieties are sown in the spring and harvested that same fall in the Northern Hemisphere. Most homebrewers use two-row varieties of barley malt. Two-row malt has larger kernels and a bit less "husky" flavor than six-row malt.

In my experience growing barley or wheat in my garden, I usually harvest between 0.05–0.08 pounds (0.023–0.036 kg) of wheat or barley grain per square foot (0.1 m^2) of area planted. Therefore, if you'd like at least 10 pounds (4.5 kg) of barley or wheat to malt, you would need to plant an area between 125– 200 square feet (11.6–18.5 m^2) in size. You will need at least 0.002 pounds (0.9 grams) of seed per square foot (0.1 m^2) of area planted. Therefore, a 200-square-foot (18.5-m^2) plot would require a minimum of 0.4 pounds (0.18 kg) of seed. This planting rate is based on placing the seed in rows approximately seven inches (18 cm) apart and an inch (2.5 cm) deep to achieve a stand of 30 plants per square foot (0.1 m^2). If you simply broadcast (or broadly scatter) the seed, you should double the seed rate to 0.004 pounds (1.8 grams) of seed per square foot (0.1 m^2) planted, as some of the seed will not germinate or it will be eaten by wildlife. If broadcasting seeds, follow up by lightly raking the area to allow dirt to cover the seeds. This will help protect the seeds from wildlife and from blowing away in strong winds.

If you plant your barley or wheat in rows it will be easier to control weeds that may grow along with your grain. If you plant an adequate amount of seed as soon as the soil temperature at a 2-inch (5-cm) depth is above 40 °F (4.4 °C) in the spring, the barley or wheat will usually grow faster than most weeds and keep them at bay. There are typically not many insect pests or diseases that will impact your barley or wheat crop except for birds that may also become interested in harvesting your grain when it is ripe.

Barley or wheat are typically ready for harvest about 90 days after planting. Signals that they are ready to harvest includes when they no longer have any green color to them, the kernels have become harder and less pliable due to the natural drying and dehydration, and the row of kernels slump over to around a 45 degree angle. To harvest a small garden plot, I usually put on a pair of gloves (to protect my hands from the stiff, sharp awns) and snap or clip the heads off of the plants and drop them in a bucket. By collecting only the heads of grain, it makes it a bit easier to thresh the grain from them instead of dealing with all of the straw if you cut down the whole plant.

Once the heads containing the grain are harvested and dry, the grain needs to be separated from the head. The simplest way I have found to accomplish the threshing process is to spread the heads on a clean concrete floor or on a tarp or canvas on a hard surface and walk on them while wearing sturdy shoes or boots. After the individual kernels have been separated from the heads of grain the kernels need to be winnowed from the chaff.

I have winnowed grain in a couple different ways. One method is to take the threshed grain/chaff mixture placed in a bucket and stand on some stairs or a step ladder outdoors on a breezy day and pour the contents of the bucket slowly so the grain falls onto a tarp or sheet and the chaff blows away (or at least to the far end of the tarp or sheet). If the breeze is sufficient, you should have a concentrated pile of grain closest to the stairs or ladder that you can collect as your cleaned grain. If you do not have a place outdoors to perform the winnowing operation you can slowly pour the grain/chaff mixture in front of a fan and the chaff will hopefully blow further away from the fan than the grain, allowing you to collect the grain separately. This method can make a significant mess, so it is best to do so on a hard floor where the mess is easier to clean up afterward.

Once you have your grain cleaned and dry, store it in a sealed container in a warm (77–86 °F/25–30 °C) dry place for a few weeks before placing it in longer-term storage at 60–65°F (15.5–18.3 °C) for a few more weeks to allow the kernels to go dormant. After this resting period, the barley should sprout uniformly with very few non-sprouting kernels to make the best quality malt. BYO

The Role of pH in Brewing

by Brandon Whalen

Photo courtesy of Shutterstock.com

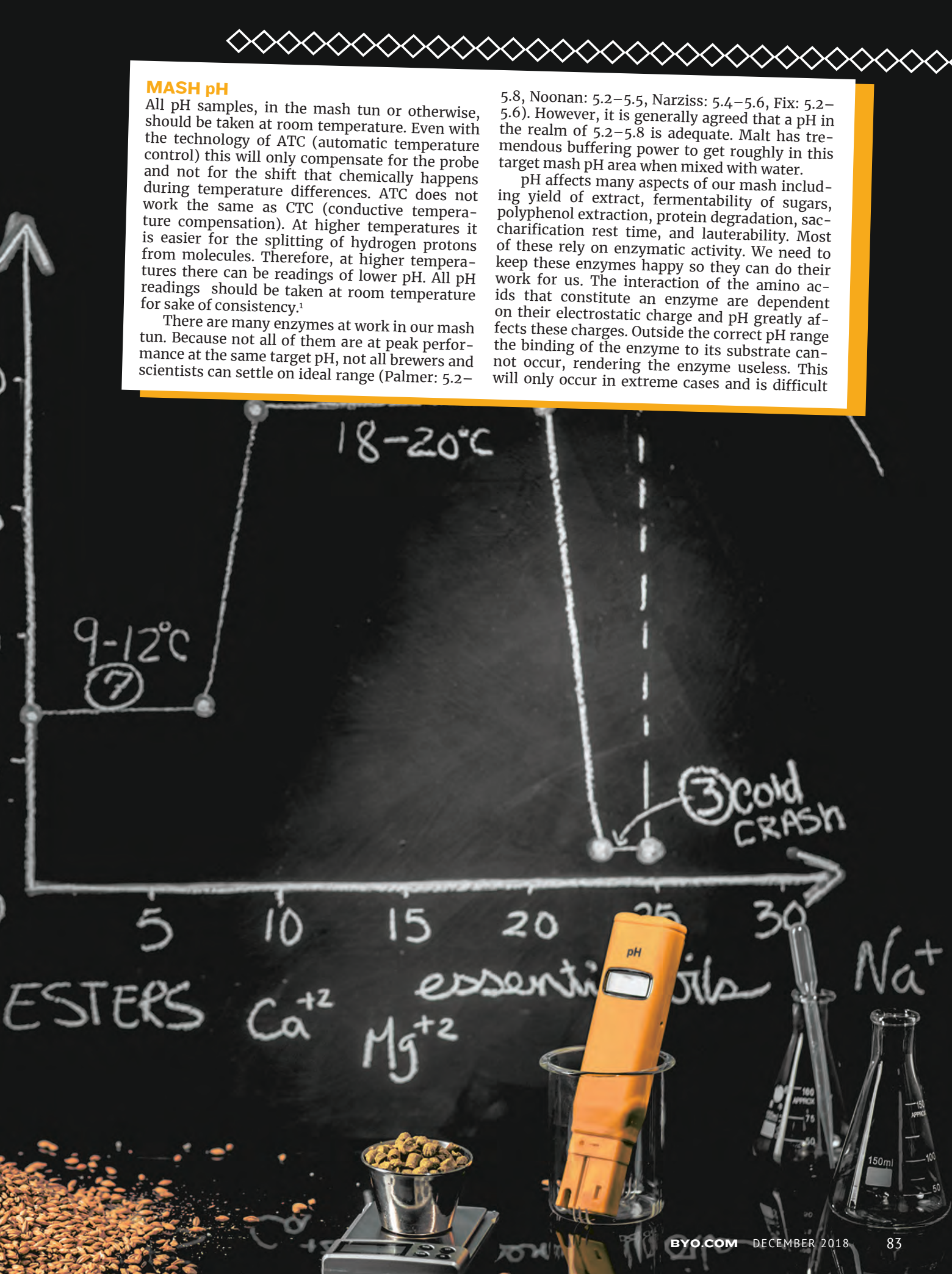
Many years ago I said to a fellow brewer, "You know, the more I learn about brewing, the more I realize I know nothing about brewing." To which he responded, "That will never change." Being as how he had many more years in the business than I, it let me know that brewing is a long mystifying road. Joys of resolving problems, frustrations of bewilderment, and of course tasting the fruits of our labor keep us coming back for more. Understanding pH is just one small piece of the brewing puzzle — but a very important piece that can take our beer from okay to great. Grain to glass, the observation of pH throughout every part of the brewing process will help us understand this wonderful beverage a little more.

MASH pH

All pH samples, in the mash tun or otherwise, should be taken at room temperature. Even with the technology of ATC (automatic temperature control) this will only compensate for the probe and not for the shift that chemically happens during temperature differences. ATC does not work the same as CTC (conductive temperature compensation). At higher temperatures it is easier for the splitting of hydrogen protons from molecules. Therefore, at higher temperatures there can be readings of lower pH. All pH readings should be taken at room temperature for sake of consistency.[1]

There are many enzymes at work in our mash tun. Because not all of them are at peak performance at the same target pH, not all brewers and scientists can settle on ideal range (Palmer: 5.2–5.8, Noonan: 5.2–5.5, Narziss: 5.4–5.6, Fix: 5.2–5.6). However, it is generally agreed that a pH in the realm of 5.2–5.8 is adequate. Malt has tremendous buffering power to get roughly in this target mash pH area when mixed with water.

pH affects many aspects of our mash including yield of extract, fermentability of sugars, polyphenol extraction, protein degradation, saccharification rest time, and lauterability. Most of these rely on enzymatic activity. We need to keep these enzymes happy so they can do their work for us. The interaction of the amino acids that constitute an enzyme are dependent on their electrostatic charge and pH greatly affects these charges. Outside the correct pH range the binding of the enzyme to its substrate cannot occur, rendering the enzyme useless. This will only occur in extreme cases and is difficult



to achieve in the mash. So long as the pH is within 2 pH units, the enzymes are not permanently deactivated and can usually be corrected.

It is important to be able to control the degradation of proteins, beta-glucans, and starches during the entire brewing process. The measurement of pH will help us get a grasp on such a task. Having a pH lower than 5.2 increases the probability of solubilizing proteins into the wort that would later have come out during the boil or cold-crashing. This will increase the possibility of haze in the finished product. Having a pH above 5.8 can extract tannins from the grain, giving the beer a harsh astringent taste. Studies by Macwilliam (1975) and Taylor (1990) found that an increase in pH will reflect a decrease in carbohydrate yield.[2] As it pertains to extract yield, an infusion at the pH of 5.2–5.4 has the most positive impact.

Often, the need of calcium or acid, (be it in the form of acidulated malt, phosphoric, or lactic) is needed to lower the mash pH. Roughly 1.5 mL per liter of 10% phosphoric acid, (or for large scale commercial batches, 7 mL/bbl of 85% phosphoric acid) will drop the mash pH by 0.1. If using salt additions, 305 mg of $CaCl_2$ or 358 mg $CaSO_4$ per liter will reduce mash pH by 0.1.[3]

LAUTER pH

Enzymatic activity is typically complete after our mash rests. Assuming we have reached mash out temperature (170 °F/77 °C), we have significantly increased the denaturing rate of our enzymes that convert starch to sugar, fermentable or otherwise.

At Rohrbach Brewing Co., where I am a brewer, we do not typically treat our sparge water. The natural high pH of water helps stimulate extraction during lautering.[2] As water is added in its natural element, the pH of the wort will increase. Therefore, it is important to start on the lower end of the mash pH spectrum. Grain bed permeability is greatly increased at a lower pH of 5.2 as compared to 5.8, increasing ease of wort transfer from the lauter tun.[2] The more wort that is run from the lauter tun, the more polyphenol extraction will occur during the final stages. At this point the pH will rise.

Photo courtesy of Shutterstock.com

Measuring pH at room temperature is the most accurate way to get a precise pH.

It is important to stop collecting wort when the pH of the final runnings climb into the 5.8–6.0 range as it will start to give the wort a harsh bitterness and astringency due to the extraction of polyphenols from the malt husk. Take a pH reading during vorlauf. As you are running off, monitor the pH by taking samples and chilling them down to room temperature for a proper pH reading every 20 minutes. Increase the rate in which you take these readings to every few minutes during the last 10 minutes of run-off. *Example: If you have planned on a 1-hour run-off, take a reading at 20, 40, 50, 53, 56,* and *59* minutes. When collecting samples you can chill them down on ice or in a freezer. I recommend using borosilicate glass for these samples as it is more resistant to thermal shock.

It can be difficult to chill samples and take pH readings while still cutting off the sparge in time to avoid over extraction. There are methods some have adopted such as taking readings at high temperatures and subtracting 0.35 to get what could be possibly the right reading. Due to the different variables stated previously and potential damage to the meter probe, I do not recommend this strategy. I have adopted the trials method of continually keeping track of pH and reviewing the data. The more attention you give to pH and gravity readings during run-off, the more of an understanding you will have of the trajectory.

KETTLE pH

The same mechanisms that increase tannin solubility in the mash and boil at a high pH will also increase the solubility of hop resins during the boil. Hop resins are acidic and during the boil at a high pH will lose hydrogen ions. This instability creates an increase of solubility in the wort.[4]

Alpha acid solubility depends primarily on two things: Temperature and pH. The boil temperature is largely constant, but the pH of the wort may fluctuate. According to a study done by Dennis Briggs in 2004, an increased pH will lead to an increase in solubility of alpha acids (A chart illustrating this point can be found online by searching "hop solubility chart." There are many claims, however, that bitterness extraction in a more basic element comes across as harsh and rough, as compared to a smoother more pleasant bitterness at a lower pH.[4]

Regardless of the pH at the beginning of the boil, it will become more acidic the longer it is boiled. This is for a couple of reasons. During the boil there will be precipitation of calcium by way of phosphates. Calcium from the water or salt additions will bind with the phosphates of the malt to form calcium phosphate and excess hydrogen ions. The calcium will pre-

cipitate out of solution and the hydrogen ions will stay behind, in turn, lowering the pH.[5] It can therefore be important to add calcium during the mash knowing that this shift will happen. If the mash pH is at target but the post-boil pH is not less than 5.4 it can be beneficial to add calcium salts to the kettle as well.

Another reason for drop in pH during the boil is due to formation of melanoidins through the Maillard reaction. Amino acids such as glutamic and aspartic acid are highly reactive during the Maillard reaction. Because of this, the development of melanoidins during the boil will decrease the pH of the wort.[6] The drop in this pH is beneficial to precipitation of proteins and polyphenols. Unlike the mash, a lower pH during the boil will help minimize turbidity. As previously mentioned, a mash pH of less than 5.2 will solubilize proteins into the wort. At a kettle pH of less than 5.2 you will see the coagulation of these proteins. This will have an impact on clarity, yeast harvesting, and filtering.

Kettle fining agents such as Irish moss and Whirlfloc are made from carrageenan, which is a type of seaweed. At a kettle pH of 5–5.7 many proteins carry a negative charge. Conversely, these agents carry a positive charge. When adding these carrageenan-based agents to the boil they attract the proteins that can cause haze.

FERMENTATION

The pH will continue to decrease after the kettle. This decrease will aid in more precipitation and coagulation of proteins that will drop out of suspension and can be discarded with cold-side trub. Low molecular weight albumins will adhere to yeast cells and flocculate out with them.[7]

When the yeast cell deviates from its optimal functioning pH range (5.0–4.3), they can become sluggish and slow the reduction of off flavors acetaldehyde (green apple) and diacetyl (butter) during maturation. The production of these are normal in the early stages of fermentation but given the proper conditions they will convert them. The diacetyl will be reabsorbed and enzymatically transformed into the essentially flavorless compounds acetoin and 2,3-butanediol. While these compounds have a similar flavor to diacetyl, the flavor threshold of them is much higher, making it difficult for the palate to detect. The vast majority of acetaldehyde will be converted to alcohol, bringing the concentration below the flavor threshold.

The yeast will need to invest energy in pumping in or out hydrogen ions to maintain optimal intracellular pH. In doing so, the cells may excrete glycogen. Glycogen is a more complex branched version of amylopectin. It has more α-1-6 bonds than starch and may cause chill haze in the final product.[7] In addition to producing these off flavors and clarity issues, a pH that is too high will also hinder the yeast to clean up these by-products. It will slow the reduction of diacetyl and acetaldehyde, and foster the production of higher molecular weight fusel alcohols.[8]

Like malt, yeast too has tremendous buffering capability, though it is important to give it the best chance possible. In some respect, it is best to be on the lower side during fermentation. Aside from inhibiting some bacterial growth, a lower pH makes for ease of filtration. If using gelatin or isinglass fining agents, a low pH beer will enhance the ability of the positively charged material to bind with the negatively charged yeast and flocculate to the bottom of the fermentation vessel.

Fermenter fining agents such as isinglass and gelatin behave differently than kettle finings. Most proteins at the <5 pH of fermented beer are positively charged and while these collagen-related fining agents have no effect on these ions, they do have an effect on protein-tannin reaction. Often, haze found in beer is not the cause of protein alone but from proteins bonding with tannins. It is tannins that these fining agents bind with and flocculate, bringing the proteins with.

Though there are mechanisms that increase hop-resin solubility on the hot-side production, a reduction in solubility of alpha acids can be seen during fermentation. As the pH falls, these alpha acid compounds will adhere to matter and will float to the top as kräusen or to the bottom as trub.[4] If a smooth bitterness is desired, this should be removed by skimming, utilizing a blow off tube, and/or dumping from the bottom of the tank.[6]

A final pH should be taken after the beer has been crashed and all yeast and trub has been discarded as to make sure there is little deviation from the final day of fermentation. Yeast autolysis will raise the pH. A target pH of ~4.4 is good for most styles. Above 4.6 in finished beer will enhance chalk/alkaline components and the beer will come off as cloying.

FLAVOR

Even by the time the beer reaches our glasses our concern for proper pH is not over. pH affects flavor perception in a big way. A high pH can make beer seem dull while a lower pH can make it seem more refreshing and crisp. For most craft beer that range is between 4.3 and 4.6 for an uncarbonated sample. Adjunct beers can sometimes be lower because they lack the buffering capacity that all-malt beers do. I have personally taken pH samples of a very popular adjunct ale that was 3.9. Sour beers, of course will have a pH much lower. BYO

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THURSDAY, MARCH 21, 2019

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

FRIDAY, MARCH 22, 2019 ASHEVILLE BOOT CAMPS

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

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

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

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

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

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

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

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

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

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

SATURDAY, MARCH 23, 2019 ASHEVILLE BOOT CAMPS

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

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

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

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

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

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

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

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

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

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

SUNDAY, MARCH 24, 2019

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Brew Your Own Boot Camp

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ASHEVILLE, NORTH CAROLINA
MARCH 22 & 23, 2019

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- ❑ Advanced Hopping Techniques
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- ❑ Advanced All-Grain Techniques
- ❑ Homebrew Experiments
- ❑ All-Grain Brewing Essentials
- ❑ Advanced Yeast Techniques

Saturday, March 23, 2019

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

Please note due to repeated requests we are repeating four of the most popular Boot Camp topics from Friday again on Saturday to give more opportunity to register for the following workshops.

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- ❑ Advanced Hopping Techniques
- ❑ Advanced Recipe Formulation
- ❑ Homebrew Experiments

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HOTEL INFORMATION

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Thursday, March 21, 2019 ($135)

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- ❑ 4:00 to 8:00 p.m.

Sunday, March 24, 2019 ($135)

- ❑ 12:00 to 4:00 p.m.

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❑ Check Enclosed (payable to *Brew Your Own* magazine)
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By registering for the Boot Camp I give permission for the free use of my name and photo in any media account of this event. I also certify that I am 21 years of age or older. Cancellation policy: For a refund, less a $100 administrative charge per person, send written notice by February 22, 2019. Refund requests received after February 22, 2019 will not be refunded. All refund requests will be processed post-Boot Camp. Early Bird Discount registration must be received and paid for by January 22, 2019.

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BY JOSH WEIKERT

BOTTLE CARBONATION AND CONDITIONING

Finishing strong with every bottle

Nothing in life is as uncomfortable as getting something right and then blowing it at the end. Losing at the finish line after running a great race. Dropping a piece of pizza in the brief-but-chasm-like distance between the oven and your plate. It's in that spirit that, today, we take a thorough look at what *finishing* the brewing process really looks like: Successfully carbonating and conditioning your beer in a bottle. Beer isn't really beer in my opinion, well unless it's lambic, until it's been carbonated. That beer you put in the bottle (or keg) also isn't "finished" — it's just consumable, and will keep evolving (for better or worse) as time passes. Conscientious care of your beer in the carbonation, conditioning, and aging stage of the process will help you get (and keep) the flavor you want.

PRIMING

Most new homebrewers (and some experienced brewers) carbonate their beer in the bottle, and this final stage of the process is far and away the most common area of inquiry from the new homebrewers who ask me questions. Their questions tend to revolve around three topics: Yeast, what form of sugar, and how much of it.

First, is it necessary to add additional yeast to the beer at bottling? I can't claim that it's *never* necessary, but I haven't yet needed to add yeast to achieve successful bottle conditioning. But my experience is only one among millions; so I will never say, "Don't dose your beer with yeast for bottle conditioning," but conversely, I have never instructed a person to do so either. Long after the beer drops clear in the fermenter there remains a substantial amount of yeast in suspension. The residual yeast should be more than capable of taking your beer down the home stretch and eking out one last bit of fermentation to provide carbonation. This has been true for me in every batch for eleven years, even for long-aged lagers that I forgot under the stairs and mid-teens ABV eisbocks. If you're not filtering your beer pre-packaging, then adding more yeast at bottling probably isn't necessary. Now, having said that, if you *want* to add some fresh yeast at bottling, it won't hurt, and you don't need to be that particular about which yeast strain you choose — we're talking about a minimal amount of fermentation, and odds are you'll get virtually no flavor impacts. Any clean ale yeast like the famed Chico ale yeast or a German ale yeast will be fine. A small starter to get them up and moving is advisable, since you'll be pitching into a truly toxic environment. Again, though, this is very much an optional step.

The second thing to consider is priming sugar method. Here we have two methods, and within one method you will find a lot of options. The two broad methods would be carbonation drops versus bulk priming. Carbonation drops are small lozenges of sugar (glucose and sucrose) added individually to each bottle of beer at packaging. They have the advantage of simplicity and predictability in terms of the amount of sugar added: One drop to carbonate a twelve-ounce bottle, two to carbonate a 22-ounce bottle (smaller drops exist that allow for somewhat-finer control) will generally produce about 2.5 volumes of CO_2. They have two key disad-

Conscientious care of your beer in the carbonation, conditioning, and aging stage of the process will help you get (and keep) the flavor you want.

While bottle conditioning may seem like a straight-forward process, there are many techniques to fine-tune the process.

vantages, however. First, brewers report inconsistent results caused by incomplete dissolution; they'll dissolve completely eventually, but you might prematurely open bottles that haven't yet fully carbonated. Second, you lose a significant degree of control since you're working with fixed addition amounts, and the final carbonation level may vary significantly based on the amount of residual CO_2 in the beer after fermentation. Your other option – bulk priming — is only marginally more complicated, significantly cheaper, and allows for fine-tuned levels of carbonation in a thoroughly predictable timeframe. Instead of adding sugar to each bottle, the brewer creates a simple syrup that is added to the bottling bucket at bottling. The syrup dissolves evenly into the beer (usually with no need to stir – the action caused by siphoning into the bucket is usually sufficient), which is then packaged in any sized bottles you choose.

Almost any sugar will do for bulk priming: Dextrose (corn sugar) dissolved into water and boiled briefly is the most common, but you can also choose to prime with candi sugars or syrups, maple or birch syrup, molasses, honeys, and more. Your choice might add a slight finishing flavor, but these though, you can get creative and maybe add some subtle flavors. Molasses, honey, maple or birch syrup, and — my personal favorite for old ales — black treacle are options for bottle conditioning, too, though you'll generally require more of them. Whatever your sugar choice, though, you shouldn't expect a big punch of flavor. These are accents, and some (maple syrup) might add effectively no flavor at all, especially in stronger-flavored beers.

In terms of process, move your fermenter to wherever your bottling will take place, then wait a beat — you'll probably shake some yeast and trub up into the beer, but it should settle out again within a few minutes. While you're waiting, go ahead and prepare a sanitized bottling bucket, tubing, and bottling wand. At this point, you can also prep your priming sugar. Whatever priming sugar you've chosen (even the syrups) it's a good idea to dissolve it into about one cup of water (assuming a five-gallon batch) before adding it to the bottling bucket. I put a small pot on the stove, add the water and priming sugar, and heat to a boil while stirring. Kill the heat, allow to cool for several minutes, then pour the syrup into the bottling bucket. Rack the beer gently off of

> **I wish I could tell you there's a tried-and-true rule of thumb for how much of each sugar you should use, but there are a lot of variables in play.**

don't expect *too* much of an impact. "Which" sugar, is to me, less important than "how much?" Different sugars have different attenuation rates, and while you could develop rules of thumb for each, it's best to use calculation to reach the decision of how much sugar to add. Rather than adding a set number of drops or a fixed weight or volume of a sugar, visit a priming calculator online or you can calculate this value yourself. You'll need the volume of beer to be carbonated, the targeted level of carbonation and a temperature: The highest temperature your beer reached in fermentation (see Chart A, on page 93). This number is important because it allows the calculator to factor in how much CO_2 is already in solution in the beer. Beers that reached higher temperatures in fermentation will have less CO_2 remaining and will therefore require more priming sugar, and vice versa. A beer that has cooled from that temperature or has been cold-crashed/lagered, at a lower temperature before packaging, will not reabsorb much CO_2, so the current temperature is negligible. Calculations will provide a specific weight of sugar to add to the beer, (see Chart B, on page 94) and all you'll need is a small scale (a hop scale will do nicely). This will greatly reduce the risk of over- or under-carbonation.

Your average table sugars – sucrose, demarara, turbinado, and (of course) dextrose/glucose are the most-fermentable, easy to find, and inexpensive. Don't feel like you have to use the trub into the bucket, and the natural action of the liquid should disperse the syrup evenly throughout the beer, but if you want to be sure you can give it a gentle stir or three before bottling. A word of warning, though: Oxidation at this stage is lethal for flavor and flavor stability, so when I say "gentle," I mean it! Bottle, cap, and you're ready to condition.

I do recommend a calculator for this step such as the ones found on many homebrew websites. I wish I could tell you there's a tried-and-true rule of thumb for how much of each sugar you should use, but there are a lot of variables in play. One thing I'm confident of is that that five-ounce package of dextrose that comes in most kits is usually *too much*.

CONDITIONING

Once you've mixed your priming sugar into the beer and packaged, we need to provide appropriate conditions for re-fermentation. There's no need to specifically raise the beers to room temperature (after cold-crashing) before packaging, and doing so invites trouble – since in my opinion all temperature fluctuations are risky. They inevitably create conditions via changes in pressure that may allow oxygen and contaminants to make their way into your fermenter if not properly managed. Once packaged, pressure differences are no longer important, allowing you to bring the bottles up to room temperature, or even a bit higher — 82 °F (28 °C) is a good target.

Chart A — Residual Carbonation Level in Beer

Temperature (°F/°C)	Volumes CO_2
47 °F (8.33 °C)	1.21
50 °F (10.0 °C)	1.15
53 °F (11.7 °C)	1.09
56 °F (13.3 °C)	1.04
59 °F (15.0 °C)	0.988
62 °F (16.7 °C)	0.94
65 °F (18.3 °C)	0.894
68 °F (20.0 °C)	0.85
71 °F (21.7 °C)	0.807

If you don't have a particularly warm room to choose from, consider placing your beer over a heating vent with a towel draped over it (which will shield it from light penetration as well as capture some heat!). This can be especially useful in cold winter months. Any time of year, though, my go-to spot in the house is on top of the laundry dryer. The surface warms, the room itself tends to be fairly warm, and I believe (though can't prove) that the subtle agitation speeds along the refermentation process by shaking the bottle slightly, keeping the yeast in suspension. Typically, I have beer that's ready to drink within seven days, and I'm confident of complete carbonation within 14 days. In extreme cases (very high alcohol, very long pre-packaging conditioning/lagering) this process could take longer, but should not take more than 3–4 weeks. You could dose with a bottle conditioning strain of yeast for these extreme examples, but I prefer to wait as this process should not cause off flavors even if the yeast count is low.

Bottle conditioning is advantageous in that it creates a beer that can continue to develop in flavor, is slightly protected from staling/oxidation effects thanks to a small amount of oxygen take-up in refermentation, and my experience judging homebrew competitions for seven years suggest that these combined effects lead to greater flavor stability than in force-carbonated beers. It does, however, generally take longer, and there's always the risk that it doesn't work. If you add priming sugar, let the beer warm, wait it out, and still get a failed carbonation, there are two likely culprits. One, your initial calculation was off, and you under-primed. Two, your bottles were not kept sufficiently warm. For those who live in colder climates and store their beer in the basement or other cool spot, try moving them to a warmer location in the house and wait a bit longer – this is most often the cause and solution for my bottle priming mishaps. If, however, they're still flat, you can either add low-dose carbonation drops if you believe you've under-primed, or add a small dose of yeast to each bottle, if yeast viability and density are suspect, and recap. I've been party to a technique used by three brewers who took the (extreme?) step of uncapping and gently adding each bottle's beer to a CO_2 — flushed keg and force-carbonating, but all three cases ended

Chart B — Additional Carbonation From Priming Sugar

Glucose•H_2O (corn sugar)	Volumes CO_2 per 5 gal./19 L	Sucrose (table sugar)	Volumes CO_2 per 5 gal./19 L
1 oz. (28 g)	0.34	1 oz. (28 g)	0.39
1.5 oz. (43 g)	0.51	1.5 oz. (43 g)	0.59
2 oz. (57 g)	0.68	2 oz. (57 g)	0.79
2.5 oz. (71 g)	0.85	2.5 oz. (71 g)	0.98
3 oz. (85 g)	1.02	3 oz. (85 g)	1.18
3.5 oz. (99 g)	1.19	3.5 oz. (99 g)	1.37
4 oz. (113 g)	1.36	4 oz. (113 g)	1.57
4.5 oz. (128 g)	1.53	4.5 oz. (128 g)	1.77
5 oz. (143 g)	1.7	5 oz. (143 g)	1.96
5.5 oz. (155 g)	1.87	5.5 oz. (155 g)	2.16
6 oz. (170 g)	2.04	6 oz. (170 g)	2.36
6.5 oz. (184 g)	2.21	6.5 oz. (184 g)	2.55
7 oz. (198 g)	2.37	7 oz. (198 g)	2.75

with a beer that was badly oxidized. I don't recommend it — time and temperature should solve most carbonation issues.

One final note here. Some may recommend flushing your bottles with CO_2 before packaging, and I don't dispute that it will protect against excess oxygen pickup at packaging. This best practice, though, does not bear up to qualitative examination compared to beers of mine that did not receive this treatment. It may provide marginal benefits, but if you don't have the capacity to do so, don't sweat it.

A MATTER OF TIME

One final point about conditioning: Be kind to your aging beer. All beers are likely oxidized and/or contaminated to some (hopefully small) degree. Slowing the effects of oxygen and the growth of contaminants is simple — store them cold. The warmer the beer is, the faster chemical reactions in the bottle or keg will occur; look up the Arrhenius Rule. This empirical relationship states that a 10 °C (18 °F) increase in temperature doubles the speed of the reaction, while a similar decrease doubles the time that reaction will take. If your beer will stale in two months at room temperature (72 °F/22 °C), you can extend that time to four months at 54 °F (12 °C), and eight months at 36 °F (2 °C); a typical refrigerator temperature. Plus, refrigerators are dark, and light is the enemy.

Some age effects are unavoidable, of course — IBU loss, loss of hop aroma and flavor, the development of off-flavors from low-grade contamination, etc. — but cold, dark storage will slow their onset. And, of course, some beers develop complex flavors with age. So you may want to store the beer in a slightly warmer location (like room temperature) if you are looking to alter the profile or mellow certain components such as those found in wood-aged beers.

Proper conditioning and carbonation will help us finish our beers in such a way that makes it a more pleasurable experience. Treat them well in this final stage and store them responsibly, and you'll be able to do so for a while to come. BYO

BY MICHAEL TONSMEIRE

RECIPE DESIGN ETHOS

Creating like a true craft brewer

There are different considerations when designing a recipe for a craft brewery compared to a home brewery. I'm not talking about adjusting for mash efficiency or hop utilization, two things every brewer should do regardless of scale. This article describes techniques that craft brewers use to make brewing easier, and their results consistent year-to-year! Only some of these techniques have potential value for homebrewers, while others only have value when planning to scale a recipe for commercial production. Over the years I've collected advice while consulting, collaborating, and drinking with a wide variety of brewers, the lessons included here reflect what I've put into practice now that I'm brewing professionally.

ROUNDING TO PACKAGE SIZE

Most homebrewers write grain bills with nice round percentages – 85% pale malt, 10% Munich, and 5% crystal 20. Commercial brewers are lazy (in a good way), so it makes sense to use an entire 50- or 55-lb. (22- or 25-kg) sack of malt even if the resulting recipe features 9.4% or 11.3% Munich malt. A deviation of a couple percentage points is unlikely to create a noticeable flavor difference in the finished beer. The exception is dark grains, which due to their intensity need more precision. In those cases ideally a half-sack can be used. If the beer comes in lower than the target gravity on the first iteration, the next will get an extra bag of base malt (rather than a little more of all the malts).

Similarly, many craft brewers try to avoid saving open packages of aroma hops for extended periods. Ideally, an 11-, 22-, or 44-lb. (5-, 10-, 20-kg) box is added as a single addition, or across multiple additions on a given brew day. This is good advice for homebrewers as well — unless you have a vacuum sealer. This approach also avoids a large number of leftover hop bags cluttering the freezer . . . a lesson I could stand to learn. If you do have older hops, then using them in the boil (rather than dry hopping) is preferred.

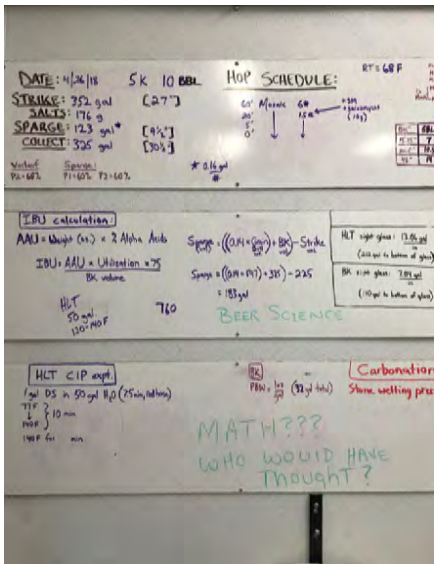
As a homebrewer brewing 11-gallon (42-L) batches, I often use one-third or half a sack of base malt, and specialty malts in pound increments (or half pound if needed). For hops I'll buy by the pound, using up last year's leftovers for hot-side additions while the freshest hops are reserved for dry hopping.

BLENDS OF HOPS

My preference is to use a simple ratio of two hops for aroma (1:1 or 2:1). This simplistic approach represents the sweet spot for me in terms of adding nuance to the hop character without creating a muddled-generic "green" hoppiness. This approach works for many craft brewers as well, in addition single-hopped beers have even gained traction as one-off or rotating releases. However, if a craft brewer is designing a year-round flagship IPA, best practice is to include three or more aroma varieties. This allows the brewery to swap out one variety for another if scarcity, agronomics, or demand causes supply issues. Although hop contracts help minimize shortfalls, swapping varieties can address uncontrollable issues that endanger the viability of a recipe, especially helpful for relatively new hop varieties.

When a substitution is required, it is easier to get away with replacing a quarter of the hops in a beer than it is to replace half or all. While using a hop-oil calculator (my Sapwood Cellars' partner Scott Janish has a nice one

As a homebrewer, I'd rather brew the best batch I can today... and not worry about making that identical beer again.



here: http://scottjanish.com/hop-oils-calculator/) to mimic the oils of the replaced variety is a great start, confirming pilot batches are required as small oil fractions can alter the perceived aroma of the beer. It may be that for a given hop, one variety is better as a hot-side substitute and another for dry hopping as both timing and temperature determine which aromatics survive into the finished beer. See my article "Hop Oil Analysis and Blending", *BYO* December 2015.

Even if all hop varieties remain available from the same farms, aroma could change thanks to annual weather differences or harvest timing. This variability can again be dampened by a larger blend of hops. For craft brewers this variability is further mitigated by traveling to Yakima, Hallertau, or Nelson for hop selection. The goal is not necessarily to pick the "best" lots, but rather the ones that provide continuity of flavor.

As a homebrewer, I'd rather brew the best batch I can today . . . and not worry about making that identical beer again. I'll buy Citra®, Galaxy, and Nelson Sauvin when I can find them, and create something unique with other varieties when I can't. This approach has become more common for NEIPA-focused breweries that do heavy can-sales on premises; they simply won't brew a particular IPA if the relevant hops are not available.

CONSISTENT INGREDIENTS

One of my favorite aspects of homebrewing beer compared to other fermentations I've tried (e.g., sourdough bread, kombucha, and ginger beer) is that I only have to brew when I'm in the mood. I don't have to "feed" brewer's yeast on a weekly basis. Craft brewers don't always have this luxury. A commercial pitch of liquid yeast costs hundreds of dollars, a not-insignificant percentage of the total price-tag. On a commercial scale, quick-repitching is also essential because large volumes of yeast slurry generate heat, leading to quicker reduction in cell viability. As a result, most craft breweries have one or at most two house yeast strains that they use to ferment their core beers. Thanks to their low price-point and high shelf-stability, dried yeast is an appealing option for breweries without a schedule that allows harvesting.

Homebrewers derive important benefits from learning about a strain from repeated brews, but starting out I'd value variety to discover a few favorites for focus. Still, there can be pleasant surprises with minimalism. JC Tetreault from Trillium Brewing (Boston/Canton, Massachusetts) mentioned that at first he used an English yeast in his IPAs because he had selected it for the porter. The results were delicious, unexpectedly hazy, and people loved the subtle addition of yeast character to the hoppiness, so he rolled with it. A limited color palette sometimes produces the most beautiful and unique paintings!

When a craft brewer orders a special yeast strain, they'll often string a few batches together with increasing gravity and bitterness. For example: Hefeweizen, to hoppy wheat, to weizenbock. This pattern works well for homebrewers as well, and supports more brewing with less time making starters. Another option that we are experimenting with at Sapwood Cellars is blending dried yeast strains for added variety, and at a price-point that doesn't require repitching (see Ziparillo recipe on page 97).

The parallel for grain is that, as breweries grow, they often add a silo of their base malt of choice. This is usually a compromise that suits all of the beers well enough. Our first few test batches for Modern Times (San Diego, California) Black House coffee stout used Maris Otter as the base. I was surprised how much depth and richness the beer lost when we switched to North American standard 2-row malt to suit the hoppy beers. Luckily once the production brewers took over they restored that lost depth by adding biscuit and pale chocolate.

Many breweries use a single hop for bittering all of their beers. This allows for a consistent and predictable amount of IBUs. CO_2 hop extract has become popular as well, see "Hop Extracts" in the July/August 2018 issue of *BYO*. As a brewery expands it may grow big enough to get an entire hop lot pelletized . . . but not big enough to get several. You may notice growing breweries have a year or two where they seem to use one hop variety in most of their beers for this reason. More breweries are also using a limited selection of less expensive high-oil hops for whirlpool additions (Columbus, Chinook, Nugget, Bravo etc.), dry hopping with more expensive varieties to add the unique character.

CARE ABOUT SOURCE

When I talk to other professional brewers about ingredients, they usually specify which maltster, yeast lab, or hop provider they prefer or are referring to.

Despite the names, Briess roasted barley (~300 °L) isn't a substitute or even a similar product to Muntons roasted barley (~500 °L). Their flavor and color contributions are completely different, so you need to be aware of which you are using. You'd be better off with Briess black barley or even black malt if you needed to substitute for Muntons because the color and flavor contributions are more similar than the names suggest. Similar story for various °L-designated caramel/crystal malts, and base malts. At the very least, start asking your homebrew supplier who the maltster is when you buy from the bulk bins if it isn't listed. Note the specific products in your recipe so you can recreate it.

There are concordance charts showing which commercially available yeast strains are from the same source. By the very nature of yeast as a lifeform it changes. Even if the two labs have done a perfect job preventing genetic drift in their stock, they may have taken their samples at different times and the culture at the brewery may have shifted in the interim. Jeffrey Stuffings from Jester King (Austin, Texas) related the differences between tasting the yeast character of their original Le Petit Prince with only French saison (it now also includes indigenous wild cultures) compared to a version brewed at Brasserie Thiriez with their house strain (the original French saison):

> *[W]hen I drink Le Petit Princesse from Thiriez . . . I get strong bitterness, firm malt character, plenty of green bottle "Euro-skunk," and a little interesting spice character from fermentation in the background. When we made Le Petit*

Photo by Michael Tonsmeire

SAPWOOD CELLARS' ZIPARILLO CLONE

(10 bbl/12 hL, commercial-size)
OG = 1.048 FG = 1.016
IBU = 14 SRM = 5 ABV = 4.2%

This hoppy wheat beer was designed to introduce hop-averse beer drinkers to the new ways hops are being used. A low-temperature whirlpool reduces alpha acid isomerization, allowing more hop flavor without big bitterness. Dry hops added to the fermenter before knockout add additional fruitiness without a raw-green aroma. A small addition of hefeweizen yeast adds subtle banana notes underpinning the apricot and peach aromas for Amarillo®.

INGREDIENTS

7 sacks (55 lbs./25 kg each) Rahr standard 2-row malt
2 sacks (55 lbs./25 kg each) Rahr white wheat malt
1 sack (50 lbs./22.7 kg) Briess Caramel Vienne malt (20 °L)
40 g Whirlfloc G (15 min.)
4.5 lbs. (2 kg) Amarillo® hops (0 min.)
6.5 lbs. (3 kg) Amarillo® hops (dry hop)
1 lb. (0.45 kg) calcium chloride
0.5 lb. (0.23 kg) calcium sulfate
300 mL 75% phosphoric acid
750 g SafAle S-04 yeast
55 g SafAle WB-06 yeast

STEP BY STEP

Treat water to achieve 150 ppm chloride and 75 ppm sulfate. Combine milled grains, salts, and 9 bbls (11 hL) of hot water to achieve a mash temperature of 156 °F (69 °C). Add phosphoric acid as needed to reach a mash pH of 5.4. Sparge with 6 bbl (7 hL) of 178 °F (81 °C) water dosed with 50 mL of 75% phosphoric acid. Boil the 11 bbls of wort adding Whirlfloc as noted.

At the end of the boil add 1 bbl of cold water to cool the wort to 195 °F (91 °C) before adding the whirlpool hop addition. The lower temperature reduces isomerization. Whirlpool for 75 minutes.

Place the dry hops into the fermenter. Chill wort to 64 °F (18 °C), transfer to fermenter, and aerate. Pitch 5 sachets of WB-06 along with one-and-a-half 500 g packages of S-04. No rehydration necessary. Hold fermentation at 64 °F (18 °C) for three days, then allow to warm to 66 °F (19 °C) until fermentation is complete. Crash cool to 32 °F (0 °C) for three days to drop out the yeast and hops. Prime and bottle or keg targeting 2.6 volumes of CO_2.

SAPWOOD CELLARS' ZIPARILLO CLONE

(5 gallons/19 L, all-grain)
OG = 1.048 FG = 1.016
IBU = 14 SRM = 5 ABV = 4.2%

INGREDIENTS

7 lbs. (3.2 kg) Rahr standard 2-row malt
2 lbs. (0.91 kg) Rahr white wheat malt
1 lb. (0.45 kg) Briess Caramel Vienne malt (20 °L)
1 Whirlfloc tablet (15 min.)
1.2 oz. (33 g) Amarillo® hops (0 min.)
1.7 oz. (47 g) Amarillo® hops (dry hop)
7 g calcium chloride
3.5 g calcium sulfate
5 mL (1 tsp.) 75% phosphoric acid
1 sachet (11 g) SafAle S-04 yeast
1 g SafAle WB-06 yeast
¾ cup corn sugar (if priming)

STEP BY STEP

Treat water to achieve 150 ppm chloride and 75 ppm sulfate. Combine milled grains, salts, and 5 gallons (19 L) of hot water to achieve a mash temperature of 156 °F (69 °C). Add phosphoric acid as needed to reach a mash pH of 5.4. Sparge with 3 gallons (11 L) of 178 °F (81 °C) water dosed with 1 mL (~1/4 tsp.) of 75% phosphoric acid. Boil the wort, adding Whirlfloc as noted.

At the end of the 60-minute boil, add 2 qts. (1.9 L) of cold water to cool the wort to 195 °F (91 °C) before adding the whirlpool hop addition. The lower temperature reduces hop isomerization. This is probably unnecessary at home where the smaller volume and shorter timescale will limit the amount of bitterness contributed. Whirlpool for 75 minutes.

Place the dry hops into the fermenter. Chill wort to 64 °F (18 °C), transfer to fermenter, and aerate. Pitch yeast, using only a pinch of the WB-06. No rehydration is necessary. Hold fermentation at 64 °F (18 °C) for three days, then allow to warm to 66 °F (19 °C) until fermentation is complete. Crash cool to 32 °F (0 °C) for three days to drop out the yeast and hops. Prime and bottle or keg targeting 2.6 volumes of CO_2.

SAPWOOD CELLARS' ZIPARILLO CLONE

(5 gallons/19 L, extract with grains)
OG = 1.048 FG = 1.016
IBU = 14 SRM = 5 ABV = 4.2%

INGREDIENTS

4 lbs. (1.8 kg) extra light dried malt extract
1 lbs. (0.45 kg) wheat dried malt extract
0.75 lbs. (0.34 kg) Briess Caramel Vienne malt (20 °L)
1 Whirlfloc tablet (15 min.)
1.2 oz. (33 g) Amarillo® hops (0 min.)
1.7 oz. (47 g) Amarillo® hops (dry hop)
7 g calcium chloride
3.5 g calcium sulfate
5 mL (1 tsp.) 75% phosphoric acid
1 sachet (11 g) SafAle S-04 yeast
1 g SafAle WB-06 yeast
¾ cup corn sugar (if priming)

STEP BY STEP

Treat water to achieve 150 ppm chloride and 75 ppm sulfate. Combine milled grains in a grain bag, salts, and 5 gallons (19 L) of water. Heat water to 170 °F (77 °C) then remove grain bag. Add phosphoric acid and the dried malt extract off of heat. Stir until the malt extract is completely dissolved, then bring wort to a boil. Boil the wort, adding Whirlfloc as noted. Boil for 15 minutes.

At the end of the boil add 2 qts. (1.9 L) of cold water to cool the wort to 195 °F (91 °C) before adding the whirlpool hop addition. Follow the all-grain recipe's step-by-step for the remaining instructions.

Prince with pure culture French Saison yeast, we got much stronger fruit, spice, bubble gum, estery character. Maybe this is just my bias talking, but when French Saison made its way stateside, it somehow got Americanized and became more aggressive in terms of traditional (or stereotypical) Belgian fermentation character.

As a result, many brewers have a preference for one lab's strain compared to others. I'd take Wyeast 1728 (Scottish Ale) over White Labs WLP028 (Edinburgh Scottish Ale) for example as it is more cold-tolerant, which seems to allow it to finish cleaner. There are some strains that are especially finicky, like Conan, for which I've had vary wildly in flavor and attenuation between pitches from East Coast Yeast, The Yeast Bay, Omega, GigaYeast, etc. Likely depending on which "generation" they harvested for their original stock.

Don't think of brewing ingredients as a commodity. There are real differences in the same products from different sources!

LESSONS LEARNED

It is great to see more breweries acting like homebrewers. Brewing a Citra®-heavy DIPA when they can get Citra®, and one loaded with Mosaic® when Mosaic® is more plentiful or better quality. Ten years ago, seemingly every brewery had four core-beers, four seasonals, and a handful or special releases. Now more are starting and staying with a model of just producing delicious beer without as much repetition!

Homebrewers aren't small-scale craft breweries, just as craft breweries aren't scaled up homebrewers. While there are lessons and techniques that can be applied in both directions, there are others that only make sense at each scale. As a homebrewer, don't get hung up on a percent on the grain bill or a few IBUs on the hop schedule. The human palate isn't nearly as precise as we'd like to think. As a homebrewer you don't have to worry much about consistency, you can strive to brew the best beer each batch! BYO

We at BYO *wish Michael Tonsmeire and Scott Janish (pictured here) the best in their new venture at Sapwood Cellars in Columbia, Maryland.*

THE TRAP DOOR KEEZER

Gain access without lifting the tower

BY STEVE KIEBZAK

As most beginning homebrewers do, I first bottled my homebrew in saved 12-oz. longnecks. After a few batches under my belt I found bottling was a hassle, and I really wanted a beer refrigerator with taps at my newly-built bar. The quest began for the perfect beer fridge/kegerator. My wife thought that having a refrigerator with multiple taps through the door would not be a fitting addition to our family room, and I had to agree even though we already had a 14 cu. ft. (0.24 cu. m) fridge in the basement we could modify. Nixing the beer fridge, I turned to the homebrew forums where members highlighted their beer fridge/kegerator/keezer creations and discussed pros and cons.

I wanted something that would integrate into my bar and hold at least 3 corny kegs. The keezer (kegerator + chest freezer) option was the way I decided to go. Many keezer builds utilize a wooden collar with taps mounted through the collar. Having taps sticking out the front of the keezer would be in the way so a keezer with a tap tower was the next logical step. However, one big con of fixed towers is having to pull the keezer away from the wall when lifting the lid because the tap tower will hit the wall. My solution was to build a keezer with a fixed tap tower and section in the rear with a removable lid in front.

I found a 7.1-cu. ft. (0.2-cu. m) chest freezer on sale that would hold three 5-gallon (19-L) corny kegs. If a future fourth keg is wanted, a 2.5-gallon (9.5-L) keg will fit on the internal compressor shelf. I had some 2-in. (5-cm) thick boards available, milled from trees taken down when we built our house, and I used those to make the top. As an option, you could use any 2-in. (5-cm) wide lumber or plywood sub-deck with a zinc sheeting or a tile surface could be used. But one key with this build is that the front section shouldn't be too heavy. This section lifts off for access to the inside of the keezer. I attached an apron to the top sections that keeps the two top sections aligned. I installed a pull-type latch on each side of the apron sections to help keep the sections tight and flush. The front "trap door" section is only attached to the fixed rear section via the apron with the two pull-type latches. The bottom of each section is insulated with XPS foam board that I had lying around. The tower box is made from leftover cherry wood with an oak front and rear. As an add-on, I slipped a piece of hard copper pipe inside each pipe riser and ran one beer line through each. I insulated the insides of the tower box, and the first pour does not take too long to run cold.

I made my tower box big enough for a fourth tap if I ever wanted that option, but I chose to use that space to mount my temperature controller. I use the 4th port in my CO_2 manifold for purging kegs before filling. Cheers!

Materials List

Chest freezer
Wood for the top (freezer size dependent)
¼-in. x 1-in. (6-mm x 2.5-cm) foam weatherstripping
½-in. (13-mm) XPS foam board
(2) pull-action latch clamps
1-in. x 3-in. (2.5-cm x 8-cm) wood for apron
1-in. x 6-in. x 4-ft. (2.5-cm x 15-cm x 1.2-m) wood for tower box
¼-in. x 6-in. x 3-ft. (6-mm x 15-cm x 91-cm) wood for front and rear tower box covers
(2) 1¼-in. x 10-in. (3-cm x 25-cm) black iron pipe nipples
(4) 1¼-in. (3-cm) floor flanges
Temperature controller (STC-1000, UNI-STAT, or Inkbird)
Kegging setup (including 3 taps and a 4-port manifold)
Miscellaneous screws, glue, electrical box, wiring

My solution was to build a keezer with a fixed tap tower and section in the rear with a removable lid in front.

Photos by Steve Kiebzak

1. REMOVE LID AND INSTALL NEW GASKET

Remove the chest freezer lid and hinges, then install foam weatherstripping around the top edge of freezer. This gasket stops air leakage and keeps the cold where it belongs. Now is a good time to paint the freezer if a color other than white is desired. I spray painted my freezer black.

2. MAKE NEW TOP SECTIONS AND INSTALL APRON

My 2-in. x 10-in. (5-cm x 25-cm) boards milled from my trees were rough cut. Being a woodworker, I had equipment to plane the boards and joint the edges. I used wood glue and clamps to assemble each section. I used 1-in. x 3-in. (2.5-cm x 8-cm) boards to craft the apron, which was glued and screwed to the underside of the top sections. My fixed section ended up being 8-in. (20-cm) deep and the removable front section is 16½-in. (42-cm) deep.

3. FINISH THE TOP SECTIONS

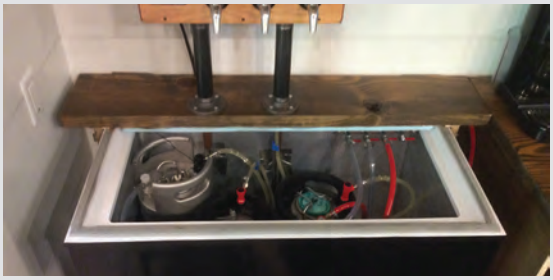
When the glue is dry, drill 1¼-in. (3-cm) holes for the two black pipe tower risers. Add XPS insulation to the back of each section. Stain and varnish. Add pull-action latches to secure front to back section (pull latch is visible in lower right corner in top photo to the right)

4. BUILD THE TOWER BOX

I built the tower box from cherry wood (1 in. x 6 in./2.5 cm x 15 cm) I had left over from another project. I bought some ¼-in. (6-mm) oak board from a big box store for the front and back of the box. I added a single receptacle in the back cover of the tower box to plug in the freezer. The receptacle is switched with the temperature controller. The temperature sensor cable runs into the freezer through one of the black iron pipe risers.

5. INSTALL FIXED SECTION AND ASSEMBLE TOWER

The fixed section of the lid was secured to the back of the freezer with bolts through the apron into the freezer top hinge holes. I slipped two sections of 3-ft. (91-cm) long, ¾-in. (19-mm) copper pipe into each black iron pipe riser and used aluminum duct tape to secure to the inside of the freezer. This is an optional addition I utilized to keep the beer cold as copper conducts heat really well. One beer line runs inside each copper pipe. Insulate the tower box once all fittings and lines are secured.



6. DROP IN THE KEGS, CHILL, SERVE!

I set my temperature control at 36 °F (2 °C) with a 2 °F (1 °C) differential. The keezer turns on at 38 °F (3 °C) and turns off at 36 °F (2 °C). The temperature continues to drop to around 34.5 °F (1 °C) before it starts to rise and begin the cycle again. The keezer runs about 2 minutes every 30 minutes, so as to not strain the compressor.

Brew Your Own — THE HOW-TO HOMEBREW BEER MAGAZINE

2018 STORY INDEX

Brew Your Own — THE HOW-TO HOMEBREW BEER MAGAZINE

2018 RECIPE INDEX

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BY ARTUR SZUDROWICZ

ICED WARSAW PORTER

Brewing a Warszawski Porter Lodowy

As it often happens, interesting beers can be born by accident. It happened to me this time — thanks to a combination of several circumstances. It was quite a chilly day during a severe winter in Poland, even by Polish standards. It was mid-January and the temperature dropped to −20 °C (−5 °F). It was at this time that the taste of the long ago sipped eisbocks like Aventinus and a few iced-beers from Polish craft breweries — like Buba from Szałpiw or a really nice offering from the Cooperative Brewery (Browar Spółdzielczy) — loomed in my head. Tough, oily, warming . . . and treacherous. The perfect sipping beer for a cold winter evening such as I found myself in. So why not create this kind of beer myself?

The weather was just perfect for this task. But which beer style would be great to freeze? Can I finish fermentation in time so that the capricious weather will still be favorable? And so thinking out loud, my lovely wife Maggy, the main brewer in our relationship, threw in the ether — "we still have a Warszawski Porter Bałtycki (Warsaw Baltic Porter) in secondary fermentation, which you promised to bottle last week!" Well, it seems that my procrastination from the previous week made our ready-for-bottling Porter Warszawski a great candidate for the freezing. Thus, from the 20-L (5.25-gallon) batch, 10 L (2.5 gallons) went to bottles and the other 10 L (2.5 gallons) went to freeze.

The base beer itself is an interesting story in its own right. Poland is located on the southern shores of the Baltic Sea, so we refer to Baltic porters as "our" style. It's a dark but not black beer with ruby reflections, hailing around 22 °P (1.092 SG), using bottom-fermenting yeast (though the style was originally fermented with top fermenting yeast), with hints of coffee, chocolate, plums, finishing at about 9% ABV, yummm . . .

Someone curious may ask — why "Warszawski" (Warsaw)? This is not a meaningless adjective here. The recipe for this beer comes straight from the famed Królewskie Browary Warszawskie (Royal Warsaw Brewery), closed in 2004 by its last owner — Heineken. The last batch of porter from this brewery bears the expiration date — January 2, 2004. What's special about this particular recipe? Mainly the lack of very dark malts/grains in the mash; with the roasted grain component never exceeding 600 EBC (225 °L) in color. The beer's final color and additional complexity of flavor is due to the effects of Maillard reactions during a 4-hour boil. The mashing itself also contributes plenty of character thanks to a 2-vessel decoction program.

We froze the porter in a "polypin" 10-L (2.5-gallon) container made of elastic plastic with a tap, which originally was used to referment and serve cask-style ales. With a temperature of approximately 18 to 22 degrees below zero centigrade (0 to -8 °F), the freezing process lasted 3 days. Actually, as it turned out later, we did not have to count on cold weather at all. The home freezer will work just as well! By the end of three cold days and nights much of the water in the porter froze. We yielded about 5 L (1.3 gallons) of Iced Warsaw Porter. The young icy porter, now at an estimated 18% ABV (not tested), has been 8 months in bottle and we are very anxious trying not to open the last remaining bottles.

Na zdrowie! BYO

You can find the recipe and step-by-step to make either the base beer or the iced version on our website at www.byo.com/recipe/warszawski-porter-lodowy

The recipe for this beer comes straight from the famed Królewskie Browary Warszawskie (Royal Warsaw Brewery), closed in 2004 by its last owner — Heineken.

Photo courtesy of Artur Szudrowicz

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