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BrewYour Own

THE HOW-TO HOMEBREW BEER MAGAZINE

OCTOBER 2014, VOL.20, NO.6

BIG BATCH SMALL BATCH

tips & techniques for scaling down or going big

Pro Brewer Recipes Straight from Pilot Systems

2 Beers from 1 Brew Day

Dialing in Mash Water Temperatures

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+Prost! Oktoberfest

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BYO 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.

Gallons:
We use US gallons whenever gallons are mentioned.

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Partigyle: Techniques

It's an old technique that still gets used today when brewers wish to make two beers from one mash — partigyle brewing. Find out how to get your parti started right.
http://byo.com/story1963

Oktoberfest: Tips from the Pros

After reading this issue's "Style Profile" on Oktoberfest, get more tips on brewing the classic German festbier from the brewers at Duck-Rabbit Craft Brewery, August Schell Brewing Co., and Harpoon Brewery.
http://byo.com/story2314

Getting the Most From Your Hydrometer

If you are new to homebrewing, check out this article all about the trusty hydrometer before reading the "Techniques" column on page 81 so you know the correct ways to measure specific gravity and Plato.
http://byo.com/story694

The Truth About Black Patent Malt

Burnt? Acrid? Or just misunderstood? Learn the truth about how black malt is made and what it's good for. http://byo.com/story155

Cover Photo: **Charles A. Parker/Images Plus**

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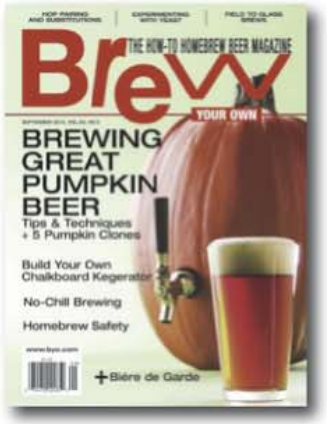

Brewing pumpkin beers

I enjoyed the story in the September 2014 issue of *Brew Your Own* about brewing pumpkin beers, but I had a few questions. First off, you said that Elysian Brewing uses hefeweizen strains in some of their pumpkin beers. Harpoon Brewery (here in Boston) brews a pumpkin hefe (UFO) every year that I really like and I want to try and brew a clone. If I wanted to brew something like that, would I start with a basic hefe-type recipe and just add pumpkin and spices? Because of the hefe yeast flavors, how much would you scale back the spicing? Also, since my hefe recipe tends to gum up the mash, am I tempting fate by adding pumpkin as well? Should I add even more rice hulls than you recommend in the story?

Mark Simons
Boston, Massachusetts

Story author Dave Green replies: "Great questions, Mark. Here are some things to keep in mind: Harpoon uses a more neutral yeast strain than the Bavarian hefeweizen strains. If you used the more expressive Bavarian strains like White Labs' WLP300 or Wyeast's 3068, then I would recommend scaling back the spices slightly to make sure that the signature banana and clove characteristics can really come through on the nose and taste. Brewer Ken Hermann from Harpoon reports that UFO Pumpkin is not technically a hefe, and that they use their in-house ale strain. So, if I were to make a Harpoon UFO Pumpkin clone I would opt for a clean, neutral ale yeast. I would not adjust the level of spicing as the spice would be the driving force for the aroma. In regards to the ingredients, Ken suggests using only about 10% wheat malt and he says, 'we use pale, Weyermann Munich II and Briess Vienna malt along with some dark crystal to give it a nice orange/amber color.' I'd suggest a pretty even split between Vienna and Munich II. Ken also says they add pumpkin puree in the mash and spices in the whirlpool. As for rice hulls, this would be a time when I would use upwards of a pound (0.45 kg) or more of rice hulls in the mash. The rice hulls are neutral additions so adding more won't hurt your final beer. Best of luck!"

contributors

Glenn BurnSilver is a freelance writer who enjoys outdoor activities such as hiking and camping in the backwoods. He has lived in Colorado and Alaska and now resides in Scottsdale, Arizona. BurnSilver is also an avid record collector and travels to record conventions across the country. He also maintains a music review blog, *Liner Notes*, which can be found at www.burnsilver.com.

Glenn is a frequent contributor to *Brew Your Own*, including a recent story about making hopped hard cider in the October 2013 issue and making the most of a commercial brewery visit in December 2013. In this issue, starting on page 60, Glenn discusses the small-scale pilot brewing setups used by commercial brewers to develop today's craft beers.

John Blichmann is President of Blichmann Engineering. For years, he worked at Caterpillar, among other things designing 8,000 horsepower diesel engines. Blichmann has been a brewer since 1991 and is a Beer Judge Certification Program (BJCP) judge, but admits that designing the equipment is his true passion. He founded Blichmann Engineering in 2001 in order to focus on designing and producing homebrewing equipment, including kettles, fermenters and more (that can be seen at http://www.blichmannengineering.com). In his latest article for *Brew Your Own*, on page 52, John discusses scaling up to brewing batches of 10, 20 or more gallons (38, 76 L) — a subject close to his heart as it was the inspiration for starting his company.

Justin Bruce lives in Eugene, Oregon with his wife and two sons. He works for a local credit union and is a Youth Minister at his church. He began brewing in late 2010 after his wife bought him a brewing kit for his birthday. From there he jumped into the hobby feet first, building his own equipment, culturing yeast, brewing sours, growing hops, designing recipes, kegging, and recently taking home three gold medals as well as Best of Show in the KLCC Microbrew Festival Homebrew Competition for a 2.5-year-old Lambic. He maintains a blog at www.endofsilencebrewing.blogspot.com. With all the busyness in his life Justin has found some work-arounds to avoid some of the schedule conflicts with brewing by adopting techniques such as the focus of his article on page 70: Making two beers from one mash.

Simple brewing story

Thoroughly enjoyed the article by Steve Ruch about #KISSOFF. Amazingly complex #homebrew starts with simple recipes.

@ihackbeer
via Twitter

BYO *Editor Betsy Parks replies: "Glad you enjoyed Steve's 'Last Call' article in the September 2014 issue. For more about brewing simply, check out Brad Smith's story, 'SMaSH Brewing' in the July-August 2014 issue of* Brew Your Own."

Proven porter

It is with great gratitude that I compliment the great work of Terry Foster. Terry's 1744 Porter recipe I brewed from the December 2013 issue placed first this past spring at the Ocean State Homebrew Competition at Johnson & Wales University in Providence, Rhode Island. A week earlier it placed second in the first round of the National Homebrew Competition.

I was as delighted to see this beer win big and reminded of the complex flavor and body as I was drinking it. Please extend thanks to Dr. Foster and tell him I'm a big fan, and not just for his recent work, but from an earlier inception of this beer at BrüRm@BAR in New Haven, Connecticut called Presumptuous Porter (I still have the commemorative glass that went along with it).

And finally, cheers to you *BYO*, for keeping my 15-year-old homebrew hobby still interesting after all these years. Please keep up the great work!

Dan Martich
Stamford, Connecticut

Beer safe?

I've got some beer in the primary that's been sitting a while (maybe too long) and I want to find out if it's safe to drink. Is there a test I can do, or a lab to send it to, that can tell me if there's anything funky in there?

Jesse Gilbride
Boston, Massachusetts

BYO *replies: "Thanks for writing in, Jesse. The biggest potential problems with beer left for eight months in a carboy would be off flavors created by long-term exposure to dead yeast cells and slow oxygen contact. If the homebrew smells OK you might want to bottle it up, or keg it, and see how it tastes. Worst case scenario, it's dumped down the drain. Good luck!"*

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homebrew nation

READER PROFILE:

Brewer: Ronaldo Dutra Ferreira

Hometown/State: Florianópolis, Santa Catarina, Brazil

Years Brewing: 4

Type of brewer: All-grain (in Brazil, 99% of the brewers are all-grain, as malt extract is virtually nonexistent).

Homebrew setup: I started with 5-gallon (19-L) aluminum equipment and went to a 66-gallon (250-L) three-vessel structure. Currently, I downsized to 13 gallons (50 L) with a brew in a bag/one vessel system in which I get a 72% efficiency. The downsizing was necessary so I could brew more beers, different styles and do more experiments.

Currently fermenting/on tap/in the fridge: Belgian Sorachi IPA, English IPA, Kölsch, Mandarina IPA, Mandarina Bavaria strong golden ale, English pale ale, and an Amarillo saison with *Brettanomyces*.

How I started brewing: Some friends and I wanted to brew beer in college, but we all lived with our parents so the project never took off. We had a deal; when the first of us had some sort of structure, we would brew beer. When I finished building my house I received a large package full of pots and the works to make beer and a note: "It's on your turf! Now learn!" I ordered a box of books and began to study. Since that, I have won some awards for my beer (and an honorable mention in *BYO*'s label competition last year. In May 2014, I helped organize a large technical event for our state association (ACERVA Catarinense) where we had Brad Smith, Stan Hieronymus and John Palmer give presentations about designing recipes, hops, Belgian brewing, and water. Homebrewing is growing exponentially in Brazil and people are hungry for information.

Favorite recipe: I developed this Belgian blond recipe (right) along with my friend Rodrigo Tasca and won a homebrewing competition sponsored by a brewery in the city of Blumenau called "Bierland." They produced this beer commercially and won many medals for it, including a gold medal at the 2014 International Beer Challenge in London. This is a moderate strength golden ale with high drinkability, sweet and fruity aroma and dry finish.

My blog/website: https://pt-br.facebook.com/CervejariaBruxa

byo.com brew polls

Do you ever brew split batches?

No, but I would like to 33%
Yes, occasionally 32%
Yes, frequently 21%
No, I am not interested 14%

reader recipe

Bruxa Belgian Blond Ale

(5 gallons/19 L, all-grain)

OG = 1.067 FG = 1.012
IBU = 28 SRM = 5 ABV = 7.5%

Ingredients

5.75 lbs. (2.6 kg) Pilsner malt (1.8 °L)
5.75 lbs. (2.6 kg) Vienna malt (3 °L)
4 oz. (0.11 kg) Castle Château Abbey® malt (17 °L)
8 AAU East Kent Golding hops (60 min.) (1.6 oz./45 g at 5% alpha acid)
19 oz. (0.54 kg) Demerara sugar (15 min.)
Yeast nutrient (15 min.)
Wyeast 1214 (Belgian Abbey) or White Labs WLP500 (Monastery Ale) yeast
Priming sugar (if bottling)

Step by Step

This is a step infusion mash. Start by treating 8 gallons (30 L) of water to create a profile along the lines of 90 ppm calcium (Ca^{2+}), 10 ppm magnesium (Mg^{2+}), 35 ppm sodium (Na^{+}), 60 ppm chloride (Cl^{-}) and 60 ppm sulfate (SO_4^{2-}). Mash in with 4 gallons (15 L) at 151 °F (66 °C) and hold for 60 minutes. Raise to 158 °F (70 °C) and hold for 15 minutes. Sparge with 4 gallons (15 L) of treated water at 172 °F (78 °C). Boil for 60 minutes, adding hops at the beginning of the boil. After flame out, whirlpool and wait 15–20 minutes. Cool wort to around 70 °F (21 °C). Pitch yeast and then ferment around 68 °F (20 °C) for three days, then turn off temperature control for 7 to 10 days. Cold crash the beer to 32 °F (0 °C) and hold for a week. Bottle or keg and enjoy.

what's new?

How to Brew

Renowned homebrew authors John Palmer from "How to Brew" and Brad Smith of "BeerSmith" have teamed up to produce two new videos on brewing. The first, *How to Brew with Malt Extract* is intended for new extract brewers, and walks the viewer through the entire process from start to finish. The second, *How to Brew All Grain*, is for intermediate to advanced brewers and covers all-grain brewing, brew-in-a-bag, kegging and more. To learn more about both DVDs or to order your copy, visit www.beersmith.com/dvd

HomebrewNinja

Developed by homebrewer Dan Born and his web developer wife, Jen, HomebrewNinja.com is a homebrew supply price comparison website that searches an ever-expanding list of online retailers and is completely free to use. Through the site, homebrewers choose product categories and quantities and receive instant search results. Helpful features include the ability to save shopping lists, set up emailed price alerts to notify you of price changes, and the ability to set store preferences to customize your results. HomebrewNinja is mobile-friendly, convenient, and designed to save you time and money. Learn more at www.HomebrewNinja.com.

Vintage Beer

Patrick Dawson, an accredited beer judge and collector of vintage beers, offers tons of quality information on recognizing beers that are suitable for the aging process in his new book, *Vintage Beer*. This go-to guide will help readers identify specific flavor changes that may occur during aging and develop their own vintage beer collection. Dawson makes aging beers easy, using a variety of brews such as ales, barleywines, and stouts, as examples. Available at major booksellers.

eDrometer

The eDrometer is a new digital hydrometer designed to give homebrewers an accurate hydrometer reading without the guesswork. The eDrometer, from STM Instruments, is durable, easy to use and easy to clean, and best of all it includes temperature-corrected measurements. With the press of a button, it supplies data on Specific Gravity; Density; °Brix; °Plato; Baumé; Grams of sugar per liter; Potential Alcohol; Percent Alcohol by Volume; and Temperature (°F and °C). There's no need to adjust the values after measurement; the temperature correction has already been taken care of by the built-in complete temperature compensation technology. With an accuracy of 0.0015 S.G., the eDrometer retails for $395. For more information, visit www.stm-instrument.com.

calendar

October 4-13
Fermentation Fest — A Live Culture Convergence
Readsburg, Wisconsin
Hosted by the Wormfarm Institute, this multifaceted food and farming festival celebrates live culture in all its forms. The signature feature is the Farm/Art DTour, a nationally recognized, 50-mile, self-guided road tour through the scenic hills of northwestern Sauk County. The Fest also offers 44 classes and tasting events about fermented foods (kimchi, yogurt, hard cider, chocolate, cheese, beer, bread, etc.), preserving the harvest, farming, and more.
Web: www.fermentationfest.com

October 16-18
Australian National Homebrewing Conference
Canberra, Australia
The fourth ANHC is a gathering of enthusiastic homebrewers from around Australia. Participants will see presentations from the top names in brewing, be able to share their knowledge and experience with other like-minded brewers and taste fantastic commercial and homebrewed beers from all over Australia. Thursday features the judging of the Australian Amateur Brewing Championship, an event which attracts over 1,000 entries each year. Friday and Saturday will comprise of presentations and demonstrations, as well as the return of the sensational Beer and Food pairing dinner, and the crowd favorite club night.
Web: www.anhc.com.au

October 31
Santa Fe Open Competition
Santa Fe, New Mexico
This is the first AHA/BJCP competition ever hosted by the Sangre de Cristo Craft Brewers club. Entries are being accepted in all 28 BJCP categories and prizes and medals will be awarded for the top brews. The entry deadline is October 31 and judging will take place November 7-8.
Entry Fee: $7 per entry
Web: https://sites.google.com/site/nmsdccb/

homebrew drool systems

FishWater Brewing

John Vetigan • Hampton, Virginia

I began my quest for a superior tasting beer after tasting the beers imported from Europe. After sampling craft beers from microbreweries and homebrewers, I became hooked and decided to join the growing number of people who brew their own beer. I began homebrewing with beer kits and then expanded to all-grain brewing. I designed and built my own system and am continually seeking methods for improving the homebrewing process at my homebrewery FishWater Brewing.

My control panel consists of 3 proportional-integral-derivative (PID) controllers, manual switches and indicator lights. One PID is a temperature readout and the others control the hot water tank (HWT) burner and the mash tun pump.

I use 16-gallon (60-L) kettles. This is a close view of the HWT and the heat exchanger coil. The mash tun (on the far right of my brew stand), has a false bottom. The boil kettle also has a built-in wort chiller.

All fittings are dimpled in and silver brazed. The system is hard-piped with ½-inch stainless steel tubing. Three pumps handle all the recirculation functions and fluid transfer. This system is still evolving, more upgrades will come soon.

beginner's **block**

FILTERING

by dawson raspuzzi

Many homebrewers bypass the step of filtering their homebrew and instead use fining agents and cold crashing (storing the beer after fermentation has completed in a cold place for a week or longer to allow the yeast to drop out of suspension and the beer to clear naturally). Cold crashing works well for most beer styles with cooperative yeast and patience; however, if you are brewing an ultra-clear beer such as a Kölsch, or you want a smoother flavored beer, filtration should be considered.

The biggest reason to filter your beer is to remove yeast cells and haze particles (colloids). These particles are complexes of protein and tannin and can add astringency to your brew. When proteins and tannins are not complexed, in other words are soluble, filtration does not remove them. For this reason, filtering should be done cold when the beer is likely to have the most chill haze. Of course, clearer beer (with the exception of styles like hefeweizen that are supposed to be unfiltered and hazy) also looks more appealing, and looks have a psychological affect on taste. Many negative side effects can be avoided without filtration if you have the time, but filtering can get done in minutes what can otherwise take weeks.

There are potential negative impacts of filtering, and it is important to be aware of these so you can make your own adjustments as needed. Filtering removes more than just the bad things from your beer. It will also remove some amount of color, body, flavor, and head retention from the finished beer. In his "Techniques" column from May-June 2013, Terry Foster details adjustments that should be made in your recipe development to compensate for what is lost in filtering. He recommends increasing the amount of aroma hops (bittering hop additions should not be impacted), bumping up the amount of malts that have the greatest impact on mouthfeel such as crystal or caramel, or adding a bit more colored malt in darker beers. The other caution to keep in mind is filtration will strip the yeast that is required to bottle condition your beer, so if you still want to bottle, you will have to add more yeast back into it (the October 2004 Mr. Wizard column at http://byo.com/story417 explains the benefits to doing this).

There are a couple filtration options homebrewers have; plate and frame style filters, inline canister filters, and cartridge filters similar to ordinary water filters. The sheet filters, which are used in most commercial breweries, are designed specifically to filter yeast and other colloidal matter and work well for homebrewers.

The size of the filters will determine how much (good and bad) is stripped from the beer. Generally a 1 micron filter is a good compromise between 5 micron and 0.5 micron filters that are also readily available to homebrewers.

Filtering is easy when done with two kegs. First, transfer your beer after fermentation is complete (be sure it really is complete!) to a keg. Using low CO_2 pressure, the process is as easy as transferring the beer from one keg to the other, having it pass through the filter in-between. Make sure everything the beer comes in contact with is sanitized (running a sanitizer solution from keg to keg through the filter prior to doing so with beer works well) and keep air contact to a minimum.

At this point your beer is ready to carbonate using your regular kegging procedure. If you used filtration sheets then it's time to throw them away. If you used a canister or cartridge filter, disassemble them and run them through your cleaning and sanitization routine.

by marc martin

DEAR REPLICATOR, LAST FALL, MY WIFE'S BROTHER BROUGHT BACK A SIX PACK OF PUMPKIN ALE FROM NEW YORK BREWED BY CAPTAIN LAWRENCE BREWING COMPANY. I THOUGHT IT WAS GOOD AND MY WIFE CLAIMED IT WAS THE BEST BEER SHE HAD EVER HAD. NOW SHE WON'T STOP HOUNDING ME ABOUT MAKING THIS BEER. I NORMALLY BREW PRETTY STANDARD ALES AND I DON'T EVEN KNOW WHERE TO START.

KYLE HALVORSEN
PORTLAND, MAINE

Like most of us, Scott Vaccaro, the owner of Captain Lawrence Brewing Company, began his brewing odyssey with a 5-gallon (19-L) pot on a stovetop. Probably the biggest difference is that he began at age 17 after seeing his friend's dad stirring a pot of wort on their kitchen stove. He brewed his own first batch, a cranberry ale recipe from Charlie Papazian, in 1995.

Scott's original plan was to become an accountant. During his first semester at Villanova University he found a friend that would let him experiment in his kitchen. Short on equipment, he would ferment in a sanitized 5-gallon (19-L) gasoline jug. It soon became apparent that accounting was not in his future as brewing was his true passion.

After seeing an ad for a brewing program at UC-Davis, and some tense discussions with his parents, Scott changed colleges and headed for California where he received a bachelor's degree in fermentation science. He gives much credit to Dr. Charles Bamforth for indulging his many questions and teaching him the real science of brewing. During the summers he was able to intern at breweries in Connecticut and England. It was in England where he became immersed in the process of cask ales.

Scott owes a lot of his knowledge to Steve Dresler of Sierra Nevada Brewing. It was Steve and Ken Grossman who hired him right after graduation. While he had a good grasp of brewing science, it was his time at Sierra Nevada when he learned quality production on a very large scale.

After six years out west, Scott moved back east to take a brewing job close to home. Unfortunately, after only six months the investors pulled out and the brewpub closed. Now unemployed, Scott began to consider what it might take to open his own brewery. That became a reality in January 2006.

Now production is conducted on a 40-barrel system with a 7-barrel pilot system for experimental batches. They are projecting 30% growth this year for a total of 25,000 barrels. Currently their beers are only available in New York, Connecticut and New Jersey, but Philadelphia and Boston distribution is on deck.

Scott now oversees 3 full-time brewers but continues to advise on all recipes and performs daily quality control. Keeping true to his homebrew roots, he hosts the local homebrewing club, WHO (Westchester Homebrewing Organization) at his brewery each month.

Scott reports that the Pumpkin Ale is one of their more popular seasonals. The dark malts contribute to a rocky tan head. A simple grain bill allows for balance but allows the full flavor of the pumpkin and spices to come through. One bittering hop addition is just enough to partially offset the residual sweetness. The flavor can best be described as "pumpkin pie in your glass."

Jim, you can surprise your wife with her favorite beer because now you can "Brew Your Own." For more information on Captain Lawrence Brewing and their other beers, visit www.captainlawrencebrewing.com. BYO

Captain Lawrence Brewing Company's Pumpkin Ale clone
(5 gallons/19 L, extract with grains)

OG = 1.052 FG = 1.013 IBU = 19 SRM = 11 ABV = 5.2%

Ingredients

3.3 lbs. (1.5 kg) Coopers light, unhopped, liquid malt extract
1.75 lbs. (0.8 kg) light dried malt extract
2 lbs. (0.9 kg) 2-row pale malt
7.5 oz. (0.21 kg) crystal malt (120 °L)
2 oz. (57 g) Fawcett pale chocolate malt (220 °L)
5.9 AAU Columbus hop pellets (60 min.) (0.4 oz./11 g at 14.8% alpha acids)
4 oz. (0.11 kg) fresh pumpkin meat
0.2 oz. (5.7 g) nutmeg (0 min.)
0.2 oz. (5.7 g) cinnamon (0 min.)
0.2 oz. (5.7 g) allspice (0 min.)
½ tsp. Irish moss (30 min.)
½ tsp. yeast nutrient (15 min.)
White Labs WLP001 (California Ale) or Wyeast 1056 (American Ale) yeast
Priming sugar (if bottling)

Step by Step

Steep the milled grain and finely diced pumpkin meat in 2.5 gallons (9.5 L) of water at 154 °F (68 °C) for 30 minutes. Remove grains and pumpkin from the wort and rinse with 2 quarts (1.8 L) of hot water. Add the malt extracts and boil 60 minutes. Add the other ingredients as per the schedule. Add the wort to 2 gallons (7.6 L) of cold water in the sanitized fermenter and top off with cold water up to 5 gallons (19 L).

Cool the wort to 75 °F (24 °C). Pitch your yeast and aerate the wort heavily. Allow the beer to cool to 68 °F (20 °C). Hold at that temperature until fermentation is complete. Gently transfer to a carboy, avoiding any splashing to prevent aerating the beer. Allow the beer to condition 1 week and then bottle or keg.

All-grain option:

This is a single step infusion mash using an additional 8.5 lbs. (3.9 kg) 2-row pale malt to replace the extracts. Finely dice the pumpkin and mix it and the crushed grains with 3.5 gallons (13 L) of 172 °F (78 °C) water to stabilize at 154 °F (68 °C) for 60 minutes. Slowly sparge with 175 °F (79 °C) water. Collect approximately 6 gallons (23 L) of wort runoff to boil 60 minutes. Reduce the hop addition to 4.4 AAU (0.3 oz./8.5 g) to allow for the higher utilization factor of a full wort boil. The remainder of this recipe is the same as the extract with grains recipe.

Brewing to Age

tips from the pros
by Dawson Raspuzzi

How and what to brew for cellaring

AS WINE CONNOISSEURS HAVE KNOWN FOR AGES, SOMETIMES YOUR FAVORITE DRINK IS BETTER WHEN AGED. NOT ALL BEERS ARE IDEAL FOR CELLARING. IT TAKES THE RIGHT STYLE, INGREDIENTS AND TECHNIQUES TO BREW A BEER THAT IS GOOD FRESH BUT DEVELOPS GREATER COMPLEXITY OVER THE YEARS.

A beer needs to have certain qualities to be ideal for aging: High alcohol content (8% minimum), high finishing gravity (above 1.024 achieved through a mash temperature of 154+ °F/ 68+ °C or dextrin malt), high melanoidin content, high IBUs, a low oxygen level at bottling, and yeast presence in the bottle.

The high starting gravity (1.085 or higher) requires extra grain. Unless your mash system is oversized, you'll need to decide whether to do a half-size batch or do two mashes into one kettle. I recommend the later, which allows for an extra hour or more of boil time on the first wort during the second mash rest. Prolonged boils tend to concentrate and darken the sugar, which is ideal for aging. You want to get all your sugar from grain: If you chose to use dextrose or table sugar as the source for your high starting gravity you're going to have wort that is too fermentable and therefore will finish too dry.

A high hop bitterness is necessary to balance the sweetness of the high unfermentable sugar content. It's important to try to stick to a hop that is somewhat balanced in its alpha-to-beta acid ratio as the aging process degrades the bitterness from alpha acids but can compensate by bringing out the bitterness from beta acids. Noble varieties such as Saaz and Hallertau are good examples.

A double size pitch of healthy brewer's yeast is needed to assure a complete fermentation of high gravity wort. Enzymes can take the ferment too far and leave you without the sweetness needed to age well. A side note I should mention is the healthier the yeast the less prone it will be to off-flavor generation, which can linger in the bottle forever. If the yeast is contaminated in any way the bacteria will have plenty of time to show its bad side in your cellar.

During fermentation, high gravity beers need more time to finish. They also need more time for all of the yeast to drop out of suspension. The high sugar and subsequent alcohol content is a stressful environment for yeast and it tends to cause it to flocculate much more slowly. I recommend prolonged conditioning at cellar temperatures for an extra week or two before transferring to bottles. For homebrewers, bottle conditioning is the best way to go.

> "A high hop bitterness is necessary to balance the sweetness of the high unfermentable sugar content."

Typically, beers designed for aging can seem overly sweet when fresh due to the use of heavy caramel malt or prolonged kettle boiling. Over time, oxidized melanoidins develop toffee and Sherry notes, bringing things into a more balanced state, and fruity yeast esters combine with other oxidized compounds to create the perception of dried fruit. Aromatic hop presence will oxidize and dissipate but with the right hops the bitter perception will be replaced from the beta acids' reaction with oxygen.

The trick to brewing a beer intended for aging that is also very drinkable when fresh is to use the right hops, and lots of them. When you boil a caramel malt-filled wort for a long time you're asking for the beer to be a sugar bomb. If you keep the hops subdued you have no balance when fresh and the beer can come across tasting like burnt sugar with a boozy nose. You need to find out how far you can push hops, malt, and alcohol without taking one over the edge.

Mike Smith began homebrewing in 1997 and got his first job brewing in 2000. In 2001 he became the Head Brewer of Eel River Brewing Company in St. Scotia, California. Eel River's Triple Exultation, an old ale/strong ale, has won 6 medals in the Great American Beer Festival since 2004, including gold in the "Aged Beer" category in 2006. Mike attended the World Brewing Academy (a Siebel Institute and Doemens Academy partnership).

Ashton Lewis is the Master Brewer at Springfield Brewing Company and Process Engineer for Paul Mueller Company in Springfield, Missouri. Ashton is also the Technical Editor for *BYO* and has answered hundreds of homebrewing questions as the author of the "Mr. Wizard" column since the magazine launched in 1995. He holds a master's degree in brewing science from UC-Davis.

Beers that age well do more than simply sit in a bottle and remain constant. Higher alcohol beers and those with microbes intended to change the beer over time are the types that I believe are ideal for aging. Malty barleywines take on some interesting notes with time and beers with *Brettanomyces*, especially those with some residual dextrins, also continue to morph during long-term storage. Don't expect top notes associated with hops, fruit or subtle spice additions to hang around during prolonged storage.

When brewing bigger beers I accept higher extract losses and often times boil for extended durations to push the original gravity up. I also like extended mash rests at lower temperatures to help increase wort fermentability, which helps avoid lots of residual carbohydrate. If you are interested in aging these beers with *Brett*, this method can help limit the available food supply, so to speak.

The basic requirement for beer intended to lie down for this duration is some viable yeast in the bottle at the onset. This will help set the stage for success with respect to oxidative stability. I do assume that beer is going to oxidize over time, especially when thinking 5+ years, so choose ingredients that lend positive attributes when changed by oxidation and time.

I would recommend using a champagne bottle due to the higher pressures and then forgetting about them for 6 months. At this point it is time to taste; if the beer tastes good but shows signs of fading it may be time to conclude the aging experiment. If the beer is holding up well, wait another 6 months and pull out another bottle for tasting. After a year you will know if the beer has what it takes to stand the test of time. But treat your stash as a treasure that may be wonderful tomorrow and awful soon after because predicting the demise of beer in a cellar is not a science.

(Bottled) Cask Ale

Dry hopping, bittering with low alpha hops

help me
mr. wizard
by Ashton Lewis

Q I THINK THAT THE BEST BEER YOU CAN HAVE IS REAL CASK ALE. BUT IF YOU ONLY HAVE EQUIPMENT TO BOTTLE YOUR BEERS, IS THERE ANYTHING YOU CAN DO TO MAKE YOUR BEERS TASTE A LITTLE CLOSER TO REAL CASK ALE?

ALEX KRISTENSEN
FREDERICIA, DENMARK

A Here in the States, the origins of homebrew trace to England where homebrewing thrived before its rise to a very popular hobby for many beer enthusiasts. Although people have "homebrewed" for as long as history has recorded beer brewing, the hobby we know as homebrewing in the US really began in the early-to-mid 1970s. As these homebrewers refined their craft and became encouraged by the reception to their beers from friends, some departed the ranks of hobby brewer to small commercial brewer and this is largely how the US craft beer scene was born.

What does any of this have to do with cask conditioning? The answer lies in how English brewing practices were applied at home. Most homebrewers brewed ales for two simple reasons. The first was that ales were a good fit because most of the US climate is too warm to ferment lagers at home without special equipment. And the second reason was this is how the English homebrewers did things and ale yeast was the type of yeast that was supplied with most kits.

These homebrewers also followed the directions in the books and manuals printed at the time and did things like "Burtonized" their brewing liquor (known today by some as adding calcium sulfate to water), tossed Irish moss into the kettle at the end of the boil, added hops to their fermenters towards the end of active fermentation and racked their beer from fermenter to bottle for a secondary fermentation in the bottle. Sounds pretty similar to how much homebrew is still made, but the main difference in my opinion is that today's brewer probably understands more about the "how" and "why" of the methods. Today's brewer also has access to a wider array of top-quality ingredients.

If the beer described earlier were simply racked into a cask for conditioning and pulled from the cask with a beer engine, "real ale" would be the result. The thing about real ale that intrigues the brewer in me is the basic simplicity of the method. Clarification, aroma modification, carbonation and flavor maturation all occurs in the cask that is later used to hold the beer during dispense. In a "modern homebrewery" outfitted with fancy gear that mirrors some of the practices used by small craft brewers, these operations are often accomplished using three to four different pieces of equipment.

> "The thing about real ale that intrigues the brewer in me is the basic simplicity of the method."

My suggestion in pursuit of your goal is really quite simple. Buy an old homebrew book written in the 1970s or early 1980s, try to forget anything you know about brewing technically perfect lager beers, store any special gear you own for beer clarification in the closet, and choose a recipe for a "simple ale" with a starting gravity somewhere around 1.048–1.052 using what seems to be a modest addition of hops.

Photo by Dave Louw

The focus will be on ingredients; a balanced flavor profile featuring floor-malted ale malt from England (mild ale malt is a great base-malt choice for many styles) and earthy, British hop varieties are the hallmarks of most cask-conditioned beers. Use Irish moss in the kettle to aid with hot break formation and removal, use an ale strain known to produce some esters and to perhaps leave a hint of diacetyl in the finished beer, add a modest amount of dry hops to the fermenter after primary has completed (about ¼ oz. per gallon/2 grams per liter) and use an isinglass preparation to aid in clarification. The last step is to rack the beer to a bottling bucket, add priming sugar and bottle. Since cask conditioned ales tend to be less carbonated than bottled beers, you may want to target a lower carbonation level (2.2 volumes or 4.5 grams/liter of carbon dioxide). In essence, you want to brew a bottled real ale using the ingredients and techniques commonly used by breweries brewing cask ales.

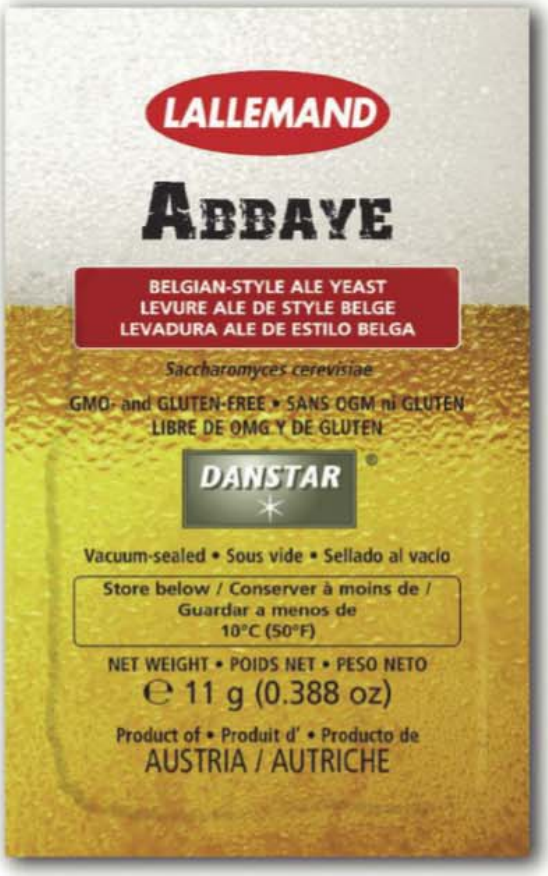
Q I AM GOING TO DRY HOP IN MY DISPENSING KEG FOR THE FIRST TIME. HOW LONG SHOULD I LEAVE THE HOPS IN THE KEG?

RICK DREVES
TRAVERSE CITY, MICHIGAN

A Dry hopping is a wonderful way to impart hop aroma to beer and is very simple to do. In my experience there are a few things to be mindful of to prevent dry hopping-related problems. The first, and most obvious bit of advice is to use hops that smell good. Really, what's the good of dry hopping with hops that smell off or have an aromatic note that is unpleasant? I personally do not like hops that have any hint of onion or garlic and simply cannot enjoy beer with those types of hop characters. If there is an aroma type you personally dislike, avoid hops with those properties. Do not rely on canned descriptions of a particular variety, instead you should take a small sample, rub it between your hands and smell the hops before deciding whether you will use them.

The second tip is to minimize the risk of oxidizing your

Simply Divine.



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help me mr. wizard

beer by dry hopping towards the tail end of fermentation. Compressed hops, whether in the form of pellets or cones, contain some air. Adding the hops to beer while the yeast is active is a great way to scrub oxygen that is added with the hops. And my last tip is to limit the time that you expose your beer to the hops to about a week. The uptake of hop aromatics in beer happens rather quickly

> "The uptake of hop aromatics in beer happens rather quickly and anything longer than about 5 days does not do much to increase the hoppiness of the beer."

and anything longer than about five days does not do much to increase the hoppiness of the beer. What can happen with prolonged exposure to hop matter is the extraction of flavors that are perceived as grassy and astringent.

You have probably noticed that I did not address your basic question about exposure time to hops in the dispensing keg. This is a method that I do not suggest using because it prevents the brewer from controlling the process unless the beer is consumed over a relatively short time frame. Brewers who add hops to cask-conditioned ales know that when a cask is tapped that it will be consumed over a couple of days. Most homebrewers who keg their beers often plan to enjoy their beer for a couple of weeks. During this time period the beer will begin to pick up some of the grassy qualities from the hops. If you want a nice hoppy beer using a process you can control, consider adding the hops in the fermenter before you rack

to your keg. I really believe that the results are better and the end result is more repeatable.

Q I WANT TO BREW A DOUBLE IPA, BUT INSTEAD OF USING HOP VARIETIES LIKE WARRIOR®, AMARILLO®, CASCADE, CENTENNIAL, OR CHINOOK I WANT TO USE SAAZ DUE TO THE LOW ALPHA ACID CONTENT. I WILL JUST USE FIVE TIMES MORE. EVERYBODY I DISCUSS THIS WITH INSISTS THAT I USE THE HIGH ALPHA HOPS FOR BITTERING. TO ME THE BITTERNESS OF HIGH ALPHA HOPS IS HARSH, AND I AM HOPING THAT THE LOW ALPHA SAAZ WILL GIVE THE APPROPRIATE BITTERNESS WITHOUT THE HARSHNESS. KIND OF LIKE STONE BREWING CO.'s GÖTTERDÄMMERUNG THAT I ENJOYED AT THE LAST GREAT AMERICAN BEER FESTIVAL.

GORDON MANESS
ARVADA, COLORADO

A You are not alone in your belief that certain hop varieties, especially many high alpha varieties, impart a harsh and unpleasant bitterness to beer. Some very large breweries also share this belief and prefer using low-alpha hops for bittering their beers. From an analytical perspective, hops high in the alpha-acid cohumulone are associated with this trait. Many a brewer selects hop varieties partly based on cohumulone content. I happen to be one of those brewers. I am also like your friends in that I do prefer using hops that have pretty decent alpha-acid contents, above 8% for hops added primarily for bittering, because high hop loads associated with using lots of low alpha hops for bittering and aroma can contribute grassy flavors.

Some of my personal favorite varieties to add to wort early in the boil include Perle, Northern Brewer and Nugget. Magnum, Horizon and Simcoe® are some other high-alpha varieties that have low cohumulone

content, and appeal to those brewers looking for that particular combination. Mitch Steele from Stone Brewing Co. confirms that Magnum hops were used for bittering the Götterdämmerung and that a huge variety of German hops were used toward the end of the boil, in the whirlpool and in the dry-hop addition.

OK, enough of the textbook stuff about what is "correct" about selecting bittering hops. Innovation does not happen when brewers simply do what is the norm. If American craft brewers listened to the jabs from Europe and Britain about "catty" hop varieties being unfit for anything other than adding bitterness to beer, then Cascade hops would have never been used as an aroma variety. Today, Cascade is timid compared to some of the newer varieties bred to produce intense aromas considered wholly inappropriate not long ago. And German hop growers are even planting US aroma varieties that no traditional lager brewer would ever consider using.

As the saying goes, nothing ventured, nothing gained. I am sure that the brewers at Stone Brewing Co. who developed Götterdämmerung would encourage you to simply give your idea a try. The worst that can happen is that you end up with a bad batch of beer, and if things go the way you envision then you end up with something that makes you happy. Either way you will learn something that will likely make you a better brewer. Prost!

Q AFTER FERMENTING MY BEERS I HAVE ALWAYS "COLD CRASHED" THE CARBOY OR BUCKET IN MY TEMPERATURE-CONTROLLED CHEST FREEZER OR OUTDOORS (DURING THE COOLER MONTHS) FOR A FEW DAYS BEFORE BOTTLING. THIS GIVES ME A NICE, COMPACT YEAST CAKE AND SEEMS TO CLEAR THE BEER VERY WELL, ESPECIALLY IF I ADD GELATIN. HOWEVER, WHEN I DO THIS, MY AIRLOCK WORKS IN REVERSE AND SEEMS TO SUCK IN PLENTY OF AIR. I HAVE BECOME CONCERNED ABOUT THIS METHOD INTRODUCING OXYGEN INTO MY FINISHED BEER. DO YOU THINK THIS IS SOMETHING I SHOULD BE WORRIED ABOUT?

ADAM SICKMILLER
CINCINNATI, OHIO

This is a fairly common question and is clearly a concern to many homebrewers. Although I have answered a similar question before (in the October 2012 *BYO*), I will give a slightly different spin on this topic. The general rule is that there is only one place in the brewing process where oxygen should be introduced, and that is during wort aeration. After this point, beer oxidation can result from air pick-up. The good news about homebrewing is that yeast is normally present and even yeast that is not actively fermenting absorbs oxygen and helps to protect beer from oxidation. This is why bottle conditioned beers are known to have better shelf life than filtered beer, especially when air pick-up during filling is high. The flow of air into your fermenter certainly would not make my top 10 list of problems homebrewers should worry about.

What does concern me a bit more is the tendency of some airlocks to suck liquid into the fermenter when they operate in reverse. Even if you use an airlock design that does not allow liquid to be sucked into your fermenter when cooled, the air that is sucked could potentially contaminate your beer. And adding alcohol to the airlock as an air sterilizer is not very effective since gas flows through in large bubbles and has a very short contact time. I suggest using cotton batting to filter air as it flows into the fermenter headspace upon chilling, and then replacing the airlock after the beer has cooled.

If you are really concerned about the air pick-up, consider racking into a keg and applying top pressure prior to crashing. Or you can introduce a slow flow of carbon dioxide into the headspace of a glass fermenter that has a cotton plug or airlock with a second hole to provide a slow flow of cover gas during cooling. This latter method will be difficult to control without a special regulator and is really a method that I would only use for experimental purposes. BYO

Related Links:

• Want to learn more about the history of cask ale, and how to brew your own? You'll find all of that and more in this story from the archives: http://byo.com/story594

• To obtain a big, fresh hop aroma, brewers turn to dry hopping — adding hops in the fermenter. Get even more information about how, when and why to dry hop in this "Techniques" column from March-April 2010: http://byo.com/story1982

• Better understand the impacts different hops will have on your homebrew by exploring the chemestry of a hop: http://byo.com/story848

Oktoberfest

A rich, toasty German lager

style profile
by Jamil Zainasheff

People often ask me, "What is your favorite style?" I tell them that I love all of the styles, because they are all great beers. Picking a favorite style for me would be like picking a favorite child. Well, almost. There are some styles that, as a consumer, I enjoy more than others.

Oktoberfest is a beer I really enjoy drinking, especially during nice fall weather when the leaves are just beginning to turn. I love that smooth, clean, rich malt character, followed by a nice balanced finish. It is a beer style I can drink in quantity since it does not fatigue my palate, as some IPAs do, nor does it fatigue my stomach, as some sour beers do, nor does it fatigue my head, as some Belgian ales do. There is a reason Germans can drink beer by the liter, and it is balance. Oktoberfest, while rich, is well-balanced and endlessly drinkable. You may recall from an earlier column (March-April 2014) that Anton Dreher developed a new, paler lager (compared to the then-common opaque dunkel), which we call Vienna lager today. Well, at the same time that Dreher was developing the Vienna lager, Gabriel Sedlmayr created his own alternative to the dunkel in Munich in 1841 that he called the Märzen-Bier, which we know today as Oktoberfest beer. (The style acquired its modern name of Oktoberfestbier in Germany only in 1872, when Sedlmayr's son introduced a variant of the Märzen at that year's Oktoberfest).

Oktoberfest is a dark gold to deep orange-red color German lager with a rich toasty and bready German malt character that starts in the aroma and lasts all the way through the finish. People often describe Oktoberfest as having a complex and rich malt character, but this is not a sweet beer. A good example of the style is well attenuated with enough hop bitterness to leave a balanced finish. This is a cleanly fermented lager (no fruity esters or diacetyl), with a soft, medium body that one might describe as creamy. There should not be any roast flavor; and any caramel flavor should be subdued and only mildly in the background. Hop flavor and aroma are low at most, and when present, have a spicy or sometimes floral quality.

> "A good example of the style is well attenuated with enough hop bitterness to leave a balanced finish."

The most common fault in brewing this style is making it too alcoholic, too hoppy, or too sweet. Keep in mind this is a balanced beer, with an emphasis on malt flavor and aroma. Often the issue of brewing too sweet an Oktoberfest occurs because the brewer assumes that maltiness and sweetness are the same thing. A beer with a lot of sweetness from malt is not necessarily malty; it is sweet. A sweet beer may or may not have a lot of malt character. It is quite possible to have a dry beer that has lots of malt flavor and aroma (malt character). When a knowledgeable beer judge uses the term "malty," he or she is referring to the rich grainy, bready, toasty flavors and aromas that come from the malt, not the residual malt sweetness.

Oktoberfest gets its substantial bready, toasty malt character from its base malts. As a general rule, I like to use around ½ each of Pilsner, Vienna, and Munich malt, but I will tweak that depending on the specialty malts involved. Often brewers want to make a beer like this "more complex," using other malts to develop color and flavor. This can be because the base malts they are using lack those key malt flavors. If you find that is the case, you can try adding character and color with specialty malts, such as

Continued on page 25

Oktoberfest by the numbers

OG:	1.050–1.056 (12.4–13.8 °P)
FG:	1.012–1.016 (3.1–4.1 °P)
SRM:	7–14
IBU:	20–28
ABV:	4.8–5.7%

Photo by Istockphoto.com

Oktoberfest
(5 gallons/19 L, all-grain)

OG = 1.055 FG = 1.015
IBU = 27 SRM = 11 ABV = 5.4%

Ingredients

4.6 lbs. (2.1 kg) continental Pilsner malt (2 °L)
3.6 lbs. (1.6 kg) Munich malt (8 °L)
2.7 lbs. (1.2 kg) Vienna malt (4 °L)
12 oz. (0.34 kg) Caramunich® III (60 °L)
4.8 AAU Hallertau hops (60 min.) (1.2 oz./35 g at 4% alpha acid)
1.6 AAU Hallertau hops (20 min.) (0.4 oz./12 g at 4% alpha acid)
Irish moss (15 min.)
White Labs WLP820 (Oktoberfest/Märzen) or Wyeast 2206 (Bavarian Lager) yeast
Priming sugar (if bottling)

Step by Step

I currently use Best Malz Pilsen, Vienna, and Munich, but feel free to substitute any high quality malt of the same type and color from a different supplier. Caramunich® III is a product of Weyermann. My hops are in pellet form and come from Hop Union, Crosby Hop Farm, or Hopsteiner depending on the variety.

Mill the grains and dough-in targeting a mash of around 1.5 quarts of water to 1 pound of grain (a liquor-to-grist ratio of about 3:1 by weight) and a temperature of 151 °F (66 °C). Hold the mash at 151 °F (66 °C) until enzymatic conversion is complete. Infuse the mash with near-boiling water while stirring or with a recirculating mash system raise the temperature to mash out at 168 °F (76 °C). Sparge slowly with 170 °F (77 °C) water, collecting wort until the pre-boil kettle volume is around 6.5 gallons (25 L) and the gravity is 1.042.

The total wort boil time is 90 minutes, which helps reduce the S-Methyl Methionine (SMM) present in the lightly kilned Pilsner malt and results in less Dimethyl Sulfide (DMS) in the finished beer. Add the first hop addition with 60 minutes remaining in the boil and the second addition with 20 minutes remaining. Add Irish moss or other kettle finings with 15 minutes left in the boil. Chill the wort to 44 °F (7 °C), aerate thoroughly, and then pitch your yeast. The proper pitch rate is about 380 billion cells, which is 4 packages of liquid yeast or one package of liquid yeast in a 2-gallon (8-L) starter.

Let the beer slowly warm over the first 36 hours to 50 °F (10 °C) and then hold this temperature for the remainder of fermentation until the yeast drops clear. With healthy yeast, fermentation should be complete in two weeks or less, but do not rush it. Cold-fermented lagers take longer to ferment than ales or lagers fermented at warmer temperatures. If desired, perform a diacetyl rest during the last few days of active fermentation. Rack to a keg and force carbonate or rack to a bottling bucket, add priming sugar, and bottle. Target a carbonation level of 2 to 2.5 volumes. A month or more of cold conditioning at near-freezing temperatures will improve the beer. Serve at 43–46 °F (6–8 °C).

Oktoberfest
(5 gallons/19 L, extract with grains)

OG = 1.055 FG = 1.015
IBU = 27 SRM = 11 ABV = 5.4%

Ingredients

7.3 lbs. (3.3 kg) Munich liquid malt extract (8 °L)
8.8 oz. (0.25 kg) Caramunich® III (60 °L)
4.8 AAU Hallertau hops (60 min.) (1.2 oz./35 g at 4% alpha acid)
1.6 AAU Hallertau hops (20 min.) (0.4 oz./12 g at 4% alpha acid)
Irish moss (15 min.)
White Labs WLP820 (Oktoberfest/Märzen) or Wyeast 2206 (Bavarian Lager) yeast
Priming sugar (if bottling)

Step by Step

There are many Munich extract blends out there. It is always best to choose the freshest extract. If you cannot get fresh liquid malt extract, see if you can find a dried Munich extract instead. Using fresh extract is very important to this style. Caramunich® III is a product of Weyermann. My hops are in pellet form and come from Hop Union, Crosby Hop Farm, or Hopsteiner depending on the variety.

Mill or coarsely crack the specialty malt and place loosely in a grain bag. Steep the bag in about ½ gallon (~2 liters) of water at roughly 170°F (77°C) for about 30 minutes. Lift the grain bag out of the steeping liquid and rinse with warm water. Allow the bag to drip into the kettle. Do not squeeze the bag. Add the malt extract and enough water to make a pre-boil volume of 5.9 gallons (22.3 liters) and a gravity of 1.047. Stir thoroughly to help dissolve the extract and bring to a boil.

Once the wort is boiling, add the first hop addition. The total wort boil time is 1 hour after adding the first hop addition. Add the second hop addition with 20 minutes left in the boil. Add Irish moss or other kettle finings with 15 minutes left in the boil. Chill the wort to 44 °F (7 °C), aerate thoroughly, and then pitch your yeast. The proper pitch rate is about 380 billion cells, which is 4 packages of liquid yeast or one package of liquid yeast in a 2-gallon (8-L) starter.

Let the beer slowly warm over the first 36 hours to 50 °F (10 °C) and then hold this temperature for the remainder of fermentation until the yeast drops clear. With healthy yeast, fermentation should be complete in two weeks or less, but do not rush it. Cold-fermented lagers take longer to ferment than ales or lagers fermented at warmer temperatures. If desired, perform a diacetyl rest during the last few days of active fermentation. Rack to a keg and force carbonate or rack to a bottling bucket, add priming sugar, and bottle. Target a carbonation level of 2 to 2.5 volumes. A month or more of cold conditioning at near-freezing temperatures will improve the beer. Serve at 43–46 °F (6–8 °C).

aromatic, melanoidin, and caramel.

One specialty grain that works really well in Oktoberfest is mid-color or caramel malts (30–70 °L) such as Caravienne and Caramunich®. They increase color and give a little residual sweetness to the finish. You want to use restraint though. Use no more than 5–10% caramel-type malts. Your specialty grains should accentuate the malty notes, not compete with them.

Extract brewers should use Munich malt extract, which is a blend of Munich and Pilsner (or other pale malts) in different percentages. It does a respectable job of brewing Oktoberfest and you can enhance the flavor by steeping specialty grains such as caramel malt or a tiny bit of huskless dark grains for color.

I like to avoid any work that I do not feel improves the beer, so I prefer a single infusion mash. Perhaps historically, a brewer would use a decoction mash when brewing most German-style beers, but I find that high quality continental malts, a single infusion mash, and excellent fermentation practices will produce beer every bit as good as the best commercial examples. It is far more important to invest time and effort in fermentation, sanitation, and post-fermentation handling than decoction. If you have ensured that all of those other aspects of your process are flawless, then decoction might be something of interest. For a single infusion mash, target a mash temperature range of 150–154 °F (66–68 °C).

Like most beer styles, you can brew a good Oktoberfest with almost any kind of water, but sometimes tweaking your water is the last key to perfecting a style. For Oktoberfest, moderately hard, moderately carbonate-rich water is best. For very soft water, add gypsum and chalk, about ½ teaspoon of gypsum and 1 teaspoon of chalk per 5 gallons (19 L) should get you close. If your water source is very hard, you can always dilute it with some distilled water.

Hop flavor and aroma are usually just background notes in Oktoberfest. Hop bitterness is restrained, just firm enough to provide a nice balance to the malt sweetness. I really like using German-grown Hallertau hops for flavor and aroma, although sometimes they are hard to source. Other German-grown hops, such as Tettnang, Perle, Tradition, Alsatian Strisselspalt and Hersbrucker work well also. These hops, when grown outside of Germany, may still work well but be cautious as different growing conditions can make them substantially different from the German-grown hops. If you cannot get any of those hops, you do have some flexibility. The trick is to select hops with that same flowery or spicy noble hop character. You do not want to use anything fruity or citrusy. Some decent substitutions are Liberty and Mt. Hood. You can also try Crystal, Ultra, and Vanguard. It is really the

overall impression that matters. The big picture is that you want very low hop character and a balancing bitterness, with both complementing and integrating with the malt. The balance of bittering versus malt sweetness should always be close to even. The bitterness to starting gravity ratio (IBU divided by the decimal portion of the specific gravity) ranges from 0.4 to 0.6, but you will want to target the middle, 0.5. While there is no real need for a late hop addition, I do like to toss in a little late addition near the end of the boil (last 10 to 20 minutes). Keep the addition to no more than ½ oz. (14 g) in a 5-gallon (19-L) batch. This might be too much hop character for the style when the beer is fresh out of the fermenter, but after a few months of lagering, it can be just right. A bit bold, but not out of style. Since there is very little specialty malt or fermentation esters, these subtle amounts of hop flavor are more noticeable than in a bigger beer style.

You can ferment Oktoberfest with many different lager yeast strains, although my favorites are White Labs WLP820 (Oktoberfest/Märzen) and Wyeast 2206 (Bavarian Lager). You will find that each lager yeast strain will emphasize different aspects of the beer. Some will have more malt character and some more hop character, but all can produce an excellent Oktoberfest with proper fermentation. If you use dry yeast, Fermentis Saflager S-23 is probably your best choice. While most lager yeasts will work well, Czech lager strains are an exception because they will add diacetyl notes (especially at the Czech fermentation temperatures) that are atypical of the Oktoberfest style.

As when brewing any lager, it is important to control the fermentation temperature and to pitch plenty of clean, healthy yeast. You want the beer to have a clean, low-ester fermentation profile, but you also want to make certain that the beer attenuates fully. This is the most common mistake new brewers make when attempting lagers. You need to make sure you pitch enough yeast, provide enough oxygen and nutrients, and use temperature control to not only start the fermentation on the cool side, but then raise it toward the end of fermentation. This rise in temperature not only helps reduce some of the unwanted compounds produced during fermentation, but it ensures that the yeast is active enough to attenuate the beer more fully.

When making lagers, I like to chill the wort down to 44 °F (7 °C), oxygenate, and then pitch my yeast. I let the beer slowly warm over the first 36 hours to 50 °F (10 °C) and then I hold this temperature for the remainder of fermentation. If fermentation seems sluggish at all after the first 24 hours, I am not afraid to raise the temperature a couple degrees more. The idea is to reduce the diacetyl pre-

cursor alpha-acetolactate, which the yeast creates during the early phase of fermentation. Once the growth phase of fermentation is complete, it is important that fermentation be as vigorous as possible. It may never be as robust as fermentation at ale temperatures, but it is important to have enough activity to blow off aromatic sulfurs and other unpleasant compounds. Vigorous yeast activity at the end of fermentation also improves reduction of compounds such as diacetyl. Starting fermentation colder only works well if you are pitching enough clean, healthy yeast at the start. If not, you will need to start warmer (perhaps 55 °F/13 °C) to encourage more yeast growth. Even if you start fermentation warmer, you can still raise the temperature toward the latter part of fermentation.

Since diacetyl reduction is slower at colder temperatures, a cold-fermented lager may require a diacetyl rest. To perform a diacetyl rest, simply raise the temperature into the range of 65–68 °F (18–20 °C) for a two-day period near the end of the fermentation. While you can do a diacetyl rest after the fermentation reaches terminal gravity, a good time for a diacetyl rest is when fermentation is 2 to 5 specific gravity points (0.5–1 °P) prior to reaching terminal gravity. Brewers ask how they should know when fermentation has reached that stage. My advice is to raise the fermentation temperature for a diacetyl rest as soon as you see fermentation activity significantly slowing. It will not hurt the beer and it should help the yeast reach complete attenuation as well. It seems that every beer improves with some period of cold conditioning and this style is no exception.

Traditional lager conditioning utilizes a slow temperature reduction before fermentation reaches terminal gravity. The purpose of the slow cooling rate is to avoid sending the yeast into dormancy. After a few days, the beer reaches a temperature close to 40 °F (4 °C) and the brewer transfers the beer into lagering tanks. If you want to use this technique, you will need precise temperature control so that fermentation slowly continues and the yeast remains active. Rapidly chilling the beer near the end of fermentation can cause yeast to excrete a greater amount of ester producing compounds instead of retaining them.

Personally, I prefer to wait until fermentation is complete, including any steps such as a diacetyl rest, before lowering the beer temperature. The yeast is far more active and able to reduce fermentation byproducts at higher temperatures. Once I am certain the yeast have completed every job needed, I use a period of cold storage near freezing. This time in storage allows very fine particulates to settle out and the beer flavors to mature. In any case, great lagers take time, so do not rush things.

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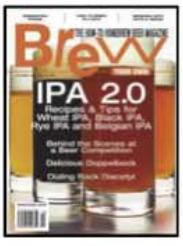

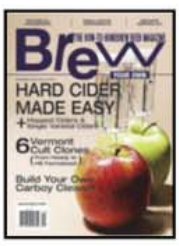

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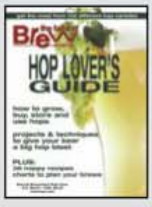

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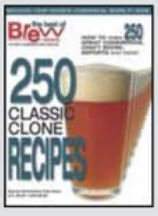

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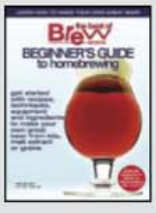

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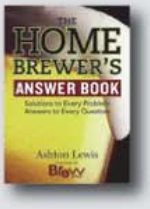

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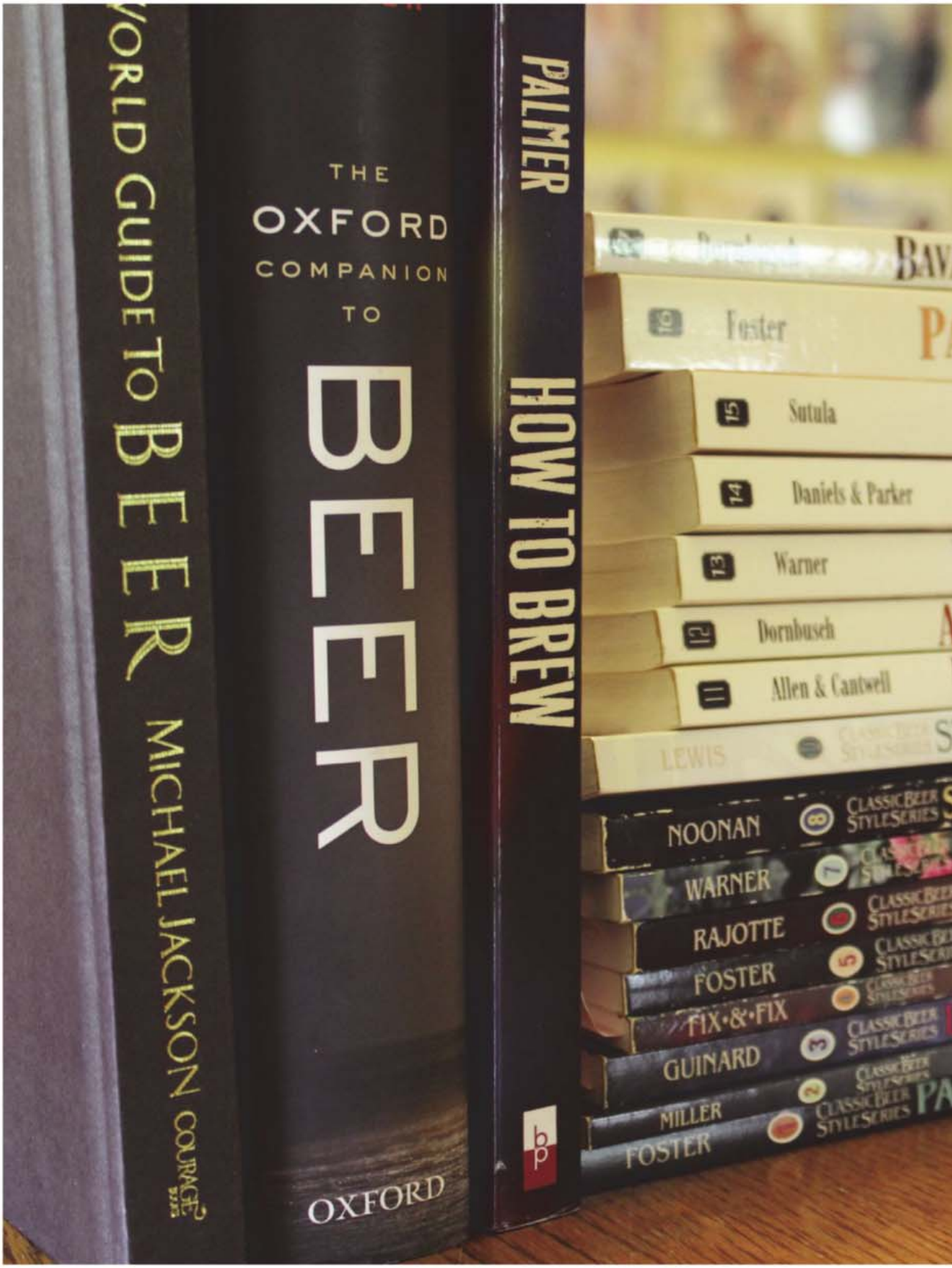
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CLASSIC BEER STYLE SERIES

by Dawson Raspuzzi

Stock your library with the favorites of *BYO* writers

HOMEBREWER'S LIBRARY

New beer books show up in the *Brew Your Own* mailbox every week, but not every book is an instant classic. We asked each of *BYO*'s longtime columnists — Ashton Lewis ("Mr. Wizard"), Marc Martin ("The Replicator"), Jamil Zainasheff ("Style Profile"), Terry Foster ("Techniques"), Chris Bible ("Advanced Brewing") — what titles they reach for in their homebrewing reference libraries time after time. Their choices provide a great list of must-haves for anyone looking to fill out the bookshelves of a well-stocked homebrewery.

A Treatise on Lager Beers

By Fred Eckhardt and Jack McCallum

Marc Martin: Fred is commonly known as "The Dean of American Beer Writers." This was the first book in my library, purchased in 1979 and the one that originally made me consider homebrewing. This book is very dear to me as Fred lives in my metro area and is a good friend. It is signed by Fred with this inscription: "One taste of Dr. Eckhardt's Steam Beer elixir and I became immune to all constructive criticism."

Beer Companion: The World's Great Beer Styles, Gastronomy, and Traditions

By Michael Jackson

Ashton Lewis: Michael Jackson's books about beer likely did more to explain beer to the consumer audience than any body of work from any other author. This book, as with several others he penned, includes interesting information about brewing materials, specific breweries and their beers, timeless descriptions of beer flavor and beautiful photography.

Brewing

By Michael J. Lewis and Tom W. Young

Chris Bible: This book dives deeply into the biochemical aspects of malting and brewing beer. It is well-written and has an almost "conversational" feel to me when reading it. Great coverage all around, but especially strong on the biochemistry.

Brewing Classic Styles

By Jamil Zainasheff & John Palmer

Chris Bible: This book comprehensively covers the BJCP style categories and presents great, detailed information on recipe formulation. This book is a great starting point when seeking to brew a style that you may not have attempted before.

Jamil Zainasheff: A broad range of award-winning recipes all from a single source. A great resource when learning to brew a new style of beer.

Brewing Science and Practice

By Dennis E. Briggs, Chris A. Boulton, Peter A. Brookes and Roger Stevens

Chris Bible: Comprehensive in coverage of brewing ingredients and the brewing process, this reference book contains well-written, technically detailed information on the science of beer and brewing. It is a great companion reference to *Malting and Brewing Science*, and contains lots of great technical data.

Brewing Quality Beers: The Home Brewer's Essential Guidebook

By Byron Burch

Marc Martin: This is the book that took my beers to the next level. It is basic but includes very complete instructions for both ale and lager production. It provides very easy reading and is not super technical.

The Chemistry of Beer: The Science in the Suds

By Roger Barth

Chris Bible: This is a great textbook-style book that we are using in the Professional Brewing Science program at South College in Knoxville, Tennessee (I am presently helping them out as an Adjunct Professor). This book starts out with a review of general chemistry and basic organic chemistry, but rapidly moves into discussion about the specific chemical processes that are going on during the brewing process. It is well illustrated and contains a depth of technical detail that is just about exactly right for educating a new brewer on the chemistry of beer and brewing.

Classic Beer Styles Series

Chris Bible: This series of books is unique in that they provide a very in-depth coverage of the available historical information associated with beer styles, and also provide a good amount of information regarding recipe formulation and brewing techniques for each major beer style.

Terry Foster: Any serious brewer should not forget the *Classic Beer Styles* series from Brewers Publications (of which I have authored a couple). These are relatively specialized for they deal with individual styles, defining them, relating what goes into them and giving recipes for producing them yourself.

The Complete Handbook of Home Brewing

By Dave Miller

Ashton Lewis: This was the first brewing book I purchased that really addressed the science of brewing in a manner that I found practical. Miller's writing style is concise and easy to understand and the topics he covered in 1988 when this book was first published are still relevant to the modern homebrewer.

Designing Great Beers

By Ray Daniels

Chris Bible: This book takes a data-driven, statistics-based approach at recipe development that sets it apart from other references. Ray analyzes and presents data based on American Homebrewers Association National Homebrew Competition (NHC) award-winning beers, and compiles it in a way to make it accessible to any technical-minded homebrewer.

Terry Foster: Not exactly a new book, but still one packed with useful information. Daniels is very good on beer color — how to measure it and ways in which it can be calculated when formulating a recipe. Apart from brewing fundamentals, Daniels also delves deeply into analyzing beers from competitions, showing not only what makes the styles, but also how to best brew them. He is a particularly good source if you want to be successful in brewing competitions.

Marc Martin: This is an all around excellent publication. It is perfect for more advanced all-grain brewers. Two of the best features are the extreme focus on duplicating individual styles and the most commonly used grain bills for NHC second round-judged beers. This is the reference book that I use for teaching advanced brewing classes in conjunction with the Bader Beer & Wine Supply store.

Jamil Zainasheff: An aging resource, but still great because it teaches you a lot about how to create recipes with a logical approach.

Froth: The Science of Beer

By Mark Denny

Chris Bible: This book is, in my opinion, unique in that it bridges a gap between "crazy-science-technical" (like the *Malting and Brewing Science* volumes)" and "just follow the recipe." It presents, in an easy to read manner, science and technical details on such topics as "yeast population dynamics" and "brewing thermodynamics," but does not read at all like a textbook or reference work for a practicing brewing-science person.

How to Brew: Everything You Need to Know to Brew Beer Right the First Time

By John Palmer

Chris Bible: This book still represents to me the gold standard in introducing new brewers to the art and science of homebrewing. John takes a very practical-minded approach to homebrewing, but still presents enough technical detail for me to get my geek on.

Terry Foster: This is a comprehensive introduction to homebrewing, including techniques and equipment. It will take you from simple to more complex malt extract beers, right on up to all-grain brewing and formulating your own recipes. In fact, it is more than an introduction to homebrewing, since it contains much information valuable even to the experienced brewer.

Marc Martin: This is probably the single-most comprehensive book in my library of over 30 volumes. It covers everything from the basics of ingredients to the most advanced techniques. For brewers wanting to take their beers to the ultimate level there is an excellent section on water adjustments. If you can only have one homebrewing book, make it this one.

Jamil Zainasheff: The most comprehensive and complete book for beginners to intermediate. A must have for every homebrewer's library.

Malting and Brewing Science, Volumes 1 & 2

By Dennis E Briggs, J.S. Hough, Roger Stevens, Tom W. Young

Chris Bible: These books are some of the best technical brewing science reference volumes available, despite being somewhat older. They are a great resource when trying to dive deep into understanding a particular technical nuance at a fundamental science/engineering level. They are comprehensive in their coverage of malting and brewing, and contain lots of data.

Ashton Lewis: The second edition of this two-volume textbook, copyrighted in 1981, is still my go-to reference for the scientific basis behind many brewing topics. This is a classic and in many ways is a more current, albeit dated, version of Jean DeClerck's masterpiece, *A Textbook of Brewing*, which was first published in English in 1957.

New Brewing Lager Beer

By Gregory J. Noonan

Terry Foster: Although almost 20 years old, the information in this book is still very relevant to those homebrewers who want to brew the best beer they possibly can. Noonan gives quite a lot of technical background coupled with basic brewing information, so whatever your brewing skill level may be you will find this book a good standby. Most importantly, this is one of the few homebrewing books to focus exclusively on lager brewing.

The New Complete Joy of Homebrewing

By Chalie Papazian

Marc Martin: This is the most beloved book in my library. It not only provides good homebrewing instruction but is also just a good read. Charlie's writing style makes this a book you could read at the beach. Great classic recipes like "Toad Spit Stout," a chapter on how to make mead, and even a few pages on hangovers — what's not to like?

Jamil Zainasheff: You'll enjoy homebrewing more if you read this book. When you find yourself caught up in the technical details more than enjoying your beer, read this book and relax a little.

The New World Guide to Beer

By Michael Jackson

Terry Foster: This is perhaps a little dated now, but it is a classic and should be in every beer lover's library. After all, Jackson was the beer guru and was influential in the re-birth of the craft brewing industry in both the USA and Great Britain. He describes in some detail the world's great beer styles and their origins and backgrounds, and is particularly good on Belgian beers. As with *Beer Companion* this is a great foundation stone on which to build the edifice of your brewing knowledge.

The Oxford Companion to Beer

Ed. Garrett Oliver

Chris Bible: This book is essentially the "Encyclopedia of Beer." It is comprehensive in its topic coverage, but does not go into a great deal of technical detail.

Terry Foster: This is a reference book, with contributions from many distinguished authors (and even a few from me) on beer brewing and the history of beer. It covers almost everything in the beer "sphere," including brewing methods, "normal" and unusual ingredients, beer styles and backgrounds, brewers and breweries. If you have a beer/brewing question, this is the place to start.

Practical Handbook for the Specialty Brewer Volumes 1-3

Ed. Karl Ockert

Ashton Lewis: A three-volume book published by the Master Brewers Association of the Americas (MBAA) in 2006 as an updated, and craft brewer-centric version of MBAA's signature text *The Practical Brewer*. This book is written in a Q&A format and covers a wide array of brewing topics ranging from raw materials to wastewater treatment and just about everything in between. Although this book is targeted to the professional craft brewer, the topics covered are also of interest and of use to the homebrewer.

Technology and Brewing Science

By Wolfgang Kunze

Ashton Lewis: Commonly called "Kunze," this book was first published in 1961. The latest Fourth International Edition was published in 2010. Kunze's text has many similarities with *Malting & Brewing Science* with a few notable differences. One of the primary differences between the two is nearly 30 years in age. Another is that Kunze touches on some of the more practical brewing topics in greater detail than Hough, Briggs, Stevens and Young do. Kunze is my go-to reference for engineering and equipment design basics.

Yeast: The Practical Guide to Beer Fermentation

By Jamil Zainasheff and Chris White

Jamil Zainasheff: Fermentation is the most important aspect of brewing great beer. Fermentation separates the great brewer from the good brewer. BYO

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Story and Photos
by **Mark Pasquinelli**

Every February, the PA Alers Homebrew Club based in Pennsylvania's Susquehanna Valley, holds its annual Big Brew. This is our club's marquee event — a gathering to brew a single recipe and celebrate the fellowship of homebrewing. We've held the Big Brew for a dozen years, which predates our club's existence. In that time, we learned how to brew big beers on a big scale. We learned what to do and, especially, what not to do. It's not as difficult as one might think — and with a little planning, your club or group can do it, too.

Choose A Recipe

Big brew events demand a special homebrew recipe, usually something high octane. In deciding what to brew, the club needs to choose a style that has both mass appeal, accessibility to ingredients, and a wide enough guideline range that it can be duplicated by either all-grain or extract brewers.

Brewing a tripel, for example, may present problems for the extract folks since it needs to be ultra pale in color and bone dry. IPAs (or even double IPAs) are wonderful, but they require massive late hop additions. This would be expensive, plus a large amount of wort would be lost to absorption by the hop material.

Location and season also play a role in the decision. It is better to work with Mother Nature rather than against her. Brew lagers, such as doppelbock, during the winter, and warm-fermenting saisons during the summer.

Styles such as Scotch ale, Baltic porter, and Russian imperial stout have worked well for our club. These beers can be easily brewed by either all-grain or extract brewers. Some sweetness is allowable and proper color is not problematic. Adjuncts, like table sugar and molasses, can be added to keep the cost reasonable. Most of the bittering is done through a single dose of hops that can be delivered by a relatively low amount of the high alpha varieties. Lastly, it's easy to maintain their fermentation temperatures in February.

Russian imperial stout, in fact, has become the Alers signature style. We always brew an extra batch that's kegged and served a few months later at a local beer festival. Surprisingly, fest goers will form a line that extends across an entire street to get a taste of

Top: Sacks of grain ready to be used in the PA Alers Homebrew Club annual "Big Brew."

Bottom: Members toast to a successful big batch brewing of Russian imperial stout.

a thick alcoholic stout on a sweltering July day.

The final decision of what to brew is best decided by a club vote, but don't supply too many choices. The decision can't get bogged down. While democracy must rule the process, remember that it's impossible to please everyone.

Plan the Event

Pick a date for the event, knowing full well that not everyone will be available. Clubs should keep a back-up date in mind for weather cancellations. The Weather Channel would be wise to consult the Alers when plotting a forecast. Our Big Brews inevitably coincide with a Nor'easter storm.

Choose a location that's close to the geographic center for the club. Outdoors is fine during warmer months, providing that water and tents for cover are available. A garage is the best solution for all seasons. Be sure that there's access to water and adequate space for brewing. Strangely, some people choose to store cars in garages rather than homebrew gear. To each his or her own.

Logistics

The next decision is deciding your club's brewing capacity. We ferment the individual batches together to reconcile any irregularities in gravity, color, etc., so fermenter size is the limiting factor for us. (I'll discuss fermenter options later in the article.)

Whatever that number of gallons is, determine how many four- to five-gallon (15- to 19-L) batches (shares) can be brewed, and email announcements to members that shares are available on a first-come-first-serve basis. Let the new brewers know this is for them, too. Sometimes there's reticence among the newbies that they're stepping on the toes of the established members. New members are the lifeblood of any organization. While new people are sometimes short on knowledge, they always provide an infusion of unbridled enthusiasm. Accommodate them.

Devise a recipe, keeping it simple for convenience's sake. Brewing software, such as BeerSmith, makes it easy to design a recipe, as well as to convert all-grain to extract. High gravity brewing is part art, part science; so it's difficult to predict efficiency. Be sure to have malt extract on hand in case the all-grain folks need to boost their gravity. Use high-alpha hops in the recipe to keep the amount of vege-

tal matter in the kettles to a minimum and hop socks to corral the mess further. Choose a well-attenuating yeast that can tolerate a wide temperature range. In its early stages, fermentation temperature can be an unruly and difficult beast to tame.

The PA Alers Big Brew

Our 2014 Russian Imperial Stout recipe was constructed with a base of Maris Otter and Munich malts for a strong backbone. Wheat was added for head retention. We kept the specialty malts simple: roasted barley, chocolate malt, Special B, and Carafa® III (see the recipe on page 41).

The Alers were aiming for a 10% ABV beer to commemorate our 10th anniversary. We knew we'd have to supplement the all-grain recipe with malt extract to hit our target gravity of 1.115 (although we would have settled for 1.105) and decided upon adding Muntons extra light dried malt extract for its fermentablity. We also added table sugar to the extract recipe to further enhance the wort fermentability and to keep the cost reasonable.

We used Galena hops for bittering because of their clean flavor profile and high alpha acid level, although any similar hop, like Magnum, would work well. Simcoe® was selected as the flavor/aroma hop for its beloved piney and citrusy qualities.

White Labs WLP007 (Dry English Ale) was our yeast of choice for its flavor, attenuation, and wide temperature tolerance. We also had White Labs WLP099 (Super High Gravity Ale) yeast waiting in the wings to clean up any final gravity points.

In Practice

Once the number of shares is totaled, procure the ingredients as soon as possible. Canvass the club for those wishing to donate grain or extract. We recommend shopping at your local homebrew store (LHBS). For a large order, the LHBS will often give a discount or even donate a few items for a local club project. Purchase the ingredients in bag or case quantities for the best discount. Leftovers, like extract, can be repackaged and sold to members at cost.

Order well in advance so everything's on hand at least a week ahead of the brew date. This allows for the inevitable disappearance of an ingredient from the local homebrew shop inventory, plus it provides time to mill the grains.

The amount of yeast cells needed for a single 5-gallon (19-L) batch of high gravity beer is huge. That number increases exponentially for 50 gallons (189 L). Yeast is available in larger pro sizes. A few years ago, our club bought a 500-g. brick of Safale US-05 for our wee heavy, but it was expensive — about $65.00. A local brewpub can be a much cheaper source. Sometimes a slurry of yeast can be procured only for the asking.

Our club uses an alternate solution. The Big Brew always falls on a Saturday. We make a 1.5-L starter on the preceding Saturday and step it up a few days later. On Wednesday, we brew a 5-gallon (19-L) batch that is, in essence, the starter. On Friday, another batch is brewed and combined with the first. By Saturday afternoon there's a 10-gallon (38-L) "starter" rip roaring at high kräusen. This has always worked well for our club — and there's no beating the cost. An added advantage is that two shares are already brewed, which frees up those members to help others — or go on a pizza run.

Synchronize everything for the brew day, with participants arriving as early as possible. The object is to have the homebrewing well underway — or done — before the nonparticipants arrive in the afternoon. This gives the brewers an opportunity to relax with a few beverages afterward and prevents the nonessential personnel from becoming a safety hazard.

With a big brew, there's a chance the total grain bill will weigh close to 200 pounds. Most homebrew systems don't have that capacity. The solution is to break the all-grain folks into groups of three or four. Usually clubs have several members with large mash tun coolers and 15–20-gallon (57–75-L) kettles. The club can also purchase large coolers during summer clearance sales and convert them to mash tuns for events such as this.

Top left: The Alers like to brew a "big" beer for their big batch brews. This year the original gravity of their Russian imperial stout came in at 1.120.
Top right: The Alers pour batches of wort into the big fermenter (a used dairy tank).
Bottom: Since they brew in February, the Alers wrap the fermenter with a waterbed heater.

Group brewing is more efficient from a time-space standpoint and much less cumbersome than having a dozen people brewing simultaneously. Set up the all-grain stations around the perimeter of the space, leaving the central area free for traffic. Sparge water can be handled by piggy-backing two smaller kettles, and remember, pumps are your friend for moving large volumes of hot liquid.

The extract brewers have it easy. They can arrive later, brew individually if they'd like, and get their shares into the fermenter. At that point, they can either relax with a homebrew or assist at an all-grain station.

One advantage of brewing in February in Pennsylvania is that the chilling water from the tap is ice-cold. Counterflow or plate chillers hooked up in a series can easily handle the larger boil volumes. It's a good idea to use a hose splitter so that two groups can chill simultaneously. The cooled wort can then be either pumped into the fermenter or carried by bucket.

The spirit of the big brew is that all the batches go into one fermenter — everyone's beer becomes one. The Alers use a converted a 60-gallon (227-L) dairy tank as a fermenter. Allowing 10 gallons (38 L) for headspace (Fermcap-S will keep the kräusen to a manageable level), gave us the capacity for a dozen shares. Plastic bin wine fermenters are another solution. They're reasonably priced and can be purchased as a club buy. For the do-it-yourselfers, 32-gallon (121-L) fermenters can also be built from food-safe Rubbermaid Brute trash cans. (See the article in the May/June 2009 *Brew Your Own* for details.)

Maintaining the proper fermentation temperature requires a little ingenuity. During February, the ambient temperature in the garage hovers in the 30s °F (~1 °C) during the day and plunges into the teens (-10 °C) during the night. We wrap a waterbed heater around the dairy tank, and the entire vessel is covered with insulation. A Ranco temperature probe is inserted into a thermowell that's threaded through the top of the fermenter and into the wort. This allows us to accurately monitor and hold the fermentation temperature at a steady 70 °F (21 °C).

Once final gravity is reached, condition the beer in a sealed fermenter as long as ambient temperatures are amenable. However, neither the plastic bin wine fermenters, nor the food-

10th Anniversary Russian Imperial Stout Recipe

10th Anniversary Russian Imperial Stout
(5 gallons/19 L, all-grain)
OG = 1.115 FG = 1.035
IBU = 84 SRM = 45
ABV = 12%

Ingredients
13 lbs. (5.9 kg) Maris Otter pale ale malt (3 °L)
3.4 lbs. (1.5 kg) light Munich malt (10 °L)
1.1 lbs. (0.51 kg) wheat malt (2 °L)
9 oz. (0.26 kg) Weyermann Carafa® III malt (525 °L)
9 oz. (0.26 kg) chocolate malt (350 °L)
9 oz. (0.26 kg) roasted barley (300 °L)
9 oz. (0.26 kg) Special B malt (135 °L)
2.4 lbs. (1.1 kg) Muntons extra light dried malt extract (3 °L)
20.7 AAU Galena hops (60 min.) (1.8 oz./51 g at 11.5% alpha acid)
19 AAU Simcoe® hops (10 min.) (1.5 oz./42 g at 12.7% alpha acid)
Whirlfloc (15 min.)
Yeast nutrient (15 min.)
White Labs WLP007 (Dry English Ale) yeast (1.5 L/1.6 qt. yeast starter)
White Labs WLP099 (Super High Gravity Ale) yeast (1L/1 qt. yeast starter)
¾ Cup corn sugar (for priming)

Step by Step
One week before brew day, get a WLP007 yeast starter going. When starter activity slows, decant the spent wort and add fresh wort.

On brew day, mill the grains and dough-in with 28 quarts (26.5 L) hot water, targeting a mash at 154 °F (68 °C). Hold until enzymatic conversion is complete. If your system allows, raise the mash temperature to 168 °F (76 °C) and recirculate the wort until clear. Sparge with 170 °F (77 °C) water to collect 6.5 gallons (25 L) of wort. Take a specific gravity reading and add the dried malt extract until the specific gravity is 1.088. Boil for 90 minutes, adding the Galena and Simcoe® hops at 60 and 10 minutes respectively. Add Whirlfloc and yeast nutrient with 15 minutes remaining in boil. Chill the wort to 70 °F (21 °C), aerate, and add WLP007 starter (decanting the spent wort first). When fermentation slows, take a gravity reading and add the WLP099 starter (if needed) to achieve a final specific gravity of 1.035. Keg or bottle carbonate, aiming for a carbonation level of 2.0–2.2 volumes of CO_2. Once carbonated, condition at cellar temperature for several months. Flavor should peak at about one year and remain there for at least another year.

10th Anniversary Russian Imperial Stout
(5 gallons/19 L, extract with grains)
OG = 1.115 FG = 1.035
IBU = 84 SRM = 45
ABV = 12%

Ingredients
10 lbs. (4.5 kg) Muntons extra light dried malt extract (3 °L)
1.7 lbs. (0.8 kg) table sugar (sucrose) (0 °L)
9 oz. (0.26 kg) Weyermann Carafa® III malt (525 °L)
9 oz. (0.26 kg) chocolate malt (350 °L)
9 oz. (0.26 kg) roasted barley (300 °L)
9 oz. (0.26 kg) Special B malt (135 °L)
20.7 AAU Galena hops (60 min.) (1.8 oz./51 g at 11.5% alpha acid)
19 AAU Simcoe® hops (10 min.) (1.5 oz./42 g at 12.7% alpha acid)
Whirlfloc (15 min.)
Yeast nutrient (15 min.)
White Labs WLP007 (Dry English Ale) yeast (1.5 L/1.6 qt. yeast starter)
White Labs WLP099 (Super High Gravity Ale) yeast (1L/1 qt. yeast starter)
¾ Cup corn sugar (for priming)

Step by Step
One week before brew day, get a WLP007 yeast starter going. When starter activity slows, decant the spent wort and add fresh wort.

On brew day, crush the grains and place in two steeping bags. Steep the bags at 155 °F (68 °C) in 16 quarts (15 L) of water for 20 minutes. Rinse the grains with 2 quarts (2 L) of 170 °F (77 °C) hot water. Add dried malt extract (DME) and table sugar. Boil for 60 minutes, adding the hops at the specified times. Chill the wort to 70 °F (21 °C) and add water to achieve 5 gallons (19 L) of wort. Aerate the wort and add WLP007 starter (decanting the spent wort first). When fermentation slows, take a gravity reading and add WLP099 starter (if needed) to achieve a final specific gravity of 1.035. Keg or bottle carbonate, aiming for a carbonation level of 2.0–2.2 volumes of CO_2. Once carbonated, condition at cellar temperature for several months. Flavor should peak at about one year and remain there for at least another year.

Tips for Success:
Pitching plenty of healthy yeast is paramount for a high gravity brew. When in doubt, pitch more. Be patient with the fermentation and conditioning process. Beer doesn't have a schedule. For bottle carbonation, pitch fresh yeast at bottling time if the WLP099 wasn't needed during the brew day. Give the bottles adequate time to carbonate. This beer needs to age, anyway. You'll thank me later for saving it until its peak. If you would like, try aging this beer in a bourbon barrel. How long to barrel condition is a matter of individual taste. Our club likes a full bourbon flavor, so we age the beer for several months. We don't worry about temperature. The barrel's alive, and varying temperatures allow the wood to expand and contract, imparting those wonderful oak and bourbon flavors.

grade trash cans are air tight. If those options are used, divide the beer as soon as possible among the participants when fermentation has finished.

Another conditioning option is a bourbon barrel. These can be obtained through homebrew shops or directly through distilleries by ordering a freshly dumped #1 select barrel. For this purpose, the spirit doesn't have to be of the premium variety. Barrels aren't expensive per se. Shipping's the killer. Partner with another club or a brewpub to get a better deal on freight.

How long to barrel condition is a matter of individual taste. Our club likes a full bourbon flavor, so we age the beer for several months. We don't worry about temperature. The barrel's alive, and varying temperatures allow the wood to expand and contract, imparting those wonderful oak and bourbon flavors.

Peristaltic pumps, which don't have to be primed, are great for emptying a barrel. The desired volume can be set, and kegs or carboys can be lined up for filling. Afterwards, the barrel can be reused. Most of the bourbon character will be gone, but those oaky notes will still be there. The barrel can also be reused almost indefinitely for making sour beers.

Our efficiency this year was a little better than expected. Our original gravity (O.G.) ended up at 1.120. However, the WLP007 (Dry English Ale) stalled at 1.040. We added the WLP099 (Super High Gravity) yeast to bring the final gravity down to 1.035 — an ABV of 11.2%. It was then finally time for tasting — the ultimate test.

We filled a pitcher and poured it into tasting glasses. For having only four specialty malts, the flavor profile was complex: lots of roast, coffee, chocolate, and dark fruit — although I suspect the initial fermentation temperature, which was in the mid 70s °F (~24 °C), may have contributed to the fruitiness. The alcohol was barely noticeable for such a big beer. We deemed it one of our best big brews.

And your club's big brew can be a winner, too, by following the Alers' method for making large batches of high-gravity homebrew. BYO

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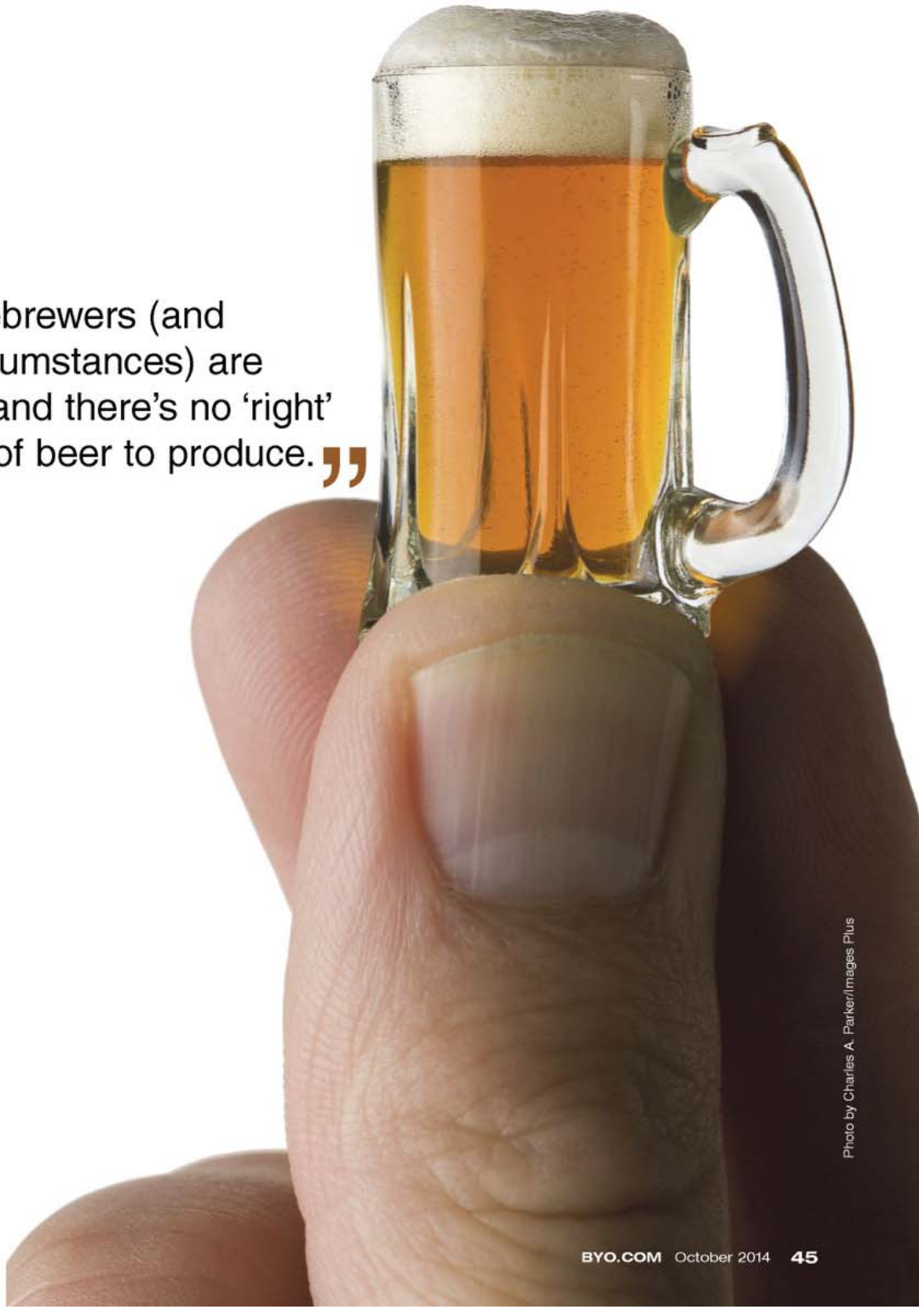
SMALL BATCH BREWING

Homebrewing one gallon at a time

by **Josh Weikert**

I've always homebrewed on the "small" side. I don't mean in terms of gravity (although that's usually true, too), but rather in terms of volume. Five gallons (19 L) is considered to be the standard batch size for the hobby, but for a variety of reasons (heat source, equipment, storage space) it had never been practical for me to produce more than 4.5 gallons (17 L) per batch. When I moved into my palatial new garage brewery, I initially ordered all the equipment necessary to brew on a larger scale, and made my first "real" batch of beer: a 10-gallon (38 L) behemoth of a North German altbier. I hated it. Not the beer — the beer turned out fine — but the process and the "big"-ness of it all. Everything took longer, weighed more, and it took more work to correct something if the process went sideways. I returned the new equipment and went back to what I realized was simply my preferred batch size. The lesson I learned was this: We're not all meant to be brewing the same volume of beer. Homebrewers (and their circumstances) are unique, and there's no "right" amount of beer to produce. There's nothing magical about 5 gallons (19 L) (other than fitting well in a 5-gallon/19-L soda keg), and in fact it's perfectly common to see "short" meads and ciders that are produced in much smaller volumes — so why not beer?

Brewing small batches of homebrew can save time, takes less space, is cheaper on brew day, and for a lot of people it can be conducive to brewing better beer, brewing a wider variety of beers, and brewing more often. There is no shame (and a lot of advantages) in brewing small, so let's talk about the pros and cons of brewing at the 1/31-barrel level (or 1 gallon/3.8 L, for those not up on their conversions).



> “Homebrewers (and their circumstances) are unique, and there’s no ‘right’ amount of beer to produce.”

Photo by Charles A. Parker/Images Plus

Size Matters (But Not How You Think)

Brewing small means spending less money. Ingredient costs per batch are lower — proportionally lower, since you're scaling down the recipe, but still lower! Many of the brewers I know would brew more often if cost weren't a factor, and this is a way to maintain a steady brewing schedule on a budget. The benefit of small batches is not only a cheaper brew day, though; brewing more frequently usually results in a more proficient brewer, which means fewer blown batches down the drain (or, unpleasantly, down your throat). One-gallon (3.8-L) brewing also enhances a pre-existing advantage homebrewers have over commercial brewers: The ability to source and use exotic specialty ingredients that are cost-prohibitive for use at larger volumes. Black truffle ESB, anyone? (SO earthy. . .) You're also saving on your most precious commodity: Time. Small-batch brewing is fast. For those who think an all-grain batch MUST take all day, smaller batches are your answer. A typical 1-gallon (3.8-L) all-grain batch takes around two hours to complete.

One-gallon (3.8-L) brewing also has process advantages. For one, small-batch brewing is perfectly suited to brew in a bag (BIAB) systems. With a smaller kettle and less grain, the process of steeping and draining your grains in a mesh bag becomes far more manageable — rather than mounting a motor-driven industrial winch into the ceiling, all you need is one arm (with hand attached) or a reasonably stout hook. Heating options open up, too; 5- to 10-gallon (19- to 23-L) batches require a lot of heat to get a proper boil (with propane burners, for example). Brewing small, though, means that nearly any heat source will do: Kitchen ranges, electric hot plates, induction elements (which are both very cost-effective and incredibly high-performing when it comes to boiling a gallon or two of wort — read my story on this subject at http://byo.com/2967).

One-gallon (3.8-L) brewing requires less space than is needed for larger batches, and the equipment is

smaller and easier to store. Small batches also allow brewers to maintain a well-stocked and flexible warehouse of ingredients without requiring the construction of a space-devouring storage mechanism for huge bins of grain. When you're working with a grain bill of only 2 or 3 pounds (0.9–1.3 kg), you only need a quarter ounce (7 g) of hops, and a 2-L yeast starter can inoculate four or five batches.

Because of these small demands you're in a better position to brew on the fly. One medium-sized cabinet can house all the base and specialty grains you could need for an impromptu brew day, and a small collection of hops can give you options for any style you want to brew. No more hauling 14-pound (6.4-kg) bags of grist home and lamenting the fact that your significant other won't let you turn the bedroom closet into your personal grain room — now you can brew what you want, when you want, and increase your recipe flexibility at the same time. Hit up your local shop and bring home a dozen bags of specialty grains you'd never use when you're only brewing one massive batch per month, and have a field day!

Small batches also mean less weight, which makes life easier for those of us who are not routinely competing in the Caber Toss at the Highland Games. If your process requires 10 pounds (4.5 kg) of grain and a single-infusion mash, in the absence of a pump you're very likely looking at the fun prospect of dumping more than 30 pounds (14 kg) of hot water into your mash and then disposing of 20 pounds (9 kg) of wet grain afterward. One of the great brewing mishaps I've ever seen (or even heard about) was when, at a group brewing event, a brewer had a handle snap off of a kettle holding 6 gallons (23 L) of 165 °F (74 °C) mash water. The thirteen folks in attendance spent the rest of the day sloshing around in wet shoes over semi-scalded feet (and the dog was never the same again).

Ultimately, small-batch brewing (particularly when we're talking about 1- or 2-gallon/3.8- or 7.6-L batches) is fast, cheap, and creates real advantages in production flexibility, recipe and brewing skills development. You'll be in a position to brew better and more-frequently, both of which will increase your enjoyment of the brewing process. Small-batch brewing is even safer than brewing larger batches.

Limitations

But . . . (there's always a "but") in the case for small-scale brewing, the primary limitation is obvious: You're producing less beer to drink. I would argue that the smaller volume is worth the increased ease of production, but if you're not swayed by that argument there are others that are worth considering. Then there's the problem of recipe scaling — it isn't always easy (or convenient) to scale down a larger-format recipe. But that problem, too, is manageable, and one that usually only

Many homebrew retailers have 1-gallon (3.8-L) "starter" equipment kits, which contain all the pieces you will need to brew a simple 1-gallon (3.8-L) batch of homebrew.

One big advantage of small-batch brewing is that you can use a conventional stovetop or gas range to heat your grains and wort — no dedicated propane setup required.

needs to be fixed once.

For one thing, the "less beer" argument is illusory. Sure, you're producing less beer per batch, but for most small-scale homebrewers they're brewing on a more regular basis. If brewing is a hardship that requires you to sacrifice a full day to accomplish it, then you're not going to brew all that frequently. If making a batch of homebrew is something you can accomplish while your significant other is out to lunch with a friend, you'll be more likely to do it. I once had a friend who would stop by the local golf club on the way home from work to play just four holes. He was there for an hour, three or four times a week, and the club didn't even charge him most days. His game got better, faster, and he was routinely taking his friends' money on those Sundays when we'd all get out to play a full round. The same logic works with small-scale brewing, just without the hideous clothing. One gallon (3.8-L) of wort in the fermenter will produce ten 12-ounce bottles of homebrew, which is insufficient to cater your best friend's wedding but more than sufficient to share with that friend on a quiet summer evening on the deck. Once you hit upon the world's best porter recipe, you can break out the big kettle and produce a large batch of it!

Another reason the "less beer" argument doesn't hold up quite as well lies in the ability to "stretch" the wort. A system that produces 2 gallons (7.6 L) of 1.050 OG Dortmunder export can produce twice as much if you simply brew your wort to 1.100 OG and dilute with cool water in the fermenter. You get all of the advantages of your small-batch brewing process (shorter time, less weight, flexible process) but twice the beer!

One of the biggest advantages of small batch, however, is that sometimes we don't even want a big batch of beer taking up space in the fridge, whether in bottles or kegs — or if you live in a small space you might not even have the means to store a large batch of beer. If you're someone who doesn't have a lot of beer-drinking friends and family, you may be drinking most of what you make yourself. You may not need or want 5 or 10 gallons (19 or 38 L) of American barleywine. Brewing small means that you can maintain and enjoy a healthy variety of beers in your collection.

Recipe formulation can be another challenge. Most homebrew recipes you'll find — whether in books, magazines, or online — are geared towards a finished 5 gallons (19 L), or somewhere around 7 gallons (26 L) boiling in the kettle, anticipating (and assuming) a specific amount of evaporation, equipment loss, and ingredient loss.

These always require small tweaks so the numbers "work" on our systems, but when scaling down by as much as 80% to 1 gallon (3.8 L), the challenge is more multifaceted. Tackle this by first doing simple linear scaling — multiply all the ingredients used by 0.2. You'll then need to pump up your water volumes to account for a greater aggregate percentage of loss to evaporation, and make any necessary adjustments for hop utilization if you're doing the double-wort-dilution trick (higher gravities mean lower utilization). You may also find that if you're using the same equipment that you did when

Another advantage of small batch brewing is that you don't need large quantities of ingredients. This means no heavy lifting of grain bags, and a fairly inexpensive brew day.

Small batches of homebrew require less equipment. For example, chilling 1 gallon (3.8 L) of wort can be done with a simple ice bath rather than with an immersion chiller.

you were brewing big batches that your mash efficiency is affected significantly: I've always noticed a clear drop-off when making small batches, almost certainly related to the amount of "flow" through the grain on lautering and sparging. This is a problem you only need to fix once, and you have help. Brewing software will automatically scale down recipes for you, and once you know your new adjustments they should hold for every batch.

Making the Switch

Unlike scaling up, scaling down doesn't require much of an investment in new equipment. Most systems will accommodate a scaled-down version of your beer with only recipe adjustments. However, there are some equipment changes that might make the transition a bit smoother, and will save space in the event that your volume reduction is the result of new living circumstances (congratulations on that new job in the city and your 540-square-foot-apartment!). Virtually every piece of brewing equipment that large-scale homebrewers use comes in a "small-batch" size, from the mash right

Amazon Old Ale

(1 gallon/3.8 L, all-grain)

OG = 1.086 FG = 1.020
IBU = 47 SRM = 24 ABV = 9.5%

Ingredients

2.8 lbs. (1.27 kg) Maris Otter pale ale malt
4 oz. (0.11 kg) Victory® malt (28 °L)
1.6 oz. (50 g) crystal malt (80 °L) (or medium English crystal)
1 pinch of black patent malt (~10–15 individual grains)
4 oz. (0.11 kg) blackstrap molasses or English treacle (first wort addition)
2.75 AAU Nugget hops (60 min.) (0.25 oz./7 g at 11% alpha acids)
Wyeast 1028 (London Ale) or White Labs WLP013 (London Ale) yeast
0.7 oz. (20 g) priming sugar (if bottling)

Step by Step

This is a single infusion mash with a batch sparging of the grains. Add 1 gallon (3.8 L) of mash water, strike temp 165 °F (74 °C), for a mash temp of 153 °F (67 °C). Mash for 60 minutes, stirring twice at 20 minute intervals, vorlauf and run out. Batch sparge with 1 gallon (3.8 L) of water at 175 °F (79 °C). Let rest for 10 minutes, then vorlauf and run out. Before achieving a boil, add 4 oz. (0.11 kg) by weight (about 3 liquid oz./89 mL) of blackstrap/dark molasses or English treacle. Boil for 60 minutes adding hops at the beginning of the boil. After boil is complete, chill and pitch 1 package of yeast. Ferment at 64 °F (18 °C), slow-rising to 72 °F (22 °C) by the end of fermentation (over about ten days). Post-fermentation, bottle condition with 0.7 oz. (20 g) of priming sugar into 4 oz. (118 mL) water, or force carbonate to about 2.25 volumes of CO_2. For an extract with grains recipe, visit http://byo.com/story3132.

Fermenting a small batch of beer takes the same amount of time as a large batch, but finding space in your house or apartment for a 1-gallon (3.8-L) carboy is a snap.

through packaging.

For all-grain brewers (those who aren't going with a BIAB process), the first place you want to look is to your mash tun. A 70-quart Coleman cooler is great if you're making 7 gallons (26 L) of beer, but a 2-gallon (7.6-L) batch is going to get lost in it, and the lower grain weight and mash water volume is going to mean a lot more heat loss. The thermal mass is proportionally smaller, and as a result you could run into problems maintaining an appropriate temperature for saccharification. There are a number of 2- to 3-gallon (7.6- to 11-L) coolers on the market that can be converted into a mash tun with a simple weldless ball valve and a flexible mesh tailpiece. The smaller headspace will mean less heat loss, and smaller mash tuns are also a breeze to store.

For a boil kettle, you'll want to mimic the dimensions of a larger-scale brew pot to keep evaporation under control. The single biggest factor affecting evaporation is the amount of energy (heat) delivered to the kettle (though intensity of the boil, humidity, and other factors also matter), so a wide-mouth boil kettle might be overdoing it. Good pot geometry to minimize evaporation is tall-and-thin (soup can) rather than wide-and-short (tuna can). A 4-gallon (15-L) pot should give you all the flexibility you need (right up to a 2.5- or 3-gallon/9.5- to 11-L "half" batch) while not being too voluminous for a 1-gallon (3.8-L) "short" batch.

Heating options are almost limitless at smaller volumes, but I like induction elements. They are fast, easy to control, have no open flame or hot element, and the smaller units are inexpensive. Of course, you can also simply use your kitchen range.

Chilling the wort can be done much more simply at smaller volumes with an old-fashioned ice bath in the sink, but you could also create a custom-sized immersion chiller using copper tubing and some pipe thread connections if you want.

Fermentation is the easy part. There is no shortage of options for vessels, and a 1-gallon (3.8-L) jug is a perennial favorite. Temperature control is also a breeze; pick up a dorm fridge from your local big box store or from Craigslist, attach a temperature controller, and you've got your own dedicated fermentation chamber in an appliance that can fit on a countertop, in any corner, or under a cabinet.

And when it comes time to package, there's really no change at all, except that instead of cleaning and sanitizing 60 bottles over a two-hour session, you're only prepping half a case. I find that a dozen 12-ounce bottles fit neatly in a bottling bucket of sanitizing solution, which kills two birds with one stone. Smaller kegs are also out there if you'd like to have a draft option, and a number of "mini-keg" systems with fill-able vessels are coming on the market.

Brewing Small

Brewing small can mean brewing more often, improving your skills, with less cost in time and money. It also allows you to experiment more without taking the risk of a big batch. And at the end of the day, the skill and quality of a brewer is not measured in gallons or barrels produced — if it was, the entire craft brewing movement would never have existed in the first place. What could be a better way to honor our roots than doing what the first microbreweries did: Don't worry about how MUCH beer you're making — just make it great.

Photo by Charles A. Parker/Images Plus

.....The key to leveraging your equipment is flexibility and adapting to some compromises.

BIG BATCH BREWING

by **John Blichmann**

IF YOU FIND YOURSELF IN NEED OF MORE HOMEBREW **IT IS TIME TO START BREWING BIGGER BATCHES.** IF YOU'RE READY TO "GO BIG," HERE IS HOW TO GO BEYOND THE BASIC HOMEBREW BATCH SIZE.

BREWING BIG BATCHES OF BEER IS A LOT OF FUN and can be a great way to expand your homebrewing horizons. But it is also a BIG topic to cover. As I thought about how to approach this topic and what exactly "big batch" meant and why "going big" was the thing to do, I realized that this is all relative. Big isn't a specific cutoff point of 10, 20 or 100 gallons (38, 76 or 378 L). Going big is really about homebrewing bigger batches than your normal batch size. Brewing big batches also isn't a slam against brewing small. Both approaches have their rightful place in homebrewing, depending on what your goals and needs are at the time. I've brewed 5/10/20-gallon and 1-bbl batches throughout the years and have never thought of locking myself into a certain size. In this article I'll walk you through reasons why big batch homebrewing is a great possibility to consider and what you'll need to get there.

Why Brew Big?

There are quite a few reasons for brewing more beer at a time, or at least brewing more beer on occasion. Here are some of the most common reasons homebrewers scale up their batches.

Sharing beer with friends: I think every homebrewer quickly realizes that they have WAY more friends than they ever realized once word gets out that they make beer — and that they will let people drink it for free. This is especially problematic if the beer is good. I have always considered this the best part of being a homebrewer — sharing the beer and sharing the hobby. But what about when a 5-gallon (19-L) batch of beer is gone in a week? That is a little depressing.

Brewing with friends: The social aspect of homebrewing is something I never really thought about when I got started in the hobby, but it quickly materialized as a great way to meet people I normally would not have known, mostly through homebrew clubs and social events. I've made a plethora of new relationships through this hobby. I really enjoy sharing my knowledge with new homebrewers and I'm always appreciative of those that continue to share their knowledge with me. And when things get social in the

Photo by Ronaldo Dutra Ferreira

If you are ready to scale up your batch size, when you purchase new equipment it is better to go bigger than you think you need — you can under fill a pot, but not the converse.

Photo by John Blichmann

Brewing big batches is a great way to socialize with friends or with a brew club. With two or more homebrewers working together, you can share the cost of equipment and ingredients.

homebrewery, you'll need more beer. Sending a new homebrewer home with a six pack of beer samples, or better yet, their first carboy of wort, is a really great way to get them to embrace the hobby.

Limited time to brew: As my children have grown up and become more active, my work more hectic, and my home in need of more remodeling, I seem to feel compelled to drink more beer. But all of this is, of course, inversely proportional to the time I have available to brew said increase of beer. So peeling away time to brew frequently is a challenge. Could I ask my wife, "Dear, will you clean the kitchen and run the kids to soccer and get groceries while I work hard and brew beer all morning?" There is no good way to put a positive spin on that question. But brewing a double batch of my favorite beer takes little more time than brewing a single batch. I also find that if I run out of my wife's favorite IPA (Bell's Two Hearted clone) she gets a little less tolerant of my quirks and unending hobbies. Let's just leave it at that.

Experimenting with different yeasts and ingredients: Now that there is a tremendous variety of homebrewing ingredients, techniques and knowledge than there ever have been, experimenting is a very alluring prospect. Brewing a single beer wort with a variety of hops, yeast or special ingredients is a great way to grow your knowledge and sensory perception of what these ingredients do, and how you can dial them in to create your special brew. Brewing a big batch of wort and splitting it into several carboys for yeast and special ingredient experimentation is perfect. If you're experimenting with boil techniques, you can split the mash into two or more kettles. The list of experimentation is virtually endless, and a big batch of beer can be divided many ways. The advantage of starting with a large base wort is that you eliminate one variable (the base wort), which lets just the experimental variable (yeast, hop, technique, etc.) shine through. This is

especially great if you brew with a buddy or a homebrew club — brew one big batch and everybody gets a few gallons or liters (read on).

Parties and events: This is yet another aspect of big batch brewing I hadn't anticipated — masses of thirsty people. My family has an annual New Year's party and it is a great way to share my passion for home-crafted beer and wine with all my friends and co-workers. It's that time of the year that I brew double-size batches so I have enough beer for the event, but also have some left over to enjoy later. I've also learned that one can garner a LOT of charitable donations through homebrewing. Doug Granlund, my good friend and VP of Operations at Blichmann Engineering, and I brew for regular events, including raffling off "Brew with John & Doug" for a day, to auctions where we'll put on a tasting and design and brew a beer for a group of winners. We also do beer-tasting events at local pubs where we pour samples of our homebrew for attendees. Let's not forget club events and beer fests — club night at the National Homebrewers Conference, anyone? All of these gatherings benefit from big batch brewing.

Club brewing and equipment sharing: When I started brewing I really hadn't thought much about the benefits of brew clubs, but they were something I quickly learned about and grew to really appreciate. Hands down, this industry would not be where it is today without the homebrew clubs and retail stores that support the hobby. Currently my meddling kids and their non-stop activities foil my attendance at most Tippecanoe Homebrewers Circle club meetings here in Lafayette, Indiana. But I am looking forward to getting back into meeting regularly and doing some of the fun things I've seen other clubs do — which includes helping to start "Big Batch Day" where we get the club together and brew a giant batch of beer together, splitting the batch for members to bring home and ferment (read about another club's "big batch" brew day on page 36 of this issue). Not only is big brew a great social event and super way to attract new members, it's an awesome way to pool resources on equipment, brew more economically, and most importantly share knowledge about brewing. Just a couple more years until my last little darling is in college . . .

Thinking of going pro: Big batch brewing is also a great way to dabble in the art of commercial brewing. There is a big difference between brewing for a hobby and brewing to make money. Brewing for money is hard work, and brewing big batches is a great way to experiment with whether or not you want to go pro. You'll get a hands-on glimpse of working with big equipment, as well as handling things like yeast propagation and quality control.

Scaling Up

If you want to start brewing larger batches of homebrew, it's tempting to simply double (or triple) the ingredients in a recipe to achieve the large-batch results. It's not quite that simple, however. Scaling up is not complicated but to do it right requires a little mathematic manipulation. This is because the efficiencies of small and large brewing setups are usually different, and small differences in ingredients can make a big difference when scaled up. Differently shaped brew kettles and heat sources can also affect the beer when you try brew it on a larger system.

The most important information to know before scaling up is the efficiency of your brewing setup. There are a few different ways to find out that information, but *Brew Your Own*'s Mr. Wizard, Ashton Lewis, recommends figuring this out by simply comparing how much extract you produce during wort production to the weight of malt you use. His advice is as follows:

"For example, let's assume that I produce 20 liters of 12 °Plato wort and used 3.4 kg of malt in the process. My extract yield is equal to (liters wort)*(decimal equivalent of °Plato)*(equivalent specific gravity to Plato). You can convert Plato to specific gravity using the following formula:

Specific gravity = {Plato/(258.6-([Plato/258.2]*227.1)}+1

Once you determine that 12 °Plato is equivalent to 1.048 SG, the rest of the calculation is easy. I have included units below to show how the units cancel, resulting in kg of extract:

(20 liter)*(0.12 kg extract/kg wort)*(1.048 kg wort/liter) = 2.52 kg extract

The 2.52 kg of extract represents what was extracted from the 3.4 kg of malt during wort production. When 2.52 kg is compared to 3.4 kg the result shows that 74% of the malt added to the mash ended up as extract in the wort."

So, if you run the numbers and find that your brewhouse efficiency is, say, 65%, you can adjust the malt bill of the recipe using the efficiency of the original recipe. Let's say the efficiency of the system for the original recipe was 75%. In this case you would multiply the malt bill by 1.15 (the number 1.15 is the two efficiencies divided: 75 ÷ 65). *Brew Your Own*, by the way, standardizes all of the recipes that appear in the magazine to a 65% extract efficiency. For the breakdown of the potential extract for grains, visit page 2 of any issue of *BYO*. For more about calculating efficiency, visit http://byo.com/story875.

As for hops, scaling up for homebrewers is more of a guessing game as there is no easy way for us to calculate the iso-alpha-acids in finished homebrews. When you scale up a homebrew recipe, simply scale up the amount of hops with simple multiplication and use your sensory perception to tweak the recipes when you go big.

Of course, if you don't want to do the math you can use any of the various brewing software platforms available to homebrewers (BeerSmith, BeerTools, iBrewMaster, etc.). A good brewing calculator or spreadsheet is your best friend in the homebrewery. In fact, *Brew Your Own* has a free brewing calculator available on the Web that will help with performing basic recipe scaling: http://byo.com/resources/brewing

~ Betsy Parks

Batch Size and Equipment

I've talked a lot about brewing multiple size batches in my travels for Blichmann Engineering, and I am frequently asked about batch size and what equipment makes sense. The key to leveraging your equipment is flexibility and adapting to some compromises. If you aren't sure what size batches you will brew most often but you know you want to brew big, the best thing when you are buying equipment is to go larger than smaller. You can under fill a pot, but not the converse. If you want to do an occasional smaller batch on your big equipment, you can switch out your biggest kettle and make it your hot liquor tank (HLT). For your mash you will want to pick the pot that gives you an adequate grain bed depth (at least 6 inches/15 cm) and use a thinner mash to make sure you reach your thermometer for temperature monitoring. This is the most critical vessel. Having a low level in the boil kettle isn't that big of a deal, but you will get a different boil off rate and larger losses than a smaller kettle. A little more water and a couple pounds of grain solves that handily.

Equipment to Brew Bigger

Once you've committed to go big it's time to put it down on paper. Create an equipment list and start a brewery layout drawing. Here is the stuff you will need:

Pumps: There are a nice selection of affordable pumps on the market today. And any batch of homebrew over 5 gallons (19 L), in my opinion, requires a pump. Yeah, you may be able to manhandle a 90-pound (~40 kg) pot of boiling wort, but the risk of burns or a back injury aren't worth it. If you're homebrewing more than 10 gallons (38 L), you'll unravel some important organs in your body trying to move it. Get a quality pump and it'll last for years. There used to be a lot of concern about sanitation with pumps, but time has shown that it was worry, not a reality. Be mindful of sanitation and you'll be fine.

Photo by Ronaldo Dutra Ferreira

One of the most important factors in brewing big batches is heat. A high-end homebrew burner is good for 10–20-gallon (38-75-L) batches. Larger batches require extra power.

Heat source: You'll definitely need a properly sized burner or electric heating element to get things heated quickly and have enough power to generate a solid boil to drive off dimethyl sulfide (DMS) and isomerize those delicious alpha acids. See the chart on page 59 for recommended power levels to get the job done properly. But note that gas and propane burner efficiency ranges are all over the place, and manufacturers ratings are not usually very accurate. In general, you'll want a higher end homebrew burner for 10 and 20 gallon (38 and 76-L) batches. For one-barrel (31 gallons/117 L) batches, a commercial stockpot range is ideal for extra power and also to safely support the weight of the pot. Hand-built frames with jet burners are also a good choice.

Kegs: Kegging is a must for big batch brewing in my opinion. Bottling a couple of cases for a 5-gallon (19-L) batch of beer isn't a major deal, but bottling 100–200+ is extremely time-consuming and takes up a lot of storage space. If you want to share some homebrew in bottles you can easily

transfer some sediment-free beer into bottles or growlers as needed. Kegging systems have really dropped in price and are one of your better investments, or you can always make your own kegerator.

Fermenters: While carboys will still get the job of fermenting done with a large batch of homebrew, managing two, four or more carboys at a time can be a lot of cleaning and racking. This is the time to consider the value of a conical fermenter. Not only can you get the job done in one vessel, you can also have the ability to easily harvest yeast, which can save money and time (no more yeast starters) if you use that yeast frequently. Taking samples is also a breeze. There are a number of other bulk tanks available, but in my opinion you should be very cautious about plastic tanks to make sure they are food grade, oxygen impermeable, and that the fittings and valves can be fully disassembled for cleaning. Cooling your larger batches while fermenting needs to be carefully considered but does not need to be elaborate. If you're brewing ales and have a room with moderate temperatures (65 °F/18 °C or less) you'll be able to ferment up to 30-gallon (114-L) batches without external cooling using a stainless tank. Expect about 5 to 10 °F (3 to 5 °C) rise over ambient temperature in a fermenter in the 20- to 30-gallon (76 to 114-L) size. A wet blanket placed over the fermenter will take the temperature edge off of an aggressive fermentation. For lagers, and the ultimate in temperature control, consider investing in a large upright freezer (about $600 new). Adding a temperature controller will let you dial in the exact temperatures and it makes a great place to store finished beer. We cover the conversion details for that project on the Blichmannengineering.com web page. Or, if your wallet allows, a thermo-electric cooling system is pretty awesome too. Many small commercial breweries I've seen have simply made a "cool room" using a window AC unit. Be a little creative and you can get the job done for a reasonable price.

Chillers: Cooling a big batch of wort is obviously not as easy as cooling a small batch. However, there are great products such as plate chillers that get the job done quickly. Your simple immersion chiller will work for 5- and 10-gallon (19- and 38-L) batches reasonably well, but a 20+ gallon (75+ L) batch really benefits by using a counterflow chiller (tube in tube, or plate type) and a pump. You'll save a lot of water and get your wort cooled quickly. Choose a product that will chill your full batch to pitching in about 30 minutes or less.

Before You Go Big . . .

There are, of course, some drawbacks to brewing big, and one of them is equipment cost. If you are patient then you can scour used restaurant supply stores for used commercial

Recommended Heat Source Power Levels

YIELD	RECOMMENDED POWER		VESSEL SIZE NEEDED, GALLONS (Liters)		
Gallons (L)	Burner KBTU/hr	Electric W	Hot Liquor Tank (HLT)	Mash Tun	Kettle
5 (19)	20-30	2200–3700	7 (26)	7 (26)	10 (38)
10 (38)	40-60	4500–5000	10-15 (38-57)	15 (57)	20 (76)
20 (76)	60-75	5500–6500	15-20 (38-76)	20 (76)	30 (114)
33 (125)	90-110	10,000	30-50 (114-189)	30-50 (114-189)	50 (189)

cooking gear, but be prepared to do some modifications to the equipment yourself. The other drawback is space. Bigger equipment takes up more space, however it does not take up double the space. I brew up to a barrel (31 gallons/ 117 L) in my indoor 9-foot X 15-foot homebrewery. The key is mobility of the equipment and organization of your brew space. (For more about designing a homebrewery, read my story in the November 2014 issue of *Brew Your Own*).

While there are a lot of advantages to big batch brewing there is also a risk: One mistake can wipe out a lot of beer. But with the knowledge, equipment and ingredients out there today that risk is certainly manageable. In the dark days of homebrewing, nasty homebrew (AKA "dumpinbrau"), was somewhat common but not anymore. So don't let that risk sway your decision. The reality is you'll focus even more intently on sanitation and your process, and you'll likely end up with even better beer than your small batches.

Go Forth and Grow

Big batches definitely offer a lot of advantages, but don't get hung up on always having to brew the same size batch every brew day. Be creative, learn to adapt your equipment, and you'll always have plenty of fresh home-crafted beer on tap for friends and family to enjoy. BYO

Learning Lessons From

PILOT BREWING SYSTEMS

How the pros perfect their recipes

Photo courtesy of O.H.S.O. Brewery

by **Glenn BurnSilver**

In order to think big, you need to start small. That is the prevalent thinking for many of today's commercial brewers who frequently utilize pilot systems as the brewhouse starting point.

Pilot systems range in size from 10 gallons (38 L) to 8 barrels (1 barrel = 31 gallons/117 L) with numerous variations in between, and often commercial brewers are experimenting on systems that wouldn't look out of place in a homebrewer's garage. Depending on the complexity of the system, features can include grain mills, lauter tuns, wort chillers, heat exchangers, whirlpools, fermentation tanks, and more. There are numerous pilot system producers on the market.

Product development and experimentation are the leading reasons commercial brewers have adopted pilot brewing as the first step in recipe creation. Naturally, even with the depth of knowledge modern brewers bring to the drawing board, there are still some risks in developing a new beer; why take a 50- or 100-barrel risk when a 10-gallon (38-L) risk is more manageable from an economic standpoint? That's to say, why brew a full batch of beer when a more moderately sized version can offer the brewer plenty of insight into the desired beer. Does it need different hops? Should the grain bill be altered? Perhaps different yeast can provide more flavor or head retention? All these questions can easily be answered — and then addressed as necessary — on a pilot system.

"In the past when we tried new beers at the production scale we've ended up dumping a lot of beer, so it's saved us a lot of resources and time. It's expensive. If it's not what you want, you end up chucking it," said Damian McConn of Summit Brewing Co. in St. Paul, Minnesota. "It really is a nice tool for product development. When you're launching a year-round brand, I think it's crucial to have a tool like this. It takes some of the risk out of it."

McConn employs a custom-built Nerb System from Munich, Germany. The semi-automated unit included a grain mill, lauter tun, mash tun, kettle, whirlpool, two double-fill fermenters (3.83 barrels, or 12-gallons each), a two-headed bottle filler and, "a few other fancy bits and bobs."

"We wanted something that was scalable that we could play around with," McConn says. "It's not a direct correlation to brew on a pilot system to brew on a commercial system, but it gives us a very good idea of what we can do before transferring to the larger system."

McConn, who puts his pilot system though "a lot of raw material experimentation," including hops and barleys, developed Summit's Saga IPA this way. By brewing multiple batches to perfect the product, his detail has paid off, as Saga is now the brewery's fastest growing beer.

"A lot of the work for that, the trials, were done on the pilot system. We played with different hop varieties to get the flavors we wanted. A lot of our beers were developed on the pilot system," he said proudly.

Chad Kennedy, Owner and Brewmaster at Worthy Brewing Co. in Bend, Oregon utilizes two pilot systems. The larger is a 5-barrel system constructed by Marks Design out of Vancouver, Washington, while his Synergy 10-gallon (38-L) setup is, "basically a glorified homebrew system." Kennedy began developing his beers on the smaller unit while his brewery was under construction.

"We were starting up a new brewery, so I didn't want to walk in there blind. The initial thoughts on brewing were more approachable on that 10-gallon (38-L) system," he said. "There are some beers you just jump in with both feet, but some, especially a wit with different combinations of spices, it's best to start on the 10-gallon (38-L) system. If it's successful, you scale it up."

"There are some beers you just jump in with both feet, but some, especially a wit with different combinations of spices, it's best to start on the 10-gallon (38-L) system."

~ Chad Kennedy, Worthy Brewing Co.

Now he primarily uses that system for research and development.

"We do trials with different hops and build recipes from that," he says. "On a small system like that you can make a batch of wort, put it in carboys and have three or four different versions by dry hopping with different hops. I've tried hops I probably wouldn't have considered, but it was like, 'what the hell.' I ended up using hops I might not have considered."

And speaking of hops, Kennedy's proximity to Oregon State University — and his relationships with scientists developing new hop strains — means Kennedy sometimes gets to brew with hops that are not yet commercially available, and are identified only by a number on the bag.

"I brew with hops that only exist in one place in the world. It's pretty cool. It's like discovering a planet for an astronomer," he says. "We might only have a couple pounds to work with, so it's good to brew on a smaller system and see what we've got. Some might be good, some might not work. A hop might smell great but when you brew with it, uh, no, it won't work."

Contrary to popular belief, Odell Brewing Co.'s popular 5 Barrel Pale Ale was not created on the brewery's 5-barrel pilot system designed by Specific Mechanical Systems in British Columbia. "It wasn't, it's just named after it," Brewery Owner Doug Odell explained from his Fort Collins, Colorado brewery. "We had Cutthroat Pale Ale to go with our Cutthroat Porter. It was a bad idea to have two beers with same name so we retired that one, modified the recipe and named it after the system."

Odell gets plenty of use out of his system. His brewery initially began with a 15-barrel set up, then switched to a 50-barrel system in the brewhouse. Adding the 5-barrel system has allowed him, like Kennedy and McConn, to use it for trouble-shooting, experimentation and the development of new recipes.

"We began to realize we were kind of limited in what we could do (with the 50-barrel set up)," he says. "It was so big we couldn't do a lot of interesting things. We got a much smaller system so we could play around with recipe development."

The company's flagship IPA began as a pilot project. Odell says his team generated four test batches, adjusting hops and grains each time, before settling on the recipe they preferred. This saved money and effort.

Continued on page 68

Pilot Breweries Profiled

Brewery: Summit Brewing Co.
Location: St. Paul, Minnesota
Head Brewer: Damian McConn
Pilot system: Custom built 1.7-barrel (52.7-gal./200-L) Nerb System (Munich, Germany)
Use: Two to three times a month

Brewery: Worthy Brewing Co.
Location: Bend, Oregon
Brewmaster: Chad Kennedy
Pilot Systems: 10-gallon (38-L) Synergy (Eugene, Oregon) and 5-barrel (155-L) Marks Design and Metalworks (Vancouver, Washington)
Use: 10-gallon (38-L): random intervals; 5-barrel: Once a week

Brewery: Odell Brewing Co.
Location: Fort Collins, Colorado
Brewmaster: Doug Odell
Pilot Systems: 5-barrel (155-L) and 8-barrel (248-L) Specific Mechanical Systems (Victoria, British Columbia)
Use: Two to three times a week

Odell Brewing Company Peach IPA Clone

Photo courtesy of Odell Brewing Co.

Odell Brewing Co. Peach IPA clone

(5 gallons/19 L, all-grain)

OG = 1.069 FG = 1.013
IBU = 60 SRM = 6 ABV = 7.2%

Ingredients

11.7 lbs. (5.3 kg) pale ale malt (3 °L)
1.7 lbs. (0.77 kg) Vienna malt (3.5 °L)
0.7 lb. (0.32 kg) melanoidin malt (25 °L)
2 tsp. gypsum
4 lbs. (1.8 kg) peach puree or crushed peaches (pits removed)
7.8 AAU Warrior® hops (60 min.) (0.5 oz./14 g at 15.5% alpha acids)
7.8 AAU Warrior® hops (30 min.) (0.5 oz./14 g at 15.5% alpha acids)
8.8 AAU Simcoe® hops (0 min.) (0.8 oz./22 g at 11% alpha acids)
4.8 AAU Australian Summer hops (0 min.) (0.8 oz./22 g at 6% alpha acids)
3.2 AAU Crystal hops (0 min.) (0.8 oz./22 g at 4% alpha acids)
1.2 oz. (33 g) Simcoe® hops (20 min. into hop stand)
1.2 oz. (33 g) Australian Summer hops (20 min. into hop stand)
1.2 oz. (33 g) Crystal hops (20 min. into hop stand)
1.2 oz. (33 g) Simcoe® hops (dry hop)
1.2 oz. (33 g) Australian Summer hops (dry hop)
1.2 oz. (33 g) Crystal hops (dry hop)
0.5 tsp. yeast nutrients (10 mins.)
White Labs WLP001 (California Ale) or Wyeast 1056 (American Ale) or Fermentis Safale US-05 yeast
Priming sugar (if bottling)

Step by Step

Adjust brewing water by adding 1 tsp. gypsum per 5 gallons (19 L) water. Mash in with 1.5 qts. (1.4 L) strike water per pound (0.45 kg) of grist to achieve a mash temperature of 152 °F (67 °C) and hold for 60 minutes. Sparge with 172 °F (78 °C) water and collect ~6 gallons (23 L) in the kettle. Boil for 60 minutes, adding hops and yeast nutrients at times indicated. At the end of the boil add "0 min." hops and stir to wort to create a whirlpool. Stir for at least a minute and then let wort settle for a total of 20 minutes. Chill the wort to 170 °F (77 °C) before adding the second addition of "hop stand" hops. Stir for at least a minute, then let settle for another 15 minutes. Chill the wort to 68 °F (20 °C) and aerate thoroughly. Hold at 68 °F (20 °C) for three days or until primary fermentation slows down. Add the peach puree after kräusen has fallen then wait until fermentation calms back down before adding dry hops. After five days on the dry hops, rack the beer to a keg and carbonate or rack to bottling bucket, add priming sugar and bottle. Carbonate to 2.4 volumes CO_2.

Odell Brewing Co. Peach IPA clone

(5 gallons/19 L, partial mash)

OG = 1.069 FG = 1.013
IBU = 60 SRM = 6 ABV = 7.2%

Ingredients

8 lbs. (3.6 kg) pale ale liquid malt extract (LME) (7 °L)
1.7 lbs. (0.77 kg) Vienna malt (3.5 °L)
0.7 lb. (0.32 kg) melanoidin malt (25 °L)
2 tsp. gypsum
4 lbs. (1.8 kg) peach puree or crushed peaches (pits removed)
7.8 AAU Warrior® hops (60 min.) (0.5 oz./14 g at 15.5% alpha acids)
7.8 AAU Warrior® hops (30 min.) (0.5 oz./14 g at 15.5% alpha acids)
8.8 AAU Simcoe® hops (0 min.) (0.8 oz./22 g at 11% alpha acids)
4.8 AAU Australian Summer hops (0 min.) (0.8 oz./22 g at 6% alpha acids)
3.2 AAU Crystal hops (0 min.) (0.8 oz./22 g at 4% alpha acids)
1.2 oz. (33 g) Simcoe® hops (20 min. into hop stand)
1.2 oz. (33 g) Australian Summer hops (20 min. into hop stand)
1.2 oz. (33 g) Crystal hops (20 min. into hop stand)
1.2 oz. (33 g) Simcoe® hops (dry hop)
1.2 oz. (33 g) Australian Summer hops (dry hop)
1.2 oz. (33 g) Crystal hops (dry hop)
0.5 tsp. yeast nutrients (10 mins.)
White Labs WLP001 (California Ale) or Wyeast 1056 (American Ale) or Fermentis Safale US-05 yeast
Priming sugar (if bottling)

Step by Step

Place crushed grains in a muslin bag and mash in with 1 gallon (~4 L) water to achieve a mash temperature of 152 °F (67 °C) and hold for 60 minutes. Wash grain bag with 1 gallon (~4 L) hot water. Top kettle to ~6 gallons (23 L) water and boil. Once at a boil, remove the kettle from heat and add the LME and gypsum. Stir until all the malt extract is dissolved, then return the wort to a boil. Now follow the remainder of the all-grain recipe.

Worthy Brewing Company Gary's No Quit Wit Clone

Photo courtesy of Worthy Brewing Co.

Worthy Brewing Company Gary's No Quit Wit clone

(5 gallons/19 L, all-grain)

OG = 1.048 FG = 1.010
IBU = 12 SRM = 3.5 ABV = 5%

Ingredients

6 lbs. (2.7 kg) North American 2-row pale malt
1.8 lbs. (0.82 kg) flaked wheat
1.8 lbs. (0.82 kg) wheat malt
5.6 oz. (0.16 kg) acidulated malt
6 oz. (0.17 kg) rice hulls
1.8 AAU Sterling™ hops (90 min.) (0.2 oz./6 g at 9% alpha acid)
1.4 AAU Sterling™ hops (15 min.) (0.15 oz./4 g at 9% alpha acid)
1 oz. (28 g) sweet orange peel (0 min.)
0.5 oz. (14 g) ground coriander (0 min.)
0.15 oz. (4 g) lemon peel (0 min.)
Wyeast 3944 (Belgian Witbier) or White Labs WLP400 (Belgian Wit Ale) yeast
Priming sugar (if bottling)

Step by Step

Mash the grains and rice hulls at 150 °F (66 °C) and hold at this temperature until conversion is complete. Raise the temperature of the grain bed to 170 °F (77 °C) and begin the sparge. Sparge slowly to avoid a stuck sparge with 172 °F (78 °C) water in order to collect 6.5 gallons (25 L) in your brew kettle. Total boil time is 90 minutes, adding hops at the beginning of the boil and with 15 minutes remaining. At 0 minutes, add the coriander, orange peel and lemon peel, then give the wort a stir and let it settle for 20 minutes.

Chill the wort rapidly to 70 °F (21 °C), let the cold break settle, pitch the yeast and aerate. Ferment at 73 °F (23 °C) for seven days. Rack the beer to a keg and force carbonate or rack to a bottling bucket, add priming sugar, and bottle.

Worthy Brewing Company Gary's No Quit Wit clone

(5 gallons/19 L, partial mash)

OG = 1.048 FG = 1.010
IBU = 12 SRM = 3.5 ABV = 5%

Ingredients

3 lbs. (1.4 kg) dried wheat malt extract
2.2 lbs. (1 kg) North American 2-row pale malt
1.8 lbs. (0.82 kg) flaked wheat
5.6 oz. (0.16 kg) acidulated malt
1.8 AAU Sterling™ hops (90 min.) (0.2 oz./6 g at 9% alpha acid)
1.4 AAU Sterling™ hops (15 min.) (0.15 oz./4 g at 9% alpha acid)
1 oz. (28 g) sweet orange peel (0 min.)
0.5 oz. (14 g) ground coriander (0 min.)
0.15 oz. (4 g) lemon peel (0 min.)
Wyeast 3944 (Belgian Witbier) or White Labs WLP400 (Belgian Wit Ale) yeast
Priming sugar (if bottling)

Step by Step

Place the crushed grains in a muslin brewing bag and mash in with 1.5 gallons (5.7 L) water to achieve a mash temperature of 150 °F (66 °C) and hold for 40 minutes. Rinse the grain bag with 1 gallon (~4 L) of hot water. Top off the kettle to about 6.5 gallons (25 L) with water and bring to a boil. Once at a boil, remove the kettle from the heat and add the dried malt extract. Stir the wort until all of the malt extract is dissolved, then return the wort to a boil. Total boil time is 90 minutes, adding hops at the beginning of the boil and with 15 minutes remaining. At 0 minutes, add the coriander, orange peel and lemon peel, then give the wort a stir and let it settle for 20 minutes. Chill the wort rapidly to 70 °F (21 °C), let the cold break settle, pitch the yeast and aerate. Ferment at 73 °F (23 °C) for seven days. Rack to a keg and force carbonate or to a bottling bucket, add priming sugar, and bottle.

Tips for Success:

BYO's "Style Profile" columnist, Jamil Zainasheff's advice for working with wit spices: "Coriander is probably the trickiest of the witbier spices to balance properly. Not only does the spice intensity vary considerably among suppliers and sources, but how you add it makes a big difference, too. I gently crush the coriander with the back of a heavy spoon to expose the inside of the seeds, which gives it a fairly strong, spicy character versus whole seeds. If you have fairly fresh coriander, start with 0.4 oz (11 g) per 5-gallon (19-L) batch."

Summit Brewing Company Foreign Extra Stout Clone

Photo courtesy of Summit Brewing Co.

Summit Brewing Co. Foreign Extra Stout clone

(5 gallons/19 L, all-grain)

OG = 1.076 FG = 1.014
IBU = 65 SRM = 52 ABV = 8.5%

Ingredients

13.7 lbs. (6.2 kg) Irish stout malt (2 °L)
1.5 lbs. (0.68 kg) Simpson black malt (550 °L)
1 lb. (0.45 kg) Crisp amber malt (27 °L)
7 AAU German Select hops (60 min.) (1.4 oz./40 g at 5% alpha acids)
7 AAU German Select hops (25 min.) (1.4 oz./40 g at 5% alpha acids)
3.5 AAU German Select hops (10 min.) (0.7 oz./20 g at 5% alpha acids)
3.4 AAU UK Phoenix hops (10 min.) (0.7 oz./20 g at 4.8% alpha acids)
8.4 AAU UK Progress hops (0 min.) (1.4 oz./40 g at 6% alpha acids)
0.7 oz. (20 g) Brewer's Gold hops (dry hops)
½ Whirlfloc tablet
Wyeast 1084 (Irish Ale) yeast or White Labs WLP004 (Irish Ale) yeast
Priming sugar (if bottling)

Step by Step

Add calcium chloride ($CaCl_2$) to the brewing water for a minimum 100 ppm of calcium (Ca^{2+}). Mash the grains at 144 °F (62 °C) and hold at this temperature for 30 minutes. Raise grain bed to 151 °F (66 °C) and hold at this temperature for 30 minutes. Raise grain bed to mash out at 172 °F (78 °C) then begin the sparge. Sparge until you collect 6 gallons (23 L) in your kettle or until pre-boil gravity in the kettle reaches about 1.063 SG. Total boil time is 60 minutes, adding hops at the times indicated and Whirlfloc tablet with 10 minutes left in the boil. At 0 minutes, add the last addition of hops then give the wort a stir for at least a minute and let settle for 20 minutes. If your wort pH needs adjusting, add lactic acid to be sure your wort is at 5.2 at this point. Chill the wort to 68 °F (20 °C), let the cold break settle, pitch the yeast and aerate.

Ferment at 70 °F (21 °C) for five days or until signs of fermentation have subsided. Add dry hops and let the beer sit on the dry hops for five days. Drop the temperature to 54 °F (12 °C) and condition the beer for three weeks at this temperature. Rack to a keg and force carbonate or rack to a bottling bucket, add priming sugar, and bottle. Target carbonation levels around 2.4 volumes CO_2.

Summit Brewing Co. Foreign Extra Stout clone

(5 gallons/19 L, partial mash)

OG = 1.076 FG = 1.014
IBU = 65 SRM = 52 ABV = 8.5%

Ingredients

7 lbs. (3.2 kg) extra light dried malt extract (2 °L)
1 lbs. (0.45 kg) Irish stout malt (2 °L)
1.5 lbs. (0.68 kg) Simpson black malt (550 °L)
1 lb. (0.45 kg) Crisp amber malt (27 °L)
7 AAU German Select hops (60 min.) (1.4 oz./40 g at 5% alpha acids)
7 AAU German Select hops (25 min.) (1.4 oz./40 g at 5% alpha acids)
3.5 AAU German Select hops (10 min.) (0.7 oz./20 g at 5% alpha acids)
3.4 AAU UK Phoenix hops (10 min.) (0.7 oz./20 g at 4.8% alpha acids)
8.4 AAU UK Progress hops (0 min.) (1.4 oz./40 g at 6% alpha acids)
0.7 oz. (20 g) Brewer's Gold hops (dry hops)
½ Whirlfloc tablet
Wyeast 1084 (Irish Ale) yeast or White Labs WLP004 (Irish Ale) yeast
Priming sugar (if bottling)

Step by Step

Place the crushed stout malt and amber malt into a muslin bag for mashing in 1 gallon (~4 L) of water. Mash the grains at 144 °F (62 °C). Hold at 144 °F (62 °C) for 30 minutes. Raise the mash to 151 °F (66 °C) and hold at this temperature for 30 minutes. Add the black malt, then raise grains to mash out at 172 °F (78 °C) and hold for 5 minutes. Raise the grains out of the mash water and rinse the grain bag with 1 gallon (~4 L) of hot water. Top off kettle to 6 gallons (23 L) water and bring to a boil. Once at a boil, remove the kettle from heat and add the dried malt extract. Stir until all the malt extract is dissolved, then return to a boil. Follow the remainder of the all-grain recipe.

From Pilot Brewing to Nano Brewing

O.H.S.O.: Outrageous Homebrewers Social Outpost.
Location: Phoenix, Arizona
Lead Brewer: Dave Burkle
Pilot System: 3-barrel Psycho Brew
Use: Two to four times a day

"We're all about promoting the craft brew scene," said Dave Burkle, Lead Brewer at Phoenix, Arizona's O.H.S.O. nano brewery. With 43 taps, he's not lying.

Brews from Oregon, California, Colorado, Montana, Arizona, and points east flow regularly from the silver handles, but so do in-house creations developed on the brewery's 3-barrel "double batch" Psycho Brew system. Considering it's a small system, and that the brewery is always busy, between two to four batches of beer are brewed daily. Twenty-five fermenters fill the various fermentation rooms (including a cold room for lagering). It's pretty much non-stop action for Burkle and his two co-brewers (he gets the "Lead" title for having been there the longest).

"Normally on production day I'll do at least two batches of one kind of beer. It's the most efficient for me," he says. "On triple batch days I'll do three barrels of one kind and then get creative with a couple smaller batches. The owner is all about creativity. I have tons of freedom. I have a dozen different lagers going right now."

What's intriguing about brewing on this scale — for Burkle and regulars at the pub — is that many of the beers are one-offs. O.H.S.O. holds six taps behind the long wooden bar for in-house creations, and when they're gone, they may not be back.

"Experimentation allows us to do a lot of cool things," Burkle says of the many one-hit wonders he's created over the last two years. (He's brewed more than 300 batches.) He does admit, however, there's a downside to producing on such a small scale, particularly when it comes to the brewery's two flagship beers: Grovey Ale and the aptly named Hoppy IPA.

"(Regular breweries) can produce 200 barrels in the same time I produce a barrel and a half, so I try and maximize as many batches as I can in one day," he says. "It's definitely a challenge. It's not built for production (level brewing). A good beer will last a day and a half. When I'm getting a little less than three full half barrels out of a batch, a triple batch will only keep me going for three weeks."

Burkle says the Psycho Brew system is "pretty straightforward," and particularly likes that the mash tuns are direct fired and, "we can re-circulate the mash with a RIMS-type system and step up mash temperatures." The kettle is also direct fired and equipped with a recalculating pump.

For the heat exchanger, Burkle improvises with a 200-foot (61 m) copper pipe that sits in a barrel of ice water. It's not a counterflow setup, and beer is pumped through on the way to the fermentation tanks. Like many a homebrewer, Burkle skips racking to a secondary fermentation.

"Nope, no secondary. We just roll the primary fermenters into a cold room for three to four days of conditioning," he says. The process is all very streamlined and efficient. Customers can see the many fermenters tucked behind glass doors and watch the brewers who put them there in action. Burkle says the team is active in the homebrew community as well, inviting brewers to come in, develop a recipe, and eventually have it on tap for the world to critique.

"This place started as a place for homebrewers to gather and make beer, talk about beer, drink beer," Burkle says. "We've grown up, but we'll always be all about beer." One small batch at a time.

Photo courtesy of O.H.S.O. Brewery

O.H.S.O. Brewery Morning Brew Clone

Photo courtesy of O.H.S.O. Brewery

O.H.S.O. Brewery Morning Brew clone
(5 gallons/19 L, all-grain)
OG = 1.050 FG = 1.011
IBU = 16 SRM = 5 ABV = 5.1%

Ingredients
8 lbs. (3.6 kg) North American 2-row pale malt
1 lb. (0.45 kg) flaked oats
10 oz. (0.27 kg) caramel Vienne malt (20 °L)
10 oz. (0.27 kg) lactose sugar (10 min.)
4.2 AAU Magnum hops (60 min.) (0.3 oz./9 g at 14% alpha acids)
0.5 oz. (14 g) Crystal hops (0 min.)
4 oz. (113 g) light roasted whole bean coffee (dry-beaned*)
8 oz. (0.23 kg) medium-dark roasted ground coffee (cold pressed)
Fermentis US-05 or White Labs WLP001 (California Ale) or Wyeast 1056 (American Ale) yeast
Priming sugar (if bottling)

Step by Step
Mash the grains at 149 °F (65 °C) and hold at this temperature until conversion is complete. Raise the temperature of the grain bed to 170 °F (77 °C) and begin the sparge. Sparge slowly with 172 °F (78 °C) water in order to collect 6 gallons (23 L) in your brew kettle. Total boil time is 60 minutes, adding hops at the beginning of the boil and lactose sugar with 10 minutes remaining. At 0 minutes, add the last addition of hops, then chill the wort to 66 °F (19 °C), pitch the yeast and aerate. Ferment at 68 °F (20 °C) for seven days. Add the dry coffee beans directly to the fermenter in a grain bag and let the beer sit on the beans for three to five days. The day before packaging the beer, grind the cold press coffee beans and add a cup of water. Let the coffee cold press overnight in the refrigerator. Guatemalan or Brazilian medium-dark roast is recommended for the ground coffee beans. Press off the liquid and gently add it to the beer just before bottling or kegging. Rack the beer to a keg and force carbonate or rack to a bottling bucket, add priming sugar, and bottle.

O.H.S.O. Brewery Morning Brew clone
(5 gallons/19 L, partial mash)
OG = 1.050 FG = 1.011
IBU = 16 SRM = 5 ABV = 5.1%

Ingredients
3.7 lbs. (1.68 kg) extra light dried malt extract
1 lb. (0.45 kg) North American 2-row pale malt
1 lb. (0.45 kg) flaked oats
10 oz. (0.27 kg) caramel Vienne malt (20 °L)
10 oz. (0.27 kg) lactose sugar (10 min.)
4.2 AAU Magnum hops (60 min.) (0.3 oz./9 g at 14% alpha acids)
0.5 oz. (14 g) Crystal hops (0 min.)
4 oz. (113 g) light roasted whole bean coffee (dry-beaned*)
8 oz. (0.23 kg) medium-dark roasted ground coffee (cold pressed)
Fermentis US-05 or White Labs WLP001 (California Ale) or Wyeast 1056 (American Ale) yeast
Priming sugar (if bottling)

Step by Step
Place crushed grains in a muslin bag and mash in with 1 gallons (~4 L) water to achieve a mash temperature of 149 °F (65 °C) and hold for 40 minutes. Rinse the grain bag with 1 gallon (~4 L) hot water. Top off the kettle to about 6 gallons (23 L) water and bring to a boil. Once at a boil, remove the kettle from heat and add the dried malt extract. Stir until all the malt extract is dissolved, then return the wort to a boil. Total boil time is 60 minutes, adding hops at the beginning of the boil and lactose sugar with 10 minutes remaining. At 0 minutes, add the last addition of hops, then chill the wort to 66 °F (19 °C), pitch the yeast and aerate. Ferment at 68 °F (20 °C) for seven days. Add the dry coffee beans directly to the fermenter in a grain bag and let the beer sit on the beans for three to five days. The day before packaging the beer, grind the cold press coffee beans and add a cup of water. Let the coffee cold press overnight in the refrigerator. Guatemalan or Brazilian medium-dark roast is recommended for the ground coffee beans. Press off the liquid and gently add it to the beer just before bottling or kegging. Rack the beer to a keg and force carbonate or rack to a bottling bucket, add priming sugar, and bottle.

* "Dry beaning" is the process of adding whole (or lightly crushed) coffee beans to your beer as you would when dry hopping.

"Eventually it was where we wanted it to be," he said. "But instead of doing those variations on a much larger batch of beer, we were essentially ready to go" when it was time to scale it up for commercial applications.

Pilot Fun

While it may sound glorious enough to work as a commercial brewer, it's not always fun brewing the same beers all the time. Pilot systems allow commercial brewers to channel their inner homebrewer. It's a chance to blow off steam, experiment with new styles, and create some tap room delights.

"It sort of lets you take the clothes off a little bit and go after some more oddball styles," Kennedy said. "Also, it's a nice relief for our production brewers. They brew IPA all the time. It gives those guys a chance to come up with recipes. It keeps their heads in the game a little bit more."

For example, Kennedy's next "oddball" brew will be a banana pancake beer using sorghum and wheat, with maple syrup for fermentation.

"It's not something I'm going to brew 30-barrels of," he said with a laugh. "Five-barrels probably; 10-gallons (38 L) no doubt."

Odell said that most of the beers created on his pilot systems are brewed by his production team and are usually created to add variety to the taproom (though occasionally a "hit" goes into full production). One of Odell's craziest pilot brew attempts? A pepperoni pizza beer using smoked malt for a bacon/salami character, basil and oregano.

"It didn't turn out very well," Odell said, "but you never know."

McConn made an oyster stout for a local French restaurant, and used both the oyster shells and meat in the boil.

"It was the first time we ventured down that road," he recalled of the brewing experiment. "Having the pilot system was great because I couldn't image doing 200 gallons of oyster stout at the production level."

Pilots at Home

For the homebrewer, brewing on a setup with some of the bells and

whistles of a commercial pilot system offers many advantages, beginning with consistency and repeatability. Commercial brewers with their larger setups can replicate beer after beer to perfect the recipes. Homebrewers working on 5-gallon (19-L) batches know it's often too hard to control all the variables all of the time, from the mineral content of the water to hop utilization to variances in fermentation heat. Many pilot systems used by commercial brewers reduce, if not eliminate, the guesswork and variability in the homebrewing process. Kennedy thinks serious homebrewers wanting to overcome the limitations of homebrewing should make the jump to a larger system — and not just because one can brew more beer, but one can brew better beer.

"When I went to start my own (brewery) and I went back to homebrewing, I realized how hard homebrewing is. You don't have as much temperature control. Heat exchangers are hard to come by. Oxygenation is a big deal in homebrewing and I never quite got that right," he says. With our system, racking is easier and temperature control is much better for boiling and for fermentation. "Getting away from the carboy, (that's) a big deal too," he adds.

Homebrewers who don't mind the usual variations, however, can always simply emulate the spirit of the pilot system by brewing experimental batches of beer that are smaller than what they normally brew. Interested in trying out a new malt or hop? Try brewing a 1- or 3- gallon (3.8- or 11-L) batch if you're currently brewing 5-gallon (19-L) batches. If you like how your small batch turns out, you can always scale it up to your normal batch size (or larger). For more about brewing small batches, check out Josh Weikert's story in this issue on page 44. Also, if you brew larger batches of beer (10 gallons/38-L or bigger), consider building your own "pilot system" — something smaller than your normal setup where you can experiment like *Brew Your Own*'s 3-gallon (11-L) countertop all-grain homebrewing system: http://byo.com/story1933.)

TWO BEERS from ONE BATCH

Partigyle, split boils, and split fermentations

Story and photos by **Justin Bruce**

I learned early on in this hobby that I needed to find a way to homebrew more beer without taking time away from other areas of life. I adopted a technique that has allowed me to double my output while keeping my brew schedule light. Basically, take the work of making one beer and turn it into two. There are a couple of options for doing this — some require a little more time and effort, and one is no more difficult than making a single 5-gallon (19-L) batch (if you have the equipment to do a single 10-gallon/38-L batch, if not, you can always scale the recipe down to 5 gallons/19-L and have 2.5 gallons/9.5 L of each). Here are the three methods that I use to maximize my homebrewing.

Partigyle Brewing

Partigyle is a method of mashing a large amount of grain and splitting the runnings into a "larger" and "smaller" beer. The more you sparge, the more diluted the wort sugars become, so if you split the early (higher-gravity) runnings into one kettle and reserve the later (lower gravity) runnings for a separate boil, you will have a high gravity beer and a lower gravity beer. This method can be used to make a barleywine and pale ale, a wee heavy and Scottish export 80/- , an imperial stout and dry stout, a doppelbock and Munich dunkel, or Belgian strong and table beer and so on.

I have not cared for the small beers from the second runnings of a single mash as they tend to be thin and lacking depth of flavor. This comes from the bulk of the flavor, color, sugars, and body in the earlier runnings. "Capping" (adding extra malts to the mash after you have run off the big beer) is a great way to counteract this by adding body and flavor back to the beer. Try capping the mash with dextrin malts (for added body) and other specialty grains for color and flavor contributions.

You can also use capping to totally change the character of the second beer. Try making an all Maris Otter English barleywine; then add 0.5 lb. (0.23 kg) each of crystal and roast bar-

Left: You can make two distinctly different beers — even different color beers — in a single brew day by splitting the batch in the mash or the fermenter. Right: One method of making two beers with one batch is to split up the first and second runnings of a single mash, a technique known as "partigyle" brewing.

One of the easiest ways to make two different beers from the same batch is by making one large batch of wort and then splitting the fermentation. Each beer gets a different yeast.

Another method of making two beers in one batch is to brew one wort and then split the boil into two. You can add unique hops or steeping grains to each, such as dark grains (above).

ley with 1 lb. (0.45 kg) of chocolate malt to make a stout; or maybe 1 lb. (0.45 kg) crystal malt and 0.5 lb. (0.23 kg) chocolate malt for a brown ale. You could even take an all Pils base for a Belgian strong and cap with 0.5 lb. (0.23 kg) of Carafa III® to brew a schwarzbier.

Split Boils

Split boil brewing offers another possibility for gaining multiple beers from a single brew day. Instead of running the single mash off into two boils with different original gravities (O.G.) from separate runnings like in partigyle brewing, the entire pre-boil volume of the mash is first run off as a full batch. Once you have the entire runnings thoroughly mixed, you split them into two separate but equal batches. In my homebrewery, I run the wort into my 17.5-gallon (66-L) kettle and split half back into my hot liquor tank (HLT) on a second burner.

I have done this with a hefeweizen and a wheat IPA with pineapple; one got light hopping and a hefeweizen yeast, the IPA got heavy doses of Falconer's Flight® hops and a pineapple in secondary. I also did a wit and a Three Floyds Gumballhead clone from the same mash. I used all flaked wheat and pale malt on the mash, split, instant oatmeal in the boil of the wit with orange peel and coriander on Belgian yeast, and the other half received Caravienne® steeped in the hot wort and lots of Amarillo® hops.

I recently used the crowd-sourced American stout recipe from the BeerAdvocate homebrew forum and split the batch of wort with a spring saison. For this I removed the dark malts from the mash and then ran off one full kettle of 13 gallons (49 L). I split the wort into two kettles, 6.5 gallons (25 L) each, and steeped the dark grains in one half which was boiled with the hops from that recipe. The other half got French hops and the 3276 Farmhouse Ale strain from Wyeast. One mash, two boils, two very different beers.

As the earlier examples show, this method can be used to make different beers from the same mash of the same

(or similar) gravities by using different hops, adding steeping grains, and changing yeasts. You can use this method to make two IPAs with different hops, or add sugar to one batch during the boil to change the OG and fermentability of one half as well as the other aspects like hops, spicing, color, and/or flavor.

Split Ferments

The third option is the easiest and requires no more time than making a single batch of beer. In this method you run off the full volume of pre-boil wort for two batches and keep it all together. This method requires the ability to do a large combined boil (though you could do a 5-gallon/19-L batch and split it into 2.5-gallon/9.5-L fermentations). Once the wort is collected you boil it as one batch, then split the wort between two separate fermenters.

You can ferment the two batches out and add a spice tea to one, or age half on oak. You could use different yeasts for comparison like English versus American in an IPA. You can make an all Pilsner base with Noble hops and ferment with lager yeast and a Belgian saison (See recipe on page 76). You can even add sugar to half and change the OG, FG and ABV of one.

Adding character malts to the beer in the fermenter is another option. I have cold steeped Midnight Wheat overnight and added the (boiled and chilled) syrup to one fermenter after a single boil for 10 gallons (38 L) of IPA. I fermented on different yeasts, and used different dry hops; one was a pale orange, and the other black.

Another option is to ferment some wort clean and sour the other half. Try brewing a recipe of 40% Pilsner malt and 60% wheat malt for 8 gallons (30 L) of 1.048 SG beer, and boil with minimal hops. Split the batch into 5 gallons (19 L) on a German wheat yeast strain, the other 3 gallons (11 L) diluted to 5 gallons (19 L) pitched with a *Lactobacillus* strain for a few days then followed with American ale for a Berliner weisse.

As you can see, in the time it takes to brew one batch of homebrew you can make more than one beer!

Partigyle Recipes

The Callen (1st Runnings) Scottish Wee Heavy

(5 gallons/19 L, all-grain)

OG = 1.126 FG = 1.034
IBU = 28 SRM = 18
ABV = 14%

Partigyle brewing is the method of brewing two batches of beer by separating the first and second runnings to create two distinct beers — one high gravity, one lower gravity. The Callen is the beer made from the first runnings.

Ingredients:

35 lbs. (15.9 kg) Golden Promise or Maris Otter pale ale malt
2 lbs. (0.90 kg) Carapils® malt
1 lb. (0.45 kg) British dark crystal malt (75/85 °L)
8.0 oz. (0.23 kg) British carastan malt (30/37 °L)
4.8 oz. (0.14 kg) special B malt
2.2 oz. (0.06 kg) black patent malt
10.5 AAU US Challenger (60 min.) (1.5 oz./43 g of 7.0% alpha acids)
Wyeast 1056 (American Ale) or White Labs WLP001 (California Ale) yeast (2 qt./2 L stirred yeast starter)
Lallemand CBC-1 yeast (if bottling)
Priming sugar (if bottling)

Step by Step

Two to three days before brew day, make your yeast starter and set on a stir plate.

On brew day, mash in at 158 °F (70 °C) in 44 qts. (41.6 L) of water. Hold at 158 °F (70 °C) for 60 minutes. Raise the temperature to 170 °F (77 °C), hold for 5 minutes then recirculate. Run off the wort and sparge with hot water. Collect 6.5 gallons (25 L) of the first runnings of wort. Leave the remaining 6.5 gallons (25 L) of second runnings in the mash tun and reserve for brewing The Caleb recipe (read on).

Boil the first runnings wort for 90 minutes, adding hops with 60 minutes left in the boil. When the boil is completed, chill the wort to 60 °F (16 °C), aerate the wort well and pitch the yeast. Ferment at 62 °F (17 °C) for three days, then raise the temperature to 68 °F (20 °C) over five days and hold to finish. Bulk age for two months before packaging in kegs or priming with fresh yeast and bottling.

The Caleb (2nd Runnings) Scottish 90/-

(5 gallons/19 L, all-grain)

OG = 1.068 FG = 1.018
IBU = 28 SRM = 12
ABV = 6.9%

The Caleb is the beer made from the second runnings of the recipe made with this ingredients list. The malt listed here is used to "cap" the wort that remains in the mash tun after the first runnings are used for brewing The Callen.

Ingredients

12 oz. (0.3 kg) Carapils® malt
8 oz. (0.23 kg) British dark crystal malt (75/85 °L)
4.8 oz. (0.14 kg) British carastan malt (30/37 °L)
8.8 AAU US Challenger (60 min.) (1.25 oz./35 g of 7.0% alpha acids)
Wyeast 1056 (American Ale) or White Labs WLP001 (California Ale) yeast (1 pt./0.5 L yeast starter)
Priming sugar (if bottling)

Step by Step

Two to three days before brew day, make your yeast starter and set on a stir plate.

On brew day, after you have taken your first runnings of wort for The Callen (recipe, left), "cap" the remaining mash with the grains listed in the ingredients (above) and allow the mash to rest at around 160 °F (74 °C). After 30 minutes, run off the wort and sparge with hot water. Collect 6.5 gallons (25 L) of wort. Boil the wort for 90 minutes adding hops with 60 minutes left in the boil. Ferment at 62 °F (17 °C) for three days, then raise the temperature to 68 °F (20 °C) over five days and hold at that temperature to finish fermentation. When fermentation is complete, package in kegs and force carbonate or prime with sugar and bottle.

The Callen (1st Runnings) Scottish Wee Heavy

(5 gallons/19 L, extract with grains)

OG = 1.126 FG = 1.034
IBU = 28 SRM = 18
ABV = 14%

Partigyle brewing is the method of brewing two batches of beer by separating the first and second runnings to create two distinct beers — one high gravity, one lower gravity. Because this method requires that the wort be made with grains, a true partigyle brewed with extract is not possible. The following recipes are provided simply for extract brewers who are interested in brewing The Callen and The Caleb independently.

Ingredients

14 lbs. (6.4 kg) Maris Otter liquid malt extract
1.3 lbs. (0.59 kg) Carapils® malt
9.6 oz. (0.27 kg) British dark crystal malt (75/85 °L)
5.3 oz. (0.15 kg) British carastan malt (30/37 °L)
3.2 oz. (91 g) Special B malt
1.44 oz. (41 g) black patent malt
14 AAU US Challenger (60 min.) (2 oz./57 g of 7.0% alpha acids)
Wyeast 1056 (American Ale) or White Labs WLP001 (California Ale) yeast (2 qt./2 L stirred yeast starter)
Lallemand CBC-1 yeast (if bottling)
Priming sugar (if bottling)

Step by Step

Two to three days before brew day, make your yeast starter and set on a stir plate.

Place the crushed grains in a steeping bag. Steep the grains at 155 °F (68 °C) in 3.0 qts. (2.9 L) of water. Remove the bag and rinse grains with 2 qts. (2 L) of 170 °F (77 °C) water. Add water to the brewpot to make at least 3.0 gallons (11 L) of wort. Stir in liquid malt extract and boil wort for 90 minutes, adding hops at times indicated. After transfering the wort to a fermenter, top up to 5 gallons (19 L). Aerate the wort well and pitch the yeast. Ferment at 62 °F (17 °C) for three days, then raise to 68 °F (20 °C) over five days and hold at that temperature to finish. Bulk age for two months before packaging in kegs or priming with fresh yeast and bottling.

The Caleb (2nd Runnings) Scottish 90/-

(5 gallons/19 L, extract with grains)

OG = 1.068 FG = 1.018
IBU = 28 SRM = 12
ABV = 6.9%

Ingredients

8 lbs. (3.6 kg) Maris Otter liquid malt extract
14.4 oz. (0.41 kg) British dark crystal malt (75/85 °L)
7.5 oz. (0.21 kg) British carastan malt (30/37 °L)
1.6 oz. (45 g) Special B malt
0.8 oz. (23 g) black patent malt
10.5 AAU US Challenger (60 min.) (1.5 oz/43 g of 7.0% alpha acids)
Wyeast 1056 (American Ale) or White Labs WLP001 (California Ale) yeast (2 qt./2 L stirred yeast starter)
Priming sugar (if bottling)

Step by Step

Two to three days before brew day, make your yeast starter and set on a stir plate.

Place the crushed grains in a steeping bag. Steep the grains at 155 °F (68 °C) in 3.0 qts. (2.9 L) of water. Remove the bag and rinse grains with 2 qts. (2 L) of 170 °F (77 °C) water. Add water to the brewpot to make at least 3.0 gallons (11 L) of wort. Stir in liquid malt extract and boil wort for 90 minutes, adding hops at times indicated. After transfering the wort to a fermenter, top up to 5 gallons (19 L). Aerate the wort well and pitch the yeast. Ferment at 62 °F (17 °C) for three days, then raise to 68 °F (20 °C) over five days and hold at that temperature to finish. When fermentation is complete, package in kegs and force carbonate or prime with sugar and bottle.

Split Fermentation Recipes

Oh So Crisp Pilsner

(5 gallons/19 L, all-grain)

OG = 1.055 FG = 1.012
IBU = 33 SRM = 3 ABV = 5.6%

The following two beers are made by splitting the wort into two fermentations. Only follow the ingredients list and step by step one time and split the wort after the boil. Follow the individual fermentation schedule for each recipe. The ingredients have been listed twice for reference or for brewing 10 gallons (38 L) of each beer independently.

Ingredients

23 lbs. (10.4 kg) Pilsner malt
13 AAU Magnum hops (90 min.) (1 oz./28 g of 13.0% alpha acids)
4.5 AAU US Saaz hops (20 min.) (1 oz./28 g of 4.5% alpha acids)
6.0 AAU Sterling™ hops (20 min.) (1 oz./28 g of 6.0% alpha acids)
10.8 AAU Liberty hops (10 min.) (2 oz./57 g of 5.4% alpha acids)
1 oz. (28 g) US Saaz hops (0 min.)
2 oz. (57 g) Sterling™ hops (0 min.)
Wyeast 2000 (Budvar Lager) or White Labs WLP802 (Czech Budejovice Lager) yeast (2 qt./2 L yeast starter)
1 cup corn sugar (if bottling)

Step by Step

Two or three days before brew day, make a yeast starter. If you are performing the split fermentation, make two separate starters: One with your lager yeast of choice (for Oh So Crisp Pilsner), the other with the saison yeast of choice (for So So Def Belgian Saison).

On brew day, mash in at 150 °F (66 °C) in 31 qts. (29 L) of strike water. Hold at that temperature for 60 minutes. Raise to 170 °F (77 °C), hold for five minutes then recirculate. Run off the wort and sparge with hot water. Collect 11.5 gallons (50 L) of wort. Boil the wort for 90 minutes adding hops at times indicated in the ingredients list. Chill the wort to 70 °F (21 °C) and rack half of the volume of wort into a sanitized fermenter. Chill the wort remaining in the kettle to under 50 °F (10 °C), rack to a second sanitized fermenter and pitch the lager yeast starter. Ferment at 48 °F (9 °C). In the first fermenter, follow the fermentation instructions for So So Def Belgian Saison (right). Following fermentation, rack to a keg or prime with sugar and bottle.

So So Def Belgian Saison

(5 gallons/19 L, all-grain)

OG = 1.055 FG = 1.005
IBU = 33 SRM = 3 ABV = 6.8%

Ingredients

23 lbs. (10.4 kg) Pilsner malt
13 AAU Magnum hops (90 min.) (1 oz./28 g of 13.0% alpha acids)
4.5 AAU US Saaz hops (20 min.) (1 oz./28 g of 4.5% alpha acids)
6.0 AAU Sterling™ hops (20 min.) (1 oz./28 g of 6.0% alpha acids)
10.8 AAU Liberty Hops (10 min.) (2 oz./57 g of 5.4% alpha acids)
1 oz. (28 g) US Saaz hops (0 min.)
2 oz. (57 g) Sterling™ hops (0 min.)
Wyeast 3724 (Belgian Saison) or White Labs WLP565 (Belgain Saison I) yeast (1 qt./1 L yeast starter)
1 cup corn sugar (if bottling)

Step by Step

Two or three days before brew day, make a yeast starter. If you are performing the split fermentation, make two separate starters: One with your lager yeast of choice (for Oh So Crisp Pilsner), the other with the saison strain of your choice (for So So Def Belgian Saison).

On brew day, mash in at 150 °F (66 °C) in 31 qts. (29 L) of strike water. Hold at that temperature for 60 minutes. Raise to 170 °F (77 °C), hold for five minutes then recirculate. Run off the wort and sparge with hot water. Collect 11.5 gallons (50 L) of wort. Boil the wort for 90 minutes adding hops at times indicated in the ingredients list. Chill the wort to 70 °F (21 °C) and rack half of the volume of wort into a sanitized fermenter. Pitch the saison yeast starter in this fermenter and ferment at 74 °F (23 °C). Chill the wort remaining in the kettle to under 50 °F (10 °C), rack to a second sanitized fermenter and pitch the lager yeast starter. In the second fermenter, follow the fermenation and packaging instructions for Oh So Crisp Pilsner (left).

Oh So Crisp Pilsner

(5 gallons/19 L, extract only)

OG = 1.055 FG = 1.012
IBU = 33 SRM = 4 ABV = 5.6%

The following two beers are made by splitting the wort into two fermentations. Only follow the ingredients list and step by step one time and split the wort after the boil. Follow the individual fermentation schedule for each recipe. The ingredients have been listed twice for reference or for brewing 10 gallons of (38 L) each beer independently.

Ingredients

12.5 lbs. (5.7 kg) Pilsner dried malt extract
14.3 AAU Magnum hops (60 min.) (1.1 oz./31 g of 13.0% alpha acids)
4.5 AAU US Saaz hops (20 min.) (1 oz./28 g of 4.5% alpha acids)
6.0 AAU Sterling™ hops (20 min.) (1 oz./28 g of 6.0% alpha acids)
10.8 AAU Liberty hops (10 min.) (2 oz./57 g of 5.4% alpha acids)
1 oz. (28 g) US Saaz hops (0 min.)
2 oz. (57 g) Sterling™ hops (0 min.)
Wyeast 2000 (Budvar Lager) or White Labs WLP802 (Czech Budejovice Lager) yeast (2 qt./2 L yeast starter)
1 cup corn sugar (if bottling)

Step by Step

Two or three days before brew day, make a yeast starter. If you are performing the split fermentation, make two separate starters: One with your lager yeast of choice (for Oh So Crisp Pilsner), the other with the saison yeast of choice (for So So Def Belgian Saison).

Add water to brew pot to make at least 6.0 gallons (11 L) of wort and raise to 170 °F (77 °C). Stir in the dried malt extract and boil the wort for 60 minutes, adding hops at times indicated in the ingredients list. Chill the wort to 70 °F (21 °C) and rack half of the volume of wort into a sanitized fermenter. Chill the wort remaining in the kettle to under 50 °F (10 °C), rack to a second sanitized fermenter, top up with water to 5 gallons (19-L) and pitch the lager yeast starter. Ferment at 48 °F (9 °C). In the first fermenter, follow the fermentation instructions for So So Def Belgian Saison (right). Following fermentation, rack to a keg or prime with sugar and bottle.

So So Def Belgian Saison

(5 gallons/19 L, extract only)

OG = 1.055 FG = 1.005
IBU = 33 SRM = 4 ABV = 6.8%

Ingredients

12.5 lbs. (5.7 kg) Pilsner dried malt extract
14.3 AAU Magnum hops (60 min.) (1.1 oz./31 g of 13.0% alpha acids)
4.5 AAU US Saaz hops (20 min.) (1 oz./28 g of 4.5% alpha acids)
6.0 AAU Sterling™ hops (20 min.) (1 oz./28 g of 6.0% alpha acids)
10.8 AAU Liberty hops (10 min.) (2 oz./57 g of 5.4% alpha acids)
1 oz. (28 g) US Saaz hops (0 min.)
2 oz. (57 g) Sterling™ hops (0 min.)
Wyeast 3724 (Belgian Saison) or White Labs WLP565 (Belgain Saison I) yeast (1 qt./1 L yeast starter)
1 cup corn sugar (if bottling)

Step by Step

Two or three days before brew day, make a yeast starter. If you are performing the split fermentation, make two separate starters: One with the lager yeast of choice (for Oh So Crisp Pilsner), the other with the saison yeast of choice (for So So Def Belgian Saison).

Add water to brew pot to make at least 6.0 gallons (11 L) of wort and raise to 170 °F (77 °C). Stir in the dried malt extract and boil wort for 60 minutes, adding hops at times indicated in the ingredients list. Chill the wort to 70 °F (21 °C) and rack half of the volume of wort into a sanitized fermenter and top up to 5 gallons (19 L). Pitch the saison yeast starter in this fermenter and ferment at 74 °F (23 °C). Chill the wort remaining in the kettle to under 50 °F (10 °C), rack to a second sanitized fermenter, top up to 5 gallons (19 L) and pitch the lager yeast starter. In the second fermenter, follow the fermenation and packaging instructions for Oh So Crisp Pilsner (left).

Split Boil Recipes

Becca's Bavarian German Hefeweisse

(5 gallons/19 L, all-grain)

OG = 1.048 FG = 1.012
IBU = 13 SRM = 5 ABV = 4.7%

The following two beers are made by making one wort and then splitting it into two factions before boiling and adding grains to steep in the wort for the second beer. Follow the individual ingredients lists and step by step instructions for each recipe. Follow the recipes in the order that they appear.

Ingredients

8.0 lbs. (3.6 kg) Pilsner malt
8.0 lbs. (3.6 kg) white wheat malt
4.0 lbs. (1.8 kg) German dark wheat malt (7 °L)
3.3 AAU Simcoe® hops (90 mins) (0.25 oz./7 g of 13.0% alpha acids)
Wyeast 3068 (Weihenstephan Weizen) or White Labs WLP300 (Hefeweizen Ale) or Safbrew WB-06 yeast (1 qt./1 L yeast starter)
1 cup corn sugar (if bottling)

Step by Step

Two or three days before brew day, make two yeast starters, one with hefeweizen yeast, the other with *Brettanomyces* yeast.

On brew day, mash all the wheat and Pilsner malts for both recipes together at 150 °F (66 °C) in 25 qts. (23.6 L) of water. Hold at that temperature for 60 minutes. Raise the mash temperature to 170 °F (77 °C), hold for five minutes then recirculate. Run off the wort and sparge with hot water. Collect 13 gallons (50 L) of wort. Separate the wort into two equal pre-boil portions. For Becca's Bavarian German Hefeweisse, boil the first half of the wort for 90 minutes, adding the hops at the times indicated in this ingredients list. Chill the wort rapidly to 70 °F (21 °C), transfer to a fermenter, aerate well and pitch the hefeweizen yeast starter. Ferment at 72 °F (22 °C). Following fermentation, rack to a keg and force carbonate or prime with sugar and bottle. For the other half of the wort, follow the instructions for Have Another 100% *Brett* Wheat APA (below).

Have Another 100% *Brett* Wheat APA

(5 gallons/19 L, all-grain)

OG = 1.049 FG = 1.009
IBU = 38 SRM = 5 ABV = 5.3%

Ingredients

5 gallons (19 L) of Becca's Bavarian wort (remaining from recipe at left)
8.0 oz. (0.23 kg) Caravienne® malt (steeped only)
13 AAU Simcoe® hops (15 min.) (1 oz./28 g of 13.0% alpha acids)
9.5 AAU Amarillo® hops (15 min.) (1 oz./28 g of 9.5% alpha acids)
2 oz. (57 g) Simcoe® hops (0 min.)
2 oz. (57 g) Amarillo® hops (0 min.)
1 oz. (28 g) Simcoe® hops (dry hops)
1 oz. (28 g) Amarillo® hops (dry hops)
White Labs WLP644 (*Brettanomyces bruxellensis* trois) yeast (1.5 qt./1.5 L yeast starter)
1 cup corn sugar (if bottling)

Step by Step

Two or three days before brew day, make two yeast starters, one with hefeweizen yeast, the other with *Brettanomyces* yeast.

Add the Caravienne® malt to the 5 gallons (19 L) of wort you reserved from brewing the Becca's Bavarian German Hefeweisse (left) using a muslin grain bag and steep in the wort for 20 minutes. Boil the wort for 90 minutes, adding hops at times indicated in this ingredients list. Chill the wort rapidly to 70 °F (21 °C), transfer to a fermenter, aerate well and pitch the *Brettanomyces* yeast starter. Ferment at 72 °F (22 °C). Add dry hops to the primary in a weighted hop sack seven days before packaging. Following dry hopping, rack to a keg and force carbonate or prime with sugar and bottle.

Becca's Bavarian German Hefeweisse

(5 gallons/19 L, extract only)

OG = 1.048 FG = 1.012
IBU = 13 SRM = 4 ABV = 4.7%

The following two beers are made by making one wort and then splitting it into two factions before boiling and adding grains to the steep in the wort for the second beer. Follow the individual ingredients lists and step by step instructions for each recipe. Follow the recipes in the order that they appear.

Ingredients

11 lbs. (5 kg) dried wheat malt extract
3.3 AAU Simcoe® hops (90 mins) (0.25 oz./7 g of 13.0% alpha acids)
Wyeast 3068 (Weihenstephan Weizen) or White Labs WLP300 (Hefeweizen Ale) or Safbrew WB-06 yeast (1 qt./1 L yeast starter)
Priming sugar (if priming)

Step by Step

Two or three days before brew day, make two yeast starters, one with hefeweizen yeast, the other with *Brettanomyces* yeast.

Add water to brew pot to make 10 gallons (38 L) of wort and raise the temperature to 170 °F (77 °C). Remove the brewpot from the heat and stir in the dried malt extract. Stir thoroughly to mix in all of the extract. Separate the wort into two equal pre-boil portions. For Becca's Bavarian German Hefeweisse, boil the first half of the wort for 90 minutes, adding the hops at the times indicated in this ingredients list. Chill the wort rapidly to 70 °F (21 °C), aerate well, top off to 5 gallons (19 L) and pitch the hefeweizen yeast starter. Ferment at 72 °F (22 °C). Following fermentation, rack to a keg and force carbonate or prime with sugar and bottle. For the other half of the wort, follow the instructions for 100% *Brett* Wheat APA (below).

Have Another 100% *Brett* Wheat APA

(5 gallons/19 L, extract only)

OG = 1.049 FG = 1.009
IBU = 20 SRM = 5 ABV = 5.3%

Ingredients

5 gallons (19 L) of Becca's Bavarian wort (remaining from recipe at left)
8 oz. (0.23 kg) Caravienne® malt
13 AAU Simcoe® hops (15 min.) (1 oz./28 g of 13.0% alpha acids)
9.5 AAU Amarillo® hops (15 min.) (1 oz./28 g of 9.5% alpha acids)
2 oz. (57 g) Simcoe® hops (0 min.)
2 oz. (57 g) Amarillo® hops (0 min.)
1 oz. (28 g) Simcoe® hops (dry hops)
1 oz. (28 g) Amarillo® hops (dry hops)
White Labs WLP644 (*Brettanomyces bruxellensis* trois) yeast (1.5 qt./1.5 L yeast starter)
1 cup corn sugar (if bottling)

Step by Step

Two or three days before brew day, make two yeast starters, one with hefeweizen yeast, the other with *Brettanomyces* yeast.

Place the crushed grains in a steeping bag. Steep grains in the 5 gallons (19 L) drawn off from orginal wort. Boil the wort for 90 minutes, adding hops at times indicated in this ingredients list.

Chill the wort rapidly to 70 °F, (21 °C), transfer to a fermenter, top off to 5 gallons (19 L), aerate well and pitch the *Brettanomyces* yeast starter. Ferment at 72 °F (22 °C). Add dry hops to the primary in a weighted hop sack seven days before packaging. Following dry hopping, rack to a keg and force carbonate or prime with sugar and bottle. BYO

BYO.com Bonus: When asked for advice on what it takes to make great beer, a famous German brewer listed four things: Buy the best ingredients you can possibly afford, clean everything all the time, boil the kettle well and pray. But what's actually going on in the boil, and how does the boil define a beer? There are several reasons why a good wort boil is important: http://byo.com/story1650

SG and Plato

Two sides of the same hydrometer

by Terry Foster

The simple hydrometer can tell us the gravity of our wort, and therefore the amount of extract we have recovered from our ingredients, and can even be used to tell us what extract we can expect from different malts. The hydrometer can also tell us how much extract the yeast has used during fermentation, and can give us a reasonable approximation for the alcohol content of our beer. After the thermometer, the hydrometer is perhaps the most important measuring instrument in the brewer's arsenal, yet many of us give little thought as to what it actually measures. Homebrewers usually use a hydrometer to measure specific gravity (SG), whereas commercial brewers more often use it to determine degrees Plato (°P), except in Britain where SG is more common. So what's the difference and why might one system be preferred over another?

Definitions

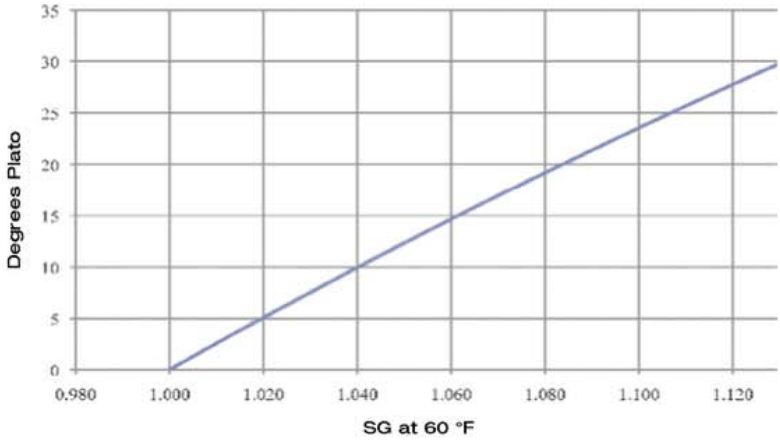
If we start at the beginning, a hydrometer is an instrument that can float in a liquid, and how far it sinks in a liquid is a measure of the density of that liquid. Hydrometers are weighted according to the density of the liquid to be measured, and the weights can be adjusted to measure the density of a whole range of liquids including oils and petroleum, battery acid, and a variety of sugar solutions including beer wort. Strictly speaking, the term "hydrometer" should only apply to aqueous (or water-based liquids), but let's not get too pedantic here. Each hydrometer carries a scale that can be calibrated to read the density of the liquid in various units, notably in our case, SG and °P.

Specific gravity is defined as the ratio of the weight of a given volume of the test liquid at a given temperature to the weight of the same volume of water at that same temperature. SG is the ratio of the densities of the two liquids, but as a ratio has no units, it is simply given as a number, such as 1.060. But SG is defined by the temperature at which the hydrometer and its scale were calibrated. That temperature is most commonly 60 °F (15.6 °C) for brewing SG hydrometers; it is possible to correct for measurements made at a different temperature, but it is best to measure your SG as close to the calibration temperature as possible.

> "Homebrewers usually use a hydrometer to measure specific gravity (SG), whereas commercial brewers more often use it to determine degrees Plato (°P) . . ."

Degrees Plato simply measures the density of the wort as percent sucrose. In other words, when you have a wort reading 10 °P on a Plato hydrometer, this means that the wort has the same density as a 10% sucrose solution at the same temperature. The temperature at which Plato instruments are calibrated is 68 °F (20 °C) and, again, measurements should be made as close to that temperature as possible. Since it measures sugar concentration, an instrument

Figure 1.
Degrees Plato vs. SG at 60 degrees F



reading in °P is more properly called a Saccharometer. Be very clear that the wort does not contain 10% sucrose, for brewing worts do not usually contain only sucrose but rather a mixture of sugars, such as glucose, maltose, maltotriose and so on.

A little bit of history

The concept of specific gravity was a not a new one when the idea of using a hydrometer to measure beer strength first became a practical reality. This was in the latter part of the 18th century, when an Englishman, John Baverstock, carried out experiments in his brewery and worked out a method to use the instrument to measure wort density. He didn't publish his work until after John Richardson, another English brewer had already published a method for using the hydrometer to measure both wort and beer strengths in 1784-85. Richardson called his instrument a Saccharometer, and used a somewhat odd scale. He calibrated it in "pounds per barrel," which meant the extra weight of an English beer barrel of 36 Imperial gallons (about 43 US gallons) of a wort or beer over that of a barrel of water. It may look as though he was measuring SG by the definition given earlier, but it is not because of the units used in the scale (in fact SG = [lb. per barrel/0.36] + 1000). English brewers took up the use of Richardson's Saccharometer and "pounds per barrel" was the normal unit used there until well into the 20th century, when SG became the norm.

That was unfortunate because such a unit was obviously peculiar to English brewers and did not appeal to their German brethren. So a gentleman by the name of Karl Balling in 1843 introduced a scale based on the concentration of sucrose in solution, making the assumption that sucrose solutions would have the same density as those of other sugars (which is not exactly true, but near enough for us). Balling's scale was later (in 1918) improved upon by Fritz Plato, and his name became attached to this instrument, although the differences incorporated by Plato are small and of no practical significance to brewers. The scale was rightly named after Balling for many years after Plato made his corrections, but nowadays it is Plato whose name is ascribed to this system of measurement.

Which is best?

The Plato scale became popular among commercial brewers in this country, partly because Richardson's pounds per barrel system was inappropriate in a country where the English barrel was not in use, and partly because of the high proportion of German brewers in this country from the middle of the 18th century onwards. An important reason why the Plato system is liked by commercial brewers is that since it measures the wort concentration as sugar, then it is regarded as a direct measurement of brewing

extract. In contrast, an SG hydrometer, strictly speaking, does not measure extract as sugar or as any other substance since SG is a ratio without units and is just a number. SG is now widely used by homebrewers because much of the literature and the ingredients when homebrewing became popular in the late 1970s and 1980s came from England where use of SG in brewing was the norm.

It is important to understand that both SG and Plato hydrometers really measure the same thing, since they both depend primarily on the density of the wort. I have already mentioned that we have sugars other than sucrose in brewing worts, and that these other sugars do have slightly different densities from those of sucrose. In practice, those differences are small enough to be ignored. However, if there are solids other than sugars present in solution (and therefore increasing the density of the wort), a Plato hydrometer would read those other solids as percent sucrose and as an increase in brewing extract. Correspondingly, those other solids would also result in an increase in SG as compared to a similar wort that did not contain such solids. In other words, both instruments are subject to the same error in terms of telling the brewer how much extract he has in his wort.

In short, there is really nothing fundamentally different between the two systems, and which you choose comes down to practical considerations. At BrüRm@BAR in New Haven, Connecticut we use °P, partly because our hydrometer contains a mercury thermometer and it directly reads corrections due to deviations from the calibration temperature. Such instruments are very easy to use but are relatively expensive. SG instruments are generally cheaper, and although some do carry a built-in thermometer they are not usually calibrated to give adjustments for different temperatures. A disadvantage with SG is the somewhat awkward form of the readings — 1.xxx, which means SG numbers cannot easily be used directly in calculations, such as for determining brewhouse efficiency or recipe formulation. Instead you have to work in terms of "gravity points." That is, use only the significant numbers after the decimal point.

However, SG hydrometers do have an advantage in terms of ease of reading, in the sense that "1" (that is 1.001) on the scale is only about one-quarter of 1 °P. So if the length of the hydrometer stem is the same and the range covered is the same in each case you can read SG more precisely than you can read °P, simply because the graduation marks are farther apart. In fact, for homebrewers, this is not really of practical significance, especially if the temperature of the measurement is not suitably controlled. I use several different SG hydrometers at home — one for "regular" brews covering 1.000-1.070, one for stronger beers with a range of 1.060-1.0130, and one for checking finishing gravity ranging from 0.980 to 1.020.

Relation between SG and °P

Although both instruments basically measure the density of the liquid, there is no fundamental relationship between the numbers they read, although approximate conversion formulae have been derived. One simple equation has been used to link SG at 60 °F (15.6 °C) and °P at 20 °C (68 °F):

°P = SG points/4

Note that this equation uses SG points as discussed earlier and more importantly that it is only an approximate relationship. This relation holds fairly well, in practical terms, for worts up to about SG 1.050, but gives inaccurate results for higher strength worts and should not be used for them. Obtaining a more accurate relationship is complicated by the fact that the instruments commonly used are calibrated at different temperatures. For instance, The American Society of Brewing Chemists have published quite complete tables comparing SG at 20 °C (68 °F) with °P measured at the same temperature, but that doesn't help a great deal if you are using an SG instrument calibrated at 60 °F (16 °C). You can make corrections for SG measured at different temperatures, but once you start doing so you are increasing the level of error in the treatment and might just as well stick to the simple equation above.

Several more equations for relating SG and °P more accurately have been proposed, one of the simpler ones is:

°P = 259 – (259/SG)

Where SG (not SG points) is measured at 60 °F (16 °C). The results for this equation are illustrated in the graph on page 81.

Conclusion

So I have indicated that SG and °P really measure the same thing but simply record the results in different ways. I have also shown that there is no great advantage in one system over the other, so whichever one you choose is entirely up to you. The most important thing is to be consistent and stick to the same system, since relationships between the two are clouded by the different calibration temperatures used for each type of instrument. The reason I have given two relatively simple ways of converting from SG to °P and vice versa is that this may be useful in deciphering recipes from another source, or if all your previous results are in one system and you have broken that hydrometer and have to use one working on the other system. Or, you may be in my position where I use only SG hydrometers in brewing at home, and only Plato instruments when brewing at BrüRm@BAR, so I need to know how to go from one system to another when converting recipes. BYO

Dark Grains

Options for using highly-kilned malts

Dark grains are an important ingredient in brewing many styles of beer. Grains that can be considered to be the "classic dark grains" include chocolate barley, black patent barley and unmalted, roasted barley. If one is so minded, it is also probably OK to include in the category of dark grains some of the very dark, roasted specialty grains such as chocolate wheat and special B.

In order to make dark grains, malt companies expose grains to relatively high temperatures within a roasting kiln for a particular amount of time, which depends upon what is being produced. Exposure to higher temperatures for longer times produces a darker grain. Longer, high-temperature kilning produces darker, more intensely flavored malt. Shorter, lower-temperature kilning produces lighter colored malt with less flavor intensity. Table 1, below, shows how temperature and time affect the color of kilned malt.

Pale malts are dried and kilned rapidly at low temperatures. Pale malts have a more subdued flavor and tend to be higher in the diastatic enzymes α-amalyase and β-amalyase (high temperatures deactivate these enzymes). More colorful and flavorful malts can be made using a two-step kilning process consisting of an initial low-temperature kilning followed by a higher temperature cure. The low-temperature step allows the formation of low-molecular-weight sugars and amino acids and the higher-temperature step allows the compounds to react via the Maillard reaction. During the Maillard reaction, compounds are formed that have very intense flavor and color characteristics. These flavor and color compounds include brown and flavorful melanoidins, volatile aldehydes such as furfural, and other compounds such as pyrazines, thiophenes, pyrroles and furans. If the malt is kilned at a high-enough temperature for a long-enough time, roasted malts

> "Longer, high-temperature kilning produces darker, more intensely flavored malt."

Table 1: Effect of Kilning Temperature and Time on Formation of Color

	Kilning Time (minutes)						
Temp °F (°C)	10	20	30	40	50	60	70
300 (149)	Pale Gold	Gold	Amber	Deep Amber	Deep Amber	Deep Amber	Deep Amber
350 (177)	Pale Gold	Amber	Deep Amber	Copper	Copper	Copper	Deep Copper
400 (204)	Gold	Deep Amber	Copper	Deep Copper	Brown	Brown	Dark Brown
440 (227)	Amber	Copper	Deep Copper	Brown	Dark Brown	Dark Brown	Dark Brown / Near Black

such as chocolate malt and black patent malt are produced. These malts contain the highest concentrations of the flavor, and color compounds and represent the most extreme results of the kilning process.

Exposure to high temperatures not only develops the dark colors and flavors associated with dark malts, but it also destroys the enzymes contained within the barley. Because dark grains have all been exposed to the relatively high temperatures within the kiln they have no functioning diastatic enzymes. As a result they do not actually need to be mashed. Steeping these malts is sufficient to release their flavor and remaining sugars.

Gordon Strong has talked about the different ways that dark malts can be used for brewing within his book *Brewing Better Beer*. In his book, Gordon describes dark grains as somewhat analogous to roasted coffee. As with coffee, time and temperature play critical roles in the taste of a beer brewed using dark grains. The intensity and duration of the exposure of dark grains to heat within the aqueous environment of the brewing process will determine how much flavor is obtained. In general, higher heat for longer periods of time will dictate the degree to which bitter, acrid and acidic flavors are extracted from the grains.

Dark grains such as chocolate malt, black patent malt and roasted barley do not need to be mashed, but brewers often do add dark grains into the mash, possibly because it is simply more convenient to handle all of the grain together. This isn't necessarily a bad way to do it, but there are other options. The following sections (using information primarily from Gordon Strong's book) describe the options:

Traditional mash

In this approach, the dark grains are milled and mashed along with the rest of the grains in the grist. This approach can lead to harsher, more astringent flavors in the finished beer, especially if the water being used is very alkaline, high in bicarbonates, or has a relatively high pH. Using dark grains in a traditional mash exposes the grains to the highest amount of heat for the longest amount of time, and so is most likely to produce a harsher, more astringent character in the finished beer.

Adding at vorlauf

The vorlauf is the recirculated wort typically drawn at the start of the sparge — usually the first few quarts of runoff for a homebrewer. These first runnings are then recirculated back to the top of the grain bed. Using this approach, the dark grains are not added during the mash, but rather are added at mash-out. The advantage of this method is that it avoids the long hot steep of the mash, and the dark wort from the vorlauf is recirculated through the mash tun again further reducing astringency.

Steeping

If using an approach of steeping dark grains, the dark grains should be milled separately. It is acceptable to mill the dark grains very finely if desired. A ratio of water to grain of 2 quarts (~2 L) of water to 1 pound (0.45 kg) of grain is a good ratio for steeping. The steeping options to be considered include hot steeping, cold steeping with no boil, and cold steeping with a short boil.

Hot steeping

Using this method, the dark grains are mixed with 165 °F (74 °C) water and steeped for five minutes. The mixture is then filtered or strained through a coarse filter media. The grain extract can then be added to the wort in the fermenter (not during the wort boil). The grain extract can also be refrigerated for later use if it is not needed for brewing immediately. You can store it for several weeks as long as it is first sanitized within the process, placed in a sanitary container, sealed, and stored cold.

Cold steeping with no boil

Using this method, the dark grains are mixed with cold water and allowed to sit at room temperature for a full day. The grain extract can then be added to the wort in the fermenter (not during the wort boil) or refrigerated for later use if is not needed immediately.

Cold steeping with a short boil

Using this method, the dark grains are mixed with cold water and allowed to sit at room temperature for a full day. The grain extract is then added to the brew kettle during the final 5-10 minutes of the boil.

The bottom line

According to the information in *Brewing Better Beer*, tasting results from experiments conducted by the Briess Malting Company indicated that black malt tasted best using the cold steep method, while roasted barley tasted best using either the hot steep or cold steep with a short boil method.

Steeping the grains and avoiding most of the longer, high temperature exposure results in less astringency, less harshness and less acidity. The only downside is that is adds another step in the brewing process. BYO

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Mixing Valve

Get a consistent water temperature

by Walter Diaz

Every time I travel I try to visit the local breweries and, if I can, do a brewery tour of each of the establishments. After touring a few breweries I found that every one does things a little bit differently in their procedures, but when it comes to the equipment there are definitely some standard tools of the trade. One of those tools that I have frequently seen used in microbreweries is the mixing valve.

As its name implies, a mixing valve is used to mix hot water and cold water to achieve a desired water temperature during the process. A mixing valve is very useful to achieve a precise temperature for mashing in or lautering, without the need for electronic temperature control. This column will explain the application and construction of a mixing valve for use at the homebrewing level.

Temperature control without electronic temperature controllers sometimes can be tedious even for preparing the water for a single infusion mash. The main problem is that the heaters always have some momentum to them and when turned off, the temperature continues to shoot up for some time. Water being hotter than needed is not a huge problem; it just means that we have to wait for it to cool down before mash in, or we have to add some "cold" water to the overheated water and mix.

Another homebrewing situation that is more difficult to control, even with electronic controllers, is maintaining constant temperature sparge water during lautering. In this process, water is drained from the hot liquor tank (HLT) and transferred to the lauter tun over the course of 30 minutes or so. Because this transfer time is fairly extended, you will find that you lose a significant amount of heat in the sparge water from the start to the finish of lautering. Adjusting the temperature would usually require a stoppage in draining water out of the HLT too, but the lautering process works best if done slowly and continuously, so this is not an attractive solution.

> "A mixing valve is very useful to achieve a precise temperature for mashing in or lautering, without the need for electronic temperature control."

This is where a mixing valve comes in handy. To keep a constant temperature using a mixing valve, you would intentionally overheat the water in the HLT by 15–20 °F (8–11 °C) and while this water is being transferred into the mash lauter tun some "cold" (room temperature water) is injected in line to achieve your target temperature. In the case of the lautering process, where significant temperature losses may be expected due to the long transfer time, it is very easy to make adjustments to the amount of "cold" water injected so that the water temperature remains constant through the entire process. As the hot water cools, you simply reduce the rate of flow of the cooler water to limit the cooling effect it has.

Parts and Materials

(1) ¼-inch needle valve (McMaster-Carr Part #46425K12)
(2) ¼-inch threaded tees
(2) ¼-inch x close nipples
(1) ¼-inch x 3-inch nipple
(1) ¼-inch ball valve (flow throttling valve)
(1) ¼ MPT x ⅜-inch barb adapter
1 Bi-metal thermometer with ¼-inch thread for installation
Teflon threading tape

BUILD THE MIXING VALVE:

1. ASSEMBLE NEEDLE VALVE CONNECTIONS

Thread ¼-inch x ¼-inch barb and ¼-inch close nipple into needle valve as shown. The needle valve used in this project is directional so the fittings must be installed according to the direction of water flow (barb fitting to the left of arrow and threaded close nipple to the right side of the arrow). One nice feature of this needle valve is that the handle threads are color coded providing a visual reference point for repeated settings (one full turn per color).

2. ASSEMBLE MIXING VALVE LOWER BODY

Assemble mixing valve lower body as shown. The needle valve side will receive cold water (tap water). The ⅜-inch barb fitting will receive hot water. Teflon threading tape should be applied on threads to get a good seal.

3. ASSEMBLE REMAINING PARTS

Assemble the remaining parts of the mixing valve upper body as shown. It is very important that the thermometer is installed in a vertical position to assure the thermometer is fully immersed in water for an accurate measurement. The main components of the mixing valve as shown in the picture are:

1. Needle valve is used to meter cold water injection.
2. Hot water inlet port (receives from hot liquor tank (HLT)).
3. Thermometer for indication of blended water temperature.
4. Throttling valve is used to adjust the flow rate going out of mixing valve.

Once the mixing valve construction has been completed, it is ready for installation into your homebrewing system. A ¼-inch ID hose is recommended for plumbing cold water to the mixing valve, and a ⅜-inch ID hose is recommended for plumbing hot water to the mixing valve from HLT. Use clamps for securing the hoses to the mixing valve. A final recommendation is to practice the temperature adjusting process until you become comfortable with the tweaking of valves and its response in temperature.

USE THE MIXING VALVE:

1. HEAT SPARGE WATER

Heat up sparge water in HLT approximately 20 °F (11 °C) higher than your desired set point (more or less depending on cooling losses expected). For example, if you want your sparge water to be 168 °F (76 °C), then you would heat up your water close to 190 °F (88 °C). Overheating the sparge water allows you to maintain a constant temperature throughout the lautering process by cooling it down by adjusting the cold water inlet at the needle valve.

2. PUMP SPARGE WATER INTO LAUTER TUN

Throttle the outlet valve of mixing valve to the approximate desired flow rate. Start pumping sparge water from HLT into lauter tun. Make any adjustments to the total water flow rate.

3. ADJUST COLD WATER FLOW

Adjust injection of cold water (room temperature water) until desired temperature is shown in thermometer located at outlet of mixing valve. Monitor the temperature of the sparge water at the outlet of mixing valve, and make small adjustments as necessary throughout the lautering process. BYO

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Holy Brewing

Priests face off in homebrew competition

On a Saturday in May, the picturesque church of Saint Mary the Virgin, in Witney, England, hosted its 3rd Annual Witney Beer festival. Witney, the area represented by Prime Minister David Cameron in the Houses of Parliament, is just over 10 miles west of Oxford and is commonly known as the gateway to the Cotswolds. It is said to be famous for the three B's — bread, blankets and beer. The first major brewery was founded in 1841 and we are delighted to still have an excellent brewery — Wychwood Brewery — in our midst! The beer festival, which has grown rapidly over each of the past three years, had over 2,000 people attending and over 40 barrels of beer were consumed.

> "The priests and ministers each tried different ways to present their beers with some very well-designed labels, and some unusual names — such as Rector's Tipple and Busty Bishop."

In a new development there was also a homebrewing competition for local priests. Advertised ecumenically with Churches Together in Witney, approximately 10 priests and ministers began to brew. For some, they were old hands with great expertise. For others, homebrewing was a new adventure. The winner was the Chaplain to the Bishop of Oxford, who is a regular brewer. Coming in 2nd place was the Rector of Witney, the Rev'd Toby Wright, who had never brewed before.

"Witney is a brewing town, with our own brewery, Wychwood. I've got newfound respect for those who do this professionally — there's a lot to it and it's all quite technical," Rev'd Wright said following the competition. Asked whether he would be continuing to brew, Rev'd Wright responded he thought he'd leave that to the experts.

The priests and ministers each tried different ways to present their beers with some very well-designed labels, and some unusual names — such as Rector's Tipple and Busty Bishop. As part of the process, local brewers tasted the homebrews, wrote down tasting notes and came up with the winners after a significant discussion of color, taste, balance and distinctiveness.

The event was also able to draw people into the ancient space that is 770 years old and has been the center and life of the town since before that time as this is the new church built on the site of the more ancient one.

There are plans afoot to continue to develop the homebrewing competition and encourage others to have a go at it, as it is a great social occasion and builds community. This included drawing people who have lived in the community all their lives into the building for the first time. One local resident said, "I've lived here since I was young, but I've never been inside the church before. It's good to see Witney's ancient church welcoming us all in. And I love the beer!"

As part of the on-going development, the hope is to ensure that there are over 50 craft beers and ciders to offer in 2015. There are also discussions of how to develop the homebrew side of the venture and to draw on the expertise of local brewers.

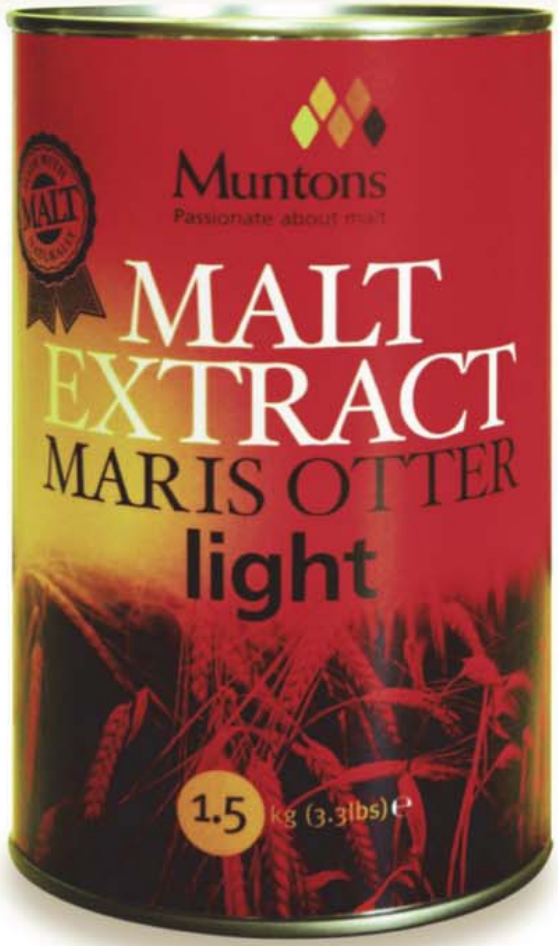
If anyone is traveling to the United Kingdom next year in May — do come and join the 4th Witney Beer Festival on May 2, 2015.

For more information on the parish see www.witneyparish.org.uk.

Got a fun human interest homebrew story that you would like to tell in a future "Last Call"? Email it to edit@byo.com.

Photo courtesy of Revd Toby Wright

CAN DO!



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