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Brew Your Own

THE HOW-TO HOMEBREW BEER MAGAZINE

JULY-AUGUST 2013, VOL.19, NO.4

HOP! TO IT!

- New Hop Varieties and Hop Blends for your Homebrew
- Harvest Wet-Hopping Techniques & Recipes

2 German Classics: Brewing Helles & Kölsch

Proper Serving Tips & Glassware for your Homebrew

+ 2 Easy, Handy Projects

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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 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.

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what's happening at BYO.COM

Hop to Style!

When seeking the perfect hop for your recipe, consider the characteristics of each variety. Even with all these new hops available, Mark Garetz's advice on hop usage and pairing the right variety with the right beer style remains timeless.
http://byo.com/hops/item/853-hop-to-style

The Art of Presentation

Poor presentation can kill your guests' appetite for your brew. The beer world is filled with ins and outs of brewing and storing, but what about drinking? Learn how to maximize your beer through the art of presentation.
http://byo.com/serving/item/1465-the-art-of-presentation

BYO Label Contests

Curious to see how our label contest has grown? Head over to BYO.com to check out previous winners and competition write-ups from as far back as 1996. This year's competition is the 18th annual, and the entries have only gotten better.
http://byo.com/label-contest/item/2419-2012-byo-label-contest-winners

Summer Clones

Looking for more brewing fun in the sun? Check out this article featuring six recipes of summer clone brews from Goose Island, Firestone Walker, Harpoon, Brooklyn, Anderson Valley and Magic Hat.
http://byo.com/component/k2/item/1888-six-summer-beer-clones

Cover Photo: **Charles A. Parker**

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Volume 19, Number 4: July-August 2013

Saison techniques

The saison story by Gordon Strong in the May-June 2013 issue was great! There was lots of tremendous detailed information and it could not be more timely, I was researching saison history and recipes when the magazine showed up in my mailbox. I do have a few questions, however; please apply these to both Mr. Fletty's Rye Saison and Mr Jackson's Saison with Ginger (all-grain) recipes. Could you provide a water profile for these recipes and do you use things like Irish moss, anti foaming agents or yeast nutrients in these brews?

Ken Luken
via email

Story author Gordon Strong replies: I don't think saison requires any special water. Fletty uses St. Paul, Minnesota water, which I know is quite soft. So if your water has relatively low minerals or a little bit of sulfate, I think it would be fine as is. If you have carbonate water (like I do), I'd use reverse osmosis (RO) water with maybe a teaspoon of calcium chloride or calcium sulfate in the mash for 5 gallons (19 L). But I do that for all my beers; nothing really different for this style. Since the yeast is expressive, I don't think you want water to impart much of a character so I'd keep it relatively neutral. That applies just to beers that are mashed; extract beers can use any water, really.

Adding Irish moss is optional, as is any fining agent. Add whatever your normal brewing process uses. I don't think any of the brewers use them, but it wouldn't really hurt anything.

Antifoaming agents are not likely used. I personally have never used them. Just use a larger carboy or a blowoff tube. I always have concern about what they'd do to the finished beer. I tend not to add a lot of extraneous stuff in my beer.

Yeast nutrients are also optional, but recommended. I tend to use them when making starters and during the boil. I prefer the Wyeast nutrient blend. If you have a good pitch of yeast and have prepared the wort properly, they aren't required but are good insurance. Follow the manufacturer's instructions for the nutrients.

contributors

Lisa Morrison, also known as "The Beer Goddess," is Host and Producer of "Beer O'Clock!," the Pacific Northwest's only weekly, hour-long commercial radio show devoted to craft beer. She released her first book, *Craft Beers of the Pacific Northwest: A Beer-Lover's Guide to Oregon, Washington and British Columbia* (Timber Press, 2011) to high critical acclaim, and writes for numerous beer publications.

Lisa was chosen as one of the three original recipients — and the first female recipient — of the national Beer Journalism Awards, presented by the Brewers Association.

In this issue, on page 48, Lisa discusses how to homebrew with wet (or fresh) hops.

Gretchen Schmidhausler is a brewmaster who runs GretchenBrew LLC., a beer-centered business offering consulting, private food and beer tastings, beer education and publications. She was the longtime Head Brewer at Basil T's Brewery in Red Bank, New Jersey, and is in the process of starting up The Little Dog Brewing Co. in the Garden State. Her recipes have won numerous medals at the Great American Beer Festival; including gold medals in 2006 and 2002 in categories for classic Irish stouts and coffee-flavored beers.

On page 40 of this issue, Gretchen introduces four new hop varieties that have hit the market in recent years and captured the imagination of brewers.

Horst Dornbusch is the founder and owner of Cerevisia Communications, a consulting firm that deals with all aspects of the brewing industry. (His website is www.cerevisiacommunications.com.) Horst is the author of several books on beer and brewing and was *BYO*'s "Style Profile" columnist for several years. Most recently, he was an Associate Editor for *The Oxford Companion to Beer* (Ed. Garret Oliver, 2012 Oxford University Press).

Horst lives in Massachusetts, but was born in Düsseldorf, Germany and visits there frequently. In this issue, on page 26, he explores two German brews that are perfect for the summer — helles, which originates from Munich and Kölsch, a favorite in Cologne.

Rusty Truck Amber Ale correction

In the Rusty Truck clone recipe on page 12 of the March-April 2013 issue of *BYO*, the instructions say "Add the dry hops and allow the beer to condition for 1 week." Are you referring to the Cascade at 0 minutes or is there another hop addition that was missed and not included in the recipe as published? Isn't a 0 minute hop addition usually a flame out addition?

Randy Saunders
via email

Story author Marc Martin responds: First let me say thanks for being a loyal reader/subscriber. The line that says, "add dry hops" was in the first draft as the owner had mentioned dry hopping. However, the brewer didn't mention any when I questioned him on the recipe. I called him to verify this after receiving your email. They do dry hop some of their beers but not the amber.

Oxygen permeability in plastic

Editor's note: The "Advanced Brewing" column in the May-June 2013 issue on oxygen permeability and plastic brought this response:

Hobby Beverage Equipment Company, manufacturer of the minibrew fermenters, mash tuns and hot liquor tanks made their first shipment in December 1997. I spent 1997 researching materials with the idea of making a fermenter. About that time a friend in the plastic business came by my shop to see what I was doing. One thing lead to another and after much research I was making plastic fermenters. One of the largest oil companies in the world makes pellets that are melted and molded to form a product. They have done a lot of research for a customer on plastic sandwich bags. I told them what I had in mind. Their response was, "you do not have a permeability problem." I started researching into what others were using such as hospitals, food companies and research labs where bacteria and permeability could be a problem. They all use HDPE as it is less expensive, easier to handle and fits their needs better. Long term storage in an HDPE fermenter was discouraged in the "Advanced Brewing" column in the May-June 2013 issue of *BYO*. I can't imagine why anyone would leave finished beer in a fermenter after it reaches target gravity. It should be transferred to a bright beer tank, keg or bottles. However, that said, HDPE should work well for long term storage in a clean sealable tank. Many liquids last for years in plastic bottles.

John S. Thomas
Hobby Beverage Equipment Company

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READER PROJECT: Strut Brew Stand

Steve Gift • Lititz, Pennsylvania

Strut Brew Stand Tools and Materials

Saw to cut struts
File
½-inch wrench/socket
(4) Main beams, 36 inches (cut)
(5) Vertical supports, 20.75 inches (cut)
(7) Cross beams, 12.75 inches (cut)
(8) Corner fittings
(8) Flat connectors
(2) "L" fittings
(46) ½–inch bolts
(46) Strut nuts

When I became an all-grain brewer I made my setup work by using a cooler mash tun perched up on my workbench with a single converted turkey fryer burner and keggle to heat the liquids. Soon I had a desire for more control over the process, and a larger overall capacity. I began looking for ways to fabricate a low-cost multiple station brewing stand, but most of what I was finding on the DIY side involved welding. I did not like the idea of being locked into a design that could not be changed without some major cutting and re-welding fabrication work.

Enter strut. This material is extruded steel in a structural shape designed to support a very heavy load while also providing a system whereby pieces can be connected together with a huge array of standard fittings. The beauty of this material is that it can be cut to any length fairly easily, and connected together with the fittings to build any brew stand/rig configuration imaginable. The only tools you need to build your stand are a band saw or abrasive chop saw to cut the strut stock material, a file to remove the burs, and a ½-inch box wrench or socket. All of the fittings can be purchased where strut is sold (or online) and utilize a specially designed locking nut that rides in the track of the strut, allowing you to place fittings, clamps, brackets, angles or other pieces of strut anywhere you want them. When every piece is connected and tightened, the resulting stand is extremely strong and able to support a load many times greater than several brewpots full of liquid. If you find you want to add a station, or lower the stand by 4 inches — no problem. Just cut a few new pieces of strut, un-bolt the old, and bolt in the new. It really is as simple as that.

I've included a parts list for my simple two-station, single-tier stand that measures 36 inches (91 cm) long, 16 inches (41 cm) wide, and 24 inches (61 cm) high. It can heat two vessels simultaneously and incorporates a direct-fired recirculating mash tun. If you would like more information on my build, I put together www.strut-stands.com, where you can also order standard kits with pre-cut lengths you can put together at home with just a ½-inch wrench.

byo.com brew polls

Do you choose your beer glassware to match your beer style?

Yes, sometimes 45%
No, but I probably should 22%
Yes, every time 17%
No, I don't think it's important 16%

social homebrews

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Brewtoad Acquires Hopville.com

Brewtoad.com

The homebrewing web and mobile application Brewtoad.com, which empowers homebrewers to create and discover homebrew recipes, has acquired Hopville.com. The process will involve making current Hopville accounts and recipes available on Brewtoad. Now users will be able to connect with over 40,000 brewers and explore over 150,000 recipes. For more information on the transition visit Brewtoad.com.

Hooch: Simplified Brewing, Winemaking & Infusing at Home

For anyone who has considered brewing a batch of beer or mead at home, or making a custom barrel of wine with local fruit, this thorough guide will clear a path to the bottle. Perfect for the city-dweller, urban gardener, or anyone with limited space and a desire to make custom concoctions.

$22.00 at major booksellers

calendar

July 12–13
Indiana State Fair Brewers' Cup
Indianapolis, Indiana

The 2013 Indiana State Fair Brewers' Cup will feature both homebrew and professional divisions. The homebrew category is a qualifying event for the Masters Championship of Amateur Brewing. Three bottles are required per entry. Drop-offs are accepted at Sun King Brewing in Indianapolis with registration available online.
Entry Deadline: June 28
Web: www.brewerscup.org

July 13
German Fest Stein Challenge (entry deadline)
Milwaukee, Wisconsin

Registration opens June 15 and closes July 13 for this German-style-only homebrew competition, organized by the Beer Barons of Milwaukee. Judging takes place July 25 and 27, and the winning entry will be brewed by the Milwaukee Brewing Company for serving at the Milwaukee Ale House.
Entry Fee: $8 per entry
Web: http://germanfesthbc.beerbarons.org/

August 24
Macon Beer Festival Homebrew Competition
Macon, Georgia

The Macon Beer Festival is a Pints for Prostates event, aiming to promote awareness and education of prostate cancer to the community through the universal language of beer. The homebrew contest is the first annual event. Participants are invited to enter as many beers as they would like, restricted to one per subcategory. The competition is open to all homebrewers regardless of location, but the Holy Ale! award is presented to the Georgia Homebrew Club with the highest point total.
Entry Fee: $10.00 per beer
Registration Deadline: August 8
Web: www.themaconbeerfest.com

homebrew drool systems

Thompson Heights

Jody "Jodewha" Wnuk • Manistique, Michigan

I've been brewing since 2007 and call my brewery Thompson Heights Brewery. My wife, Meg, came up with the slogan, "Reach For The Heights." I use whole grain, leaf hops and Wyeast liquid strains. I brew five different beers and I keep Palien Pale Ale and Promiscuous Porter on tap year-round. I brew my Breakfast Stout in the winter and Half-Wit Heffy during the summer months. I also do two special batches of Drunken Yooper Brown during the year. I use Wyeast 1028 (London Ale) for all my beers except the Heffy, in which I use Wyeast 3068 (Weihenstephan Wheat).

My grain mill is homemade from 1½-inch knurled steel rollers. I grind 10 pounds (4.5 kg) in about three minutes. Rollers are geared and the belt drive has a ½ horsepower motor. I bring 16 gallons (60 L) to the brew kettle and chill 12 to 13 gallons (45 to 49 L) through my counterflow chiller.

I use a gravity system. The homemade kettles are 20-gallon (75-L) made from 20-inch (0.5-m) stainless pipe. The mash tun screen is ⅛-inch perforated brass plate. It takes about six hours from lighting the burner until the kettles are cleaned and put back in the shop.

There's always homebrew to be drawn from three taps of the Amana 17-cubic-foot (0.5 cubic meter) kegerator at Thompson Heights Brewery. For more about my setup, check out my website at www.thompsonheights.com.

beginner's block

SELECTING HOPS

by dawson raspuzzi

Whether it's a double IPA from which the hops literally jump from the glass to punch you in the mouth, or a stout where the hop characteristics are more subtle and used to balance the sweetness of roasted malts; choosing the right variety of hops is not a responsibility to be taken lightly.

Many factors must be considered when selecting the right hops to balance your homebrew. You must first understand the purpose each hop addition serves — whether it is to add bitterness for balance, to add aroma, or to flavor your beer. A misguided hop selection may clash with other ingredients in the beer such as spices, fruit, or even other hop additions. In order to select the appropriate hops for each recipe, it is important to understand the basic differences between varieties.

Hops are generally divided into two types: bittering and aroma. Some varieties, however, bring both to the glass. Hop cones contain little yellow sacs, or lupulin glands, that hold the bittering agents, called alpha acids, and aroma constituents that come from essential oils. Hops used for bittering generally have higher percentages of alpha acids. High alpha US varieties such as Simcoe®, Columbus, or Nugget, have anywhere from 10 to 18% alpha acids and are often used for adding bitterness to beer, (although Simcoe® and Columbus are sometimes used for aroma as well).

It is important to remember that the longer hops are boiled, the more bitterness will be extracted from them. Just because a variety of hops may have a high alpha content does not guarantee it will bring lots of bitterness to a beer if it is not boiled long enough. Hop aromas are largely lost in the boil, so aroma hops must be added late in the boil or after the boil is complete.

Hops intended to add aroma have high concentrations of essential oils and may have lower concentrations of alpha acids; however, more and more brewers are now using hops with high alpha acids for aroma as well because high alpha hops are often also high in essential oils. Alpha acids aren't very soluble in wort. However, boiling causes a chemical reaction called isomerization that transforms them into iso-alpha acids. Iso-alpha acids are soluble, and they are what create bitterness. This is why hops intended to add bitterness to a beer must be added early in the boil.

The other source of bitterness in hops comes from beta acids, also known as lupulones. Rather than isomerization, beta acids undergo oxidation during aging to produce their bitterness. Oxidized beta acids are not as bitter as isomerized alpha acids, so their role in the bittering process is lesser, but still of value.

Hops also play a key role in a beer's aroma. Hop aroma compounds, known as terpenes, are lumped into the category known as essential oils that typically make up 1 to 1.5 percent of a dry hop's weight. Most hop terpenes are lost to the wort as it boils, so aroma hops must be added late in the boil (last 5 to 10 minutes) or after the boil to be utilized effectively.

Depending on the ratio of different terpenes, hop varieties can bring an array of tastes and aromas to beer such as floral, sweet, perfumy, citrusy, earthy and piney, to cite a few. To get a true sense of a hop's aroma, rub a hop cone between your hands vigorously to release the oils and then take a big whiff. Rubbing multiple varieties between your hands at the same time will give you a good sense of what hops accentuate each other, as well as which do not. A general rule is that hops native to the same region often complement each other.

by marc martin

DEAR REPLICATOR, LAST FALL I MADE A TRIP UP TO THAT GREAT BEER CITY, PORTLAND, OREGON, TO VISIT A GOOD FRIEND. HE TOOK ME TO THE SOUTHWEST PART OF TOWN TO SASQUATCH BREWING. THEY HAD ONLY BEEN BREWING FOR A FEW MONTHS BUT ALL OF THEIR BEERS WERE EXCELLENT. BY FAR MY FAVORITE WAS THE OSA (OREGON SESSION ALE). IT WAS LOW ALCOHOL BUT WITH GREAT BODY AND BALANCE. I WOULD LOVE TO BE ABLE TO BREW THIS AT HOME AND HOPE YOU CAN GET SOME INFO.

DAVID RANKER
SAN DIEGO, CALIFORNIA

Tom Sims, the Owner and Head Brewer at Sasquatch Brewing Co., is relatively new to commercial brewing but his success can't be denied. With his good friend Steve Neely, Tom entered the world of homebrewing a mere three years ago and he was immediately hooked.

Tom developed a plan to combine his hobby with a new business in August 2011 and signed a lease on a closed Italian restaurant. Once the restaurant was up and running, Tom began to assemble equipment for a 7-barrel brew house. He found a used industrial boil kettle on Craigslist. The mash tun is a used, open-top dairy tank with a copper tube drain manifold. He bought new wine fermenters, two 7-barrel and one 14-barrel. Those, combined with used Grundy conditioning tanks in a large walk-in cooler, and his system was complete.

Knowing that their homebrew recipes would not be linear in scale, the services of a well-known local brewery consultant were solicited. The first batch, a pale ale, was brewed in February, 2012. Since then, eight other styles have been added to their lineup of beers. Sasquatch beer was featured twice at the Portland Spring Beerfest and the 2013 Cheers to Belgian Beers event.

Assistant Brewer Charlie Van Meter came on board to help Tom out in late-fall of 2012. Charlie brewed his first homebrew batch as soon as he turned 21. Charlie also helped out with the startup of the popular Portland U-Brew.

The Oregon Session Ale is based on a cream ale recipe developed by their consulting company, Northwest Brewery Advisors. This clear, straw-colored beer exhibits a white, creamy, long-lasting head. Just enough bitterness is supplied to balance the residual sweetness, and it's an easy-drinking beer with delicate grain flavors that demand another pint.

David, you'll be able to enjoy your new favorite session ale anytime because now you can "Brew Your Own." For further information about Sasquatch Brewing Company and their other fine beers, visit www.sasquatchbrewery.com or call the brewery at 503-402-1999. BYO

Sasquatch Brewing Company's OSA (Oregon Session Ale) Clone

(5 gallons/19 L, extract with grains)

OG = 1.048 FG = 1.009 IBU = 20 SRM = 3.1 ABV = 5.1%

Ingredients

3.3 lbs. (1.5 kg) Muntons, extra light, unhopped, malt extract
10 oz. (0.28 kg) light, dry malt extract
1 lb. (0.45 kg) pale malt
1.75 lb. (0.79 kg) flaked corn
8.0 oz. (0.22 kg) flaked barley
8.0 oz. (0.22 kg) Carapils® dextrin malt
5.5 AAU Willamette hop pellets (60 min.) (1 oz./28 g at 5.5% alpha acids)
1.37 AAU Willamette hop pellets (15 min.) (0.25 oz./7 g at 5.5% alpha acids)
½ tsp. Irish moss (30 min.)
½ tsp. yeast nutrient (15 min.)
White Labs WLP 001 (American Ale) or Wyeast 1056 (American Ale) yeast
0.75 cup (150 g) of corn sugar for priming (if bottling)

Step by Step

Steep the crushed grain and flaked corn in 2 gallons (7.6 L) of water at 152 °F (67 °C) for 30 minutes. Remove grains from the wort and rinse with 2 quarts (1.8 L) of hot water. Add the liquid and dry malt extracts and boil for 60 minutes. While boiling, add the hops, Irish moss and yeast nutrient as per the schedule. Once the boil is complete, 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. Transfer to a carboy, avoiding any splashing to prevent aerating the beer. Allow the beer to condition for one week and then bottle or keg. Allow the beer to carbonate and age two weeks.

All-grain option:

This is a single step infusion mash using 4 lbs. (1.81 kg) Pilsner malt and an additional 2.25 lbs. (1.02 kg) 2-row pale malt to replace the liquid and dried malt extracts. Mix the crushed grains with 6 gallons (22.7 L) of 173 °F (78 °C) water to stabilize at 152 °F (67 °C) for 60 minutes. Sparge with 175 °F (79 °C) water. Collect approximately 6 gallons (22.7 L) of wort runoff to boil for 60 minutes. Reduce the 60-minute Willamette hop addition to 0.8 oz. (23 g) (4.4 AAU) to allow for the higher utilization factor of a full wort boil. Follow the remainder of the extract with grains recipe.

Eisbock

Cold as ice

by Dawson Raspuzzi

GETTING YOUR HANDS ON AN EISBOCK IN THE U.S. CAN BE DIFFICULT BECAUSE OF FEDERAL AND STATE LAWS AROUND DISTILLATION THAT LIMIT THE AMOUNT OF ICE COMMERCIAL BREWERS MAY REMOVE TO CONCENTRATE THE BEER (WHICH IS CONSIDERABLY LESS THAN IS TRADITIONALLY SUBTRACTED FOR THE STYLE). TO AVOID THE NEED FOR A DISTILLING LICENSE, MOST AMERICAN BREWERIES OVERLOOK THE STYLE. HOWEVER, WE HAVE TRACKED DOWN TWO PROS WHO COULD NOT RESIST THE TEMPTATION OF BRINGING THE POTENT GERMAN LAGER TO AMERICA.

Our Fire and Eisbock, which was a seasonal offering available for the first time this past winter, was the first beer of this unique style I set out to make at Mammoth Brewing. We previously iced a pale ale and before that we made an eisbock out of a doppelbock by accident when some kegs froze in the winter. After freezing, we tasted the beer that had not turned to ice in those kegs and it tasted great! That mistake, much like how eisbock originated in Germany, sparked the idea for Fire and Eisbock.

This past winter we (intentionally) brewed 22 barrels of Fire and Eisbock. Our Eisbock has a very similar grain bill and hop character as our doppelbock. The big difference, of course, is freezing out a portion of the water, which concentrates the alcohol and creates a smoother finish.

For our eisbock, we used Weyermann CaraMunich®, Gambrinus Dark Munich, and Crisp Crystal 120 for the specialty malts, and Gambrinus ESB as our base malt. The hops we used were Sterling, just enough to balance the sweetness from all of the specialty malt. I also like to try and get a little bit of floral aroma into the beer. A piece of advice for anyone brewing an eisbock for the first time would be to make sure to get a complete fermentation. The icing will concentrate the malt flavors and sweetness of the beer so any unfermentable sugars will be more evident. Plan your bittering hops with that in mind as well.

I think an eisbock could be made at home pretty easily by sticking the beer in the freezer after fermentation and then watching for ice to form. At that point the ice could be skimmed off the top of the beer and racked from the bottom. For us, it's a little more difficult; we have to rely on our glycol jackets to get the beer cold enough to start freezing. It is hard to coax our glycol unit down that cold with everything else going on in the brewery. That is why Fire and Eisbock is a winter seasonal. We use an outside fermenter and hope for really cold nights to help out the glycol. Our outside fermenters also have top manways so we can open them up and look for ice formation.

Fire and Eisbock is a lager, so we ferment it at 50 °F (10 °C) with a Mexican lager strain. After primary fermentation and diacetyl rest, we drop the temperature to 32 °F (0 °C) for a week and drop as much yeast as possible out. Then we drop the temperature down to 25 °F (-4 °C) and wait for it to start freezing. That's what takes a while. Since we used an outside tank and turned off the glycol jackets at night, the beer temperature bounced between 25 °F (-4°C) at night to 29 °F (-2 °C) during the day for two weeks. After we saw ice formation and liked the flavor, we transferred the beer off the bottom and left the ice behind. Other than that, the brewing process is not any more difficult than brewing a doppelbock.

Eisbocks are a really fun style to make and concentrating it really adds something to the beer. It really does smooth out the beer.

Jason Senior has worked for Mammoth Brewing Co. in Mammoth Lakes, California, since 2000 and has been the Head Brewer there since 2006. Jason was a homebrewer before landing a job at the brewery, where Jason's recipes won multiple awards in last year's Brewers Association World Beer Cup.

Matthew Allyn, Founder and Master Brewer of Voodoo Brewery in Meadville, Pennsylvania, has been brewing professionally for 20 years. After studying brewing techniques in Germany, Matt returned to the states where he has started a handful of breweries across the country. Matt has brewed a number of eisbocks in his career. To the excitement of Pennsylvanians, Voodoo brewed Trapped Under Eisbock for the first time this past winter.

Eisbock is pretty much a freeze-distilled product. We do ours from an American dry doppelbock design along the lines of Troegenator. We freeze the beer and test its depth from the top where we have no direct cooling jackets. By the time the ice measures about one inch thick on the bottom of the tank it measures two to three inches thick on the walls. At that point we rack the beer into another tank to carbonate and package it. Removing some of the water concentrates the beer, thus concentrating flavor. This gives you a non-typical flavor that cannot be replicated from traditional brewing methods.

Brewing an eisbock is more difficult on a large-scale system than for a homebrewer, largely because it is difficult to get the large tanks cold enough to freeze-concentrate the beer. We run our chiller at 20 °F (-7 °C) for a month. We run glycol to the tank to freeze the outer layer of the tank faster than normal. This way the cold temperature does not absorb into the beer as much. The water on the outside freezes first, similar to how a lake freezes. Over time, the ice will slowly thicken until we feel we have frozen enough out of the beer.

After racking the beer, I take a measurement of the water that is left in the tank after it melts to get a clear idea of the beer's alcohol content. If too much ice has been removed we may add de-aerated water to achieve our desired alcohol level and taste.

Trapped Under Eisbock sticks with a very standard German recipe using 50/50 German Pilsner and dark German Munich malt. To be different, we add fresh tart cherries for about a month after freezing. Any lager yeast strain will work fine. Like traditional eisbocks, ours has very little hop character. We go with a standard German strain, such as Hallertau, to add bitterness to the beer. The beer ends up at about 18 IBUs. BYO

High Alcohol Beers

Starting your yeast starter

by Ashton Lewis

Q DO YOU HAVE SUGGESTIONS FOR BREWING A HIGH ALCOHOL BEER? I'M TRYING TO GET ONE OVER 20%.
SCOTT BAND
TAMPA, FLORIDA

A In order to brew high alcohol beers, three challenges must be addressed. The first is the production of wort with the potential for a high degree of fermentation. The second challenge is producing high gravity wort. The combination of high original gravity with high degree of fermentation gives you the chance of producing the big beers you seek. The third challenge is carrying out the fermentation without problems from unhappy yeast.

Brewing high alcohol beers using all-grain techniques is the most difficult approach. The first thing that will put you on the right path is to use a mash profile that results in highly fermentable wort. I like conducting a long mash that starts around 147 °F (64 °C). This step may last as long as two hours before the mash reaches 158 °F (70 °C) for about 20 minutes and then mash-off at 169 °F (76 °C).

The challenge with ultra-high alcohol beers is that the first wort gravity of a relatively thick mash is about 24 °Plato (1.101 specific gravity) and this will give you a beer with about 10% alcohol by volume. The only way to really push the original gravity higher than this when brewing all-grain beers is to use a very long boil, and when you do this some of the fermentable sugars are converted into non-fermentable components via browning reactions. The other problem, especially cost-wise, is that the pursuit of high gravity wort oftentimes sacrifices efficiency in return for strength. Some brewers make a weaker beer by collecting lower gravity runnings from the mash, but this is not always practical.

One method used by many brewers of high alcohol beers is to add fermentables to the wort in the kettle or even in the fermenter. Cane sugar, rice syrup, honey, dried malt extract (DME) and liquid malt extract (LME) are examples of some of the ingredients added to wort to boost strength.

So now we have a few ideas of how to produce high gravity wort with the potential to produce a very strong beer. The word "potential" is really important because it is the yeast that ultimately does the work. You need to use a yeast strain that is known to have a high tolerance for alcohol, pitch sufficient healthy cells and give the wort enough oxygen so that the yeast can properly divide and generate the cell membranes and organelles required for growth.

Selecting an alcohol-tolerant strain is not so difficult due to the number of yeast strains available and the really great information yeast labs provide about the strains they carry. And developing a starter with enough cells is not difficult; you simply need to use proportionally more yeast starter as the original gravity increases. Wort aeration is a true challenge since the solubility of oxygen in wort decreases as gravity increases. One way to address this inconvenient fact is to use oxygen instead of air for "aeration." Some brewers have experimented with adding unsaturated fatty acids to wort, such as olive oil, to provide yeast cells some of the compo-

"One method used by many brewers of high alcohol beers is to add fermentables to the wort in the kettle or even in the fermenter."

Photo by Charles A. Parker/Images Plus

nents that are synthesized using oxygen.

You can do everything mentioned earlier and still end up with a fermentation that becomes "stuck." One of the causes of stuck fermentations is that yeast cells preferentially uptake fermentable sugars, and in the course of normal metabolism may not ferment all of the sugars present in the wort that actually can be fermented. Some brewers combat this by adding fermentable sugars, especially simple sugars like cane sugar and honey, later in the fermentation.

This actually does a few things to improve the chances of producing giant beers. For starters, it means the wort's original gravity is not super high at the beginning of fermentation; this reduces the membrane stresses caused by high osmotic pressure, or difference in concentration between the wort and the cytoplasm of the yeast cell. The other thing that happens is that the type of sugars taken up first by yeast cells are being added after the slower-to-absorb carbohydrates have been absorbed, thereby giving yeast cells the equivalent of dessert when it is appropriate.

Finally, some brewers add fresh yeast when the fermentation stalls, basically kräusening, and some even aerate during fermentation. I like the kräusening method, but not aerating after fermentation has begun because of the potential for oxidation. Brewing very high alcohol beers, basically anything above 10% alcohol by volume, is a real challenge. Take one step at a time and work towards your target. If you cook up a batch of 40 °Plato wort and think this is the silver bullet to brewing these strong beers and do nothing else, the chances of failure and frustration are high. Be patient and may the force be with you!

Q IN THE MAY-JUNE 2013 EDITION OF *BYO*, JAMIL ZAINASHEFF DISCUSSES THE BELGIAN BLOND STYLE. AT THE VERY END OF THE ARTICLE, HE DISCUSSES "OXYGENATION" (I.E., WITH PURE O_2, AS OPPOSED TO "AERATION" WITH AIR) AND STATES THAT (A) OVER-OXYGENATION OF WORT AT PITCHING CAN RESULT IN FUSEL PRODUCTION, PRESUMABLY OUTSIDE OF ANY OTHER FACTORS OR VARIABLES; WHICH OBVIOUSLY ALSO SUGGESTS THAT (B) OVER-OXYGENATION OF WORT IS EVEN POSSIBLE. JAMIL GOES ON TO SUGGEST AN OXYGENATION RATE OF 1 L/MIN FOR ONE MINUTE.

FIRST, IS (B) TRUE? IS OVER-OXYGENATION OF WORT EVEN POSSIBLE? I'VE READ ON A NUMBER OF FORUMS AND OTHER PLACES — THOUGH, UNFORTUNATELY, NONE AVAILABLE TO CITE AT THE MOMENT — THAT SPECULATE THAT OVER-OXYGENATION OF THE COOLED WORT (AT PITCHING TIME) IS *NOT* A REASONABLE CONCERN. THE THOUGHT IS THAT THE SOLUBILITY OF O_2 IN THE WORT IS LIMITED, AND THAT ANY POSSIBLE OVER-SATURATION WOULD LIKELY LEAVE SOLUTION WITHIN SHORT ORDER.

SECOND, IF (B) SHOULD BE TRUE, I HAVE NEVER READ ANYTHING (ELSE) THAT SUGGESTS A LINK BETWEEN FUSEL PRODUCTION AND OXYGENATION. EVERYTHING I'VE READ SUGGESTS FUSEL PRODUCTION IS A RESULT OF POOR FERMENTATION TEMPERATURE CONTROL. IS THERE ANY SUPPORT FOR JAMIL'S OXYGENATION CLAIM? IS THERE ANY KNOWN OXYGENATION RATE (I.E., IN CONTRAST TO THE CITED 1 L/MIN FOR ONE MINUTE) THAT WILL LEAD TO NOTICEABLE FUSEL PRODUCTION, EVEN WITH TIGHTLY CONTROLLED FERMENTATION TEMPERATURES?

I ASK BECAUSE I DO OXYGENATE MY WORT, AND HAVE FOR SOME TIME, BUT MY REGULATOR DOES NOT HAVE A GAUGE BY WHICH I CAN MEASURE FLOW. IF THIS IS MORE THAN A THEORETICAL ISSUE, I MAY NEED TO INVEST IN SOME KIND OF FLOW-METERED REGULATOR.

ANDREW WILLING
MINNEAPOLIS, MINNESOTA

A I have been writing this column for nearly 18 years and I think I have been writing about the importance of wort aeration for nearly the same time period. While oxygen is not a brewing ingredient, the addition of oxygen, either through aeration or injection of oxygen, is as important as any other brewing ingredient. Given the choice of forgetting to add a specialty grain to a brew or forgetting to aerate my wort, I would pick the former any day of the week.

So is it possible to add too much oxygen to wort? The answer is . . . a resounding maybe . . . when the source of oxygen is from a bottle. Higher oxygen levels can be achieved when pure oxygen is used, and that is the issue. Oxygen solubility depends on wort gravity, but for normal gravity wort in the range of 10–15 °Plato (1.040–1.060) aeration produces up to about 10 ppm of dissolved oxygen, compared to about 30 ppm when oxygen is used. Brewing scientists agree that high rates of oxygenation can cause oxidative damage to intracellular membranes, especially when oxygen is added to propagation vessels. But the problems associated with this typically do not manifest themselves until the yeast is harvested and re-used after fermentation, and in practical terms not all scientists have the same opinions about this topic. Since most homebrewers do not re-use yeast for more than one or two batches, there is not much written about over-oxygenation in the homebrewing literature. Given the importance of aeration, many homebrewing advisors would rather a brewer err in the high side rather than err on the low side, or worse yet, simply forget to add oxygen to the wort.

The easiest way to control the amount of gas that dissolves into wort is to limit the flow rate and time of the process. In Jamil's article about Belgian blond ales he recommends 1 L/min for one minute. Without getting too

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geeked out with this topic, it is fairly easy to calculate the amount of gas being added during this one-minute period. One mole of an ideal gas (as in the ideal gas law) expands to 22.4 L at atmospheric pressure, so 1 L of oxygen is equal to about 0.05 moles or 16 grams, and corresponds to about 75 mg/L in a 5-gallon batch. Since the solubility of oxygen is limited, a little less than half of this gas is dissolved into the wort. Brewers who use pure oxygen and are concerned about adding too much simply dial back the flow rate or duration of oxygenation. Commercial brewers commonly use air instead of oxygen because the amount of oxygen that dissolves into wort when using air is limited to 10 ppm or less and there is no concern about oxidative stress.

What does this have to do with higher alcohols (also called fusel alcohols and fusel oils)? Higher alcohols are derived from amino acids. When yeast absorb amino acids from wort some are used for building new yeast cells and others end up as carboxylic acid chains with a couple of biochemical possibilities. If these organic acids are decarboxylated and reduced they end up as alcohols. The most common organic acid to follow this path is pyruvate and the resulting alcohol is ethanol. Organic acids can also be combined with ethanol within the yeast cell to form esters and the most common ester is ethyl acetate. Ester production is higher when wort oxygen levels are low, and the corollary is an increase in the levels of higher alcohols when wort oxygen levels are increased.

From a practical view there are a few take-home messages related to this topic. The first is that aeration and oxygenation are important, and the notion that wort can be over-oxygenated is certainly true. Whether this is critical for the homebrewer is debatable, but process control is not debatable. If you are adding oxygen to your wort, you should have a regulator that allows you to adjust the pressure. Even if you do not have a gas flow meter, you can be consistent if you use a given pressure for a given time. If you think you are adding too much or too little, you can adjust the time of oxygenation as needed. Higher alcohols and esters are influenced by aeration and this just highlights the importance of this process since both compounds are flavor-active. The thing about higher alcohols to remember is that they are derived from amino acids, and when you increase the original gravity of wort you should expect an increase in the amount of higher alcohols in the finished beer. Adjuncts like sugar, rice and maize do not have much protein and do not increase higher alcohol levels as much as malt; that's one reason they are commonly used as adjuncts. BYO

Do you have a homebrewing question for Mr. Wizard? Email your questions to wiz@byo.com.

Eisbock

A strong, malty lager

by Jamil Zainasheff

It is amazing how rich our memories can be. Every time I think about eisbock, several moments in my life leap to mind, complete with flavors and aromas. I recall the time I was sitting at my friend Steve's kitchen table, tasting beers and discussing the failure of judges to award a perfect score of 50 points to any beer. During our conversation, Steve poured an eisbock he had brewed nearly five years earlier. It turned out to be not only the best eisbock I had ever tasted, but also one of the best beers I had ever tasted. I exclaimed, "Now this is a 50 point beer." It was a perfect, flawless eisbock. Steve later entered that beer into a competition and the beer took first place, but of course, no judge awarded it a perfect score. What a shame the judges could not let go of their fear of being wrong long enough to give the credit due to a perfect beer.

Eisbock is a strong, rich lager with a big malt character. It ranges in color from deep copper to dark brown. All bock beers have a lot of bready and toasty malt character, but that does not mean they are overly sweet. An eisbock should not be under-attenuated, but the low hopping rate results in a balance toward the sweet side. The alcohol present should be warming, but should also be smooth and never hot or solvent-like. The fermentation character is clean, although freeze concentration is going to emphasize what esters are present. Some examples will exhibit, through a combination of malts and alcohol, a fruity, grape or dark fruit character.

A great eisbock recipe is relatively simple, but many brewers start with a far too big and complex base. You cannot start with a doppelbock recipe and make a perfect eisbock. You must take into account the freeze concentration step, which increases all of the flavors from the base beer. If you start with an over the top malt, caramel, and alcohol character, you will end up with a beer that needs to be served in a thimble. Keep in mind that all German-style beers are easy-drinking and eisbock should be no exception.

Start your recipe with high quality continental Pilsner and Munich malts. You can use other base malts, but the light, grainy and bready taste of high quality Pilsner and Munich malt is right on target for this style. While a doppelbock should have Munich as the bulk of the grist, for eisbock you will want Pilsner to make up the majority of your grist, approximately 50 to 70% is good. Munich malt is still a large portion of the grist, ranging from 25 to 45%. How much depends a lot on the character of the Munich malt you use. Generally, the darker the Munich malt the less you will use. Of course, there are Munich malts at lower color levels that have far more flavor and aroma than lesser quality dark Munich malts. I like to use Munich in the 8 to 10 °L range for 40% of the grist. The last malt needed is some caramel malt. This is often where many new brewers go astray. Too much and the beer is cloying. Too little or too light a color, and the beer ends up more like hard candy dissolved in alcohol. You can experiment with different color levels and percentages, but 5% of a mid-color (40 to 80 °L) caramel is going to be close to ideal. You should be able to make an excellent example of the style with just those three malts. Usually, this is the point where I say that you can experiment with other malts to add more character, but in this instance, don't. It just becomes too much, too heavy. While you want rich melanoidin flavors that specialty malts can provide, adding more will often make the beer taste meaty or brothy.

Extract brewers will need to use a Munich extract or do a partial mash with Munich malt. Most Munich malt extract is a blend of Munich and Pilsner (or other pale malts) in different percentages. Many of the Munich

Continued on page 21

EISBOCK
by the numbers

OG:	1.078–1.120 (18.9–28.1 °P)
FG:	1.020–1.035 (5.1–8.8 °P)
SRM:	18–30
IBU:	25–35
ABV:	9–14%

Photo by Charles A. Parker/Images Plus

Steve's 50 Eisbock
(4 gallons/15 L, all-grain)

OG = 1.090 (21.6 °P)
FG = 1.021 (5.3 °P)
IBU = 27 SRM = 15 ABV = 9.2%
(10.6% ABV after concentration)

Ingredients

10.4 lbs. (4.7 kg) Best Malz Pilsen (or similar continental Pilsner) malt 2 °L
7.3 lbs. (3.3 kg) Munich malt (8 °L)
0.9 lb. (400 g) Weyermann CaraMunich® III malt (57 °L)
4.8 AAU Magnum hops (60 min.) (0.4 oz./12 g at 13.5 alpha acids)
1.6 AAU Hallertau hops (30 min.) (0.4 oz./12 g 4.0% alpha acids)
White Labs WLP830 (German Lager) or Wyeast 2206 (Bavarian Lager)

Step by Step

Mill the grains and dough-in targeting a mash of around 1.5 quarts (1.4 L) of water to one pound (0.45 kg) of grain (a liquor-to-grist ratio of about 3:1 by weight) and a temperature of 155 °F (68 °C). Hold the mash at 155 °F (68 °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 1.070 (17 °P).

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. Add the second hop addition 30 minutes later. Add Irish moss or other kettle finings with 15 minutes left in the boil. Chill the wort to 50 °F (10 °C) and aerate thoroughly. The proper pitch rate is around 600 billion cells, which is six packages of liquid yeast or two packages of liquid yeast in a 10-liter starter. You should consider making a smaller beer first and repitching the yeast from that beer into this one instead of making such a large starter.

Ferment around 50 °F (10 °C) 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.

Once the beer has finished fermentation, let it lager for one month at near-freezing temperatures. Transfer the beer to a Cornelius keg or similar container that can be flushed with CO_2 and can withstand the freezing process without cracking. Freeze concentrate the beer by 20%. Transfer the still liquid portion to another container, leaving behind the ice portion. It will be best to force carbonate this beer versus trying to bottle condition it. Target a carbonation level of two volumes. A month or more of cold conditioning at near freezing temperatures will improve the beer. Serve at 43 to 46 °F (6 to 8 °C).

Steve's 50 Eisbock
(4 gallons/15 L, extract with grains)

OG = 1.090 (21.5 °P)
FG = 1.021 (5.3 °P)
IBU = 27 SRM = 17 ABV = 9.2%
(10.6% ABV after concentration)

Ingredients

12.3 lb. (5.6 kg) Munich blend LME (9 °L)
0.9 lb (400 g) Weyermann CaraMunich® III Malt (57 °L)
4.8 AAU Magnum hops (60 min.) (0.4 oz./12 g at 13.5 alpha acids)
1.6 AAU Hallertau hops (30 min.) (0.4 oz./12 g 4.0% alpha acids)
White Labs WLP830 (German Lager) or Wyeast 2206 (Bavarian Lager)

Step by Step

I have used a number of Munich blend extracts and most will do an admirable job of brewing eisbock. Always choose the freshest extract that fits the beer style instead of focusing on the brand name. If you cannot get fresh liquid malt extract, use an appropriate amount of dried malt extract instead.

Place the milled CaraMunich® loosely in a grain bag. Steep the bag in about 1 gallon (~4 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 bags to drip into the kettle. Do not squeeze the bags. Add the malt extract and enough water to make a pre-boil volume of 5.9 gallons (22.3 liters) and a gravity of 1.076 (18.4 °P). Stir thoroughly to help dissolve the extract and bring to a boil.

Once the wort is boiling, add hops at times indicated. Add Irish moss or other kettle finings with 15 minutes left in the boil. Chill the wort to 50 °F (10 °C) and aerate thoroughly. The proper pitch rate is around 600 billion cells, which is six packages of liquid yeast or two packages of liquid yeast in a 10-liter starter. You should consider making a smaller beer first and repitching the yeast from that beer into this one instead of making such a large starter.

Ferment around 50 °F (10 °C) 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.

Once the beer has finished fermentation, let it lager for one month at near-freezing temperatures. Transfer the beer to a Cornelius keg or similar container that can be flushed with CO_2 and can withstand the freezing process without cracking. Freeze concentrate the beer by 20%. Transfer the still liquid portion to another container, leaving behind the ice portion. It will be best to force carbonate this beer versus trying to bottle condition it. Target a carbonation level of two volumes. A month or more of cold conditioning at near freezing temperatures will improve the beer. Serve at 43 to 46 °F (6 to 8 °C).

blends out there should work fairly well for this beer, but let flavor and freshness be your guide rather than the percentage of Munich in the blend. The only supplier of 100% Munich extract I am aware of is Weyermann. If you can get 100% Munich extract, then you can blend it with a Pilsner malt or pale malt extract to get the right proportions. However, I do not think it is worth the effort in this case.

I like to avoid any work that I do not feel improves a 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 a beer that is 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 on 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 152 to 156 °F (67 to 69 °C).

At most, hop character is just a background note in eisbock. This beer is about rich malt character and a fine example requires no hop character. If you do like a touch of hop character, keep it subtle and use only floral or spicy type hops. I prefer German grown Hallertau hops, but other German grown hops, such as Tettnang, Perle or Tradition, work well also. These hops, when grown outside of Germany, can still work well but you should check with your supplier first if you are not sure how closely they match the German grown hops. If you cannot get any of those hops, try to select hops with that same flowery or spicy noble hop character. Some decent substitutions are Liberty and Mt. Hood. You can also try Crystal, Ultra, and Vanguard. The big picture is that you want very low hop character and just a balancing bitterness that complements and integrates with the malt. The balance of bittering versus malt sweetness should be even or slightly on the sweet side. The bitterness to starting gravity ratio (IBU divided by the decimal portion of the specific gravity) ranges from 0.2 to 0.4, but I like to target around 0.3 when looking at the recipe before taking concentration into account. Restrict your late hops to small additions. In general, 0.25 to 0.5 oz (7 to 14 g) in the last 20 to 30 minutes of the boil for a 5-gallon (19 L) batch is the most you should use.

You can ferment eisbock with almost any lager yeast, though my favorites are White Labs WLP830 (German Lager) and Wyeast 2206 (Bavarian Lager). Different lager yeast strains will emphasize different aspects of the beer. Some will emphasize malt character, some will emphasize hop character, and some will be

in-between, but all can produce an excellent eisbock with proper fermentation. It is important to note that the sweetness present in eisbock is from a low ratio of hop bitterness to residual malt sweetness, not from incomplete fermentation.

While this style is higher in alcohol than most lagers, the beer should never be hot or solvent-like. A gentle warming when you drink the beer is what you want. Anything more is a flaw. You will run into judges that do not understand this and seem to think eisbock is what they use to fuel jets at the airport. Do not fall into that trap. Instead, make efforts to educate those that think hot alcohols are good to drink. Proper control of fermentation temperature, a proper pitch of healthy yeast, and adequate nutrients is all it takes to avoid that hot alcohol problem.

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 precursor 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 65 to 68 °F (18 to 20 °C) range 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 to 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 nearly every beer

style 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 and to prevent them from excreting a greater amount of compounds that lead to fruity character in the beer. 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.

Personally, I do not expect lagering to reduce undesirable fermentation compounds. I prefer to hold the beer at warmer temperatures if I expect the yeast to accomplish any change in the beer. The yeast is far more active and able to reduce fermentation byproducts at higher temperatures. Once I am certain the yeast has completed every job needed, I slowly lower the beer temperature and then 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.

Once the beer has finished fermentation, let it lager for one month at near-freezing temperatures. Then transfer the beer to a Cornelius keg or similar container that can be flushed with CO_2 and can withstand the freezing process without cracking. Put the beer in the freezer, checking every 30 minutes by shaking the container. Once ice crystals form, you will hear them sloshing against the side of the keg. Initially, the sound of the ice crystals will be faint, but as more ice forms, the sound will increase. Pull the beer out of the freezer when the beer sounds slushy. What you are shooting for is the point where approximately 20% of the beer has turned to ice. The first few times you might freeze too much or too little, but experience will eventually let you get the process down pretty close to 20%. Use CO_2 pressure to transfer the liquid portion from the keg to another container, leaving behind the ice. You can melt and measure the ice left behind to help determine the strength of the beer post-concentration. If you are lower than intended, you can freeze the beer again. If you are higher, you can always add sterile, distilled, de-aerated water to dilute it.

If you remove anywhere in the general range of 10 to 30% concentration, call it good enough and try to adjust your process next time. I know some brewers who shoot for as much as 50% water removal, but most of those beers I have tasted were heavy, syrupy, alcoholic and not great examples of the style. It is best not to freeze concentrate the beer by more than 25%. BYO

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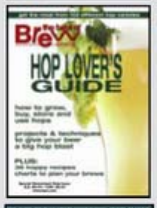

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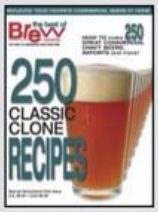

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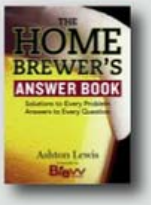

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Photo courtesy Gaffel

By Horst Dornbusch

HELLES & KÖLSCH

Photo courtesy of Bavarian Brewers Federation, Munich, Germany

Germany's Summer Session Beers

With apologies to George Gershwin: "Summer time; and the livin' is easy; Kölsch's a'quaffin'; and the helles is fine." There's just nothing like one of those lazy, hot days, when you kick back and purvey all that you behold . . . with a crisp, clear brew of summer in your glass. That's when life's good…but to get there, you've got to brew it first…and there are no better brews to match the occasion than the delicate and sublime, super-blond, clean-tasting quaffing brews of Bavaria and the Rhineland. That is, nothing goes with summer like the bottom-fermented helles from Munich and the top-fermented Kölsch from Cologne — two beers that epitomize like no other the art of session beer-making, the *haute école* of "lawnmower" beers.

Though helles is a typical Bavarian lager and Kölsch a typical Rhenish ale, in many ways, these two German brews are very similar . . . except of course for the yeast. Compared to some of the more robust beers of the Belgian and British traditions, these two German blondes could not be easier to make in terms of ingredients. However, they are among the most difficult beers to brew in terms of process, because if you make a mistake you can taste it. If you underpitch yeast or fail to aerate properly, the acetaldehyde (green apple flavor) will become noticeable immediately; if you fail to control the fermentation temperature, the butterscotch notes from too much diacetyl will quickly become overbearing; if your mash temperature is too low, the beer will lack body and head; if you overdo your hops, you may taste bitter astringency, but nothing else. However, if everything comes together just so, the reward will be heavenly!

In the world of clichés, Germans do not necessarily cut a good figure — certainly not when it comes to *joie de vie*. While the Italians, for instance, are considered artful and enthusiastic, the French *amoureuse*, the Spanish passionate, and the Russians full of somber melancholy, the Germans are often portrayed as hardworking, precise, meticulous and sincere — even dour and lacking a sense of humor. Like all

stereotypes, however, this is only partly true. In fact, there are pockets of Germany where the local character is anything but German. Just visit the Rhineland and Bavaria, where beer drinking is not just a pastime, but an indispensable part of the fabric of life, natural sociability and general conviviality. There is nothing like the unhurried attitude of a Bavarian just hanging out in a beer garden on a summer afternoon. Likewise, there is nothing like the backslapping joviality and camaraderie of a Rhinelander having a few in a Kölsch pub in the old town of Cologne, just a stone's throw from the 800-year old cathedral, which is the city's landmark . . . and the beers these vivacious folk people drink are the most sublime in the world — a straw-blond lager and an almost equally straw-blond lagered ale.

Interestingly, both helles and Kölsch are fairly recent developments by beer-historical standards. Helles was first introduced by the style's inventor, the Spaten Brewery of Munich on March 21, 1894, as a Bavarian competitor to the Pilsner from neighboring Bohemia. *Hell* or *helles* is German for "light," in color, not in calories or alcohol. Helles has an ABV of 4.7 to 5.4 percent, with versions above 5 percent usually called export helles. Its hop loading is very restrained with IBU values in the low 20s and a lingering malty, rather than hop-aromatic, finish. Kölsch, by contrast, has no exact "birthday." Instead, it emerged gradually as a beer style in Cologne, shortly after World War I. It is usually brilliantly straw-blond like the Munich helles, but just a touch more hop-accented with IBU values more in the mid- to upper 20s. While helles was traditionally always decocted and Kölsch just step-mashed, both beers are nowadays usually just step-mashed.

A Kölsch is always served in a cylindrical 0.25-liter glass, roughly 0.525 pints) called a "Stange" (meaning "rod"or "pole").

The parameters of the modern Kölsch style were formally codified only as recently as 1986, when some two dozen brewers from in and around Cologne got together to form the so-called Cologne Convention ("Kölner Konvention"). After that date, only members of the Convention were permitted to call their beers Kölsch. The European Union recognized the uniqueness of this beer style by granting it the status of a "Protected Geographical Indication." This put Kölsch into same name-protected category as, for instance, Roquefort cheese, sparkling wine from the Champagne region of France, and brandy from Cognac, which is named for the French town by the same name.

Helles and Kölsch Grain Bills

The key to making such delicate pale beers well is brewing with top quality

Continued on page 31

Helles and Kölsch Recipes

Kölsch
(5 gallon/19 L, all-grain)

OG = 1.045 FG = 1.008
IBU = 27 SRM = 3 ABV = 4.7%

Ingredients

8 lbs. (3.6 kg) Weyermann Extra Pale Pilsner (or similar continental Pilsner malt) (1.5 °L)
8 oz. (0.24 kg) pale wheat malt (2 °L)
6 oz. (0.17 kg) Weyermann Carafoam® (or similar dextrin malt) (2 °L)
3.7 oz. (0.1 kg) Weyermann acidulated malt
4.4 AAU Tettnanger hops (1.1 oz./31 g of 4% alpha acids) (60 min.)
4.4 AAU Tettnanger hops (1.1 oz./31 g of 4% alpha acids) (10 min.)
Wyeast 2565 (Kölsch) or White Labs WLP029 (German Ale/Kölsch) yeast

Step by Step

Step-infusion. Mash-in at around 110 °F (43 °C). Stir thoroughly then raise temperature to 151 °F (66 °C). Rest mash for 30 minutes. Raise temperature to 158 °F (70 °C). Rest for 15 minutes. Raise temperature for mash-out to 172 °F (78 °C) to begin lauter process. Boil for 70 minutes. Add bittering hops 10 minutes into the boil. Add aroma hops 60 minutes into the boil. Remove from heat, whirlpool 30 minutes. Cool wort to recommended temperature for the yeast strain, approximately 55 to 70 °F (13 to 21°C). Primary ferment about two weeks. Rack to a secondary fermenter. Lager for about four to six weeks, allowing pressure to build up. Filter; note that an unfiltered beer is officially not considered a Kölsch, according to the Kölsch Convention. Prime or adjust CO_2 to about 2.5 to 3 volumes (about 5 g/L) or bottle condition with 1 cup of corn sugar. Bottle or keg.

Kölsch
(5 gallon/19 L, extract)

OG = 1.045 FG = 1.008
IBU = 27 SRM = 3 ABV = 4.7%

Ingredients

5.7 lbs. (2.6 kg) Weyermann Bavarian Pilsner liquid malt extract (2 °L)
0.5 lbs. (0.2 kg) wheat liquid malt extract
4.4 AAU Tettnanger hops (1.1 oz/31 g of 4% alpha acids) (60 min.)
4.4 AAU Tettnanger hops (1.1 oz/31 g of 4% alpha acids) (10 min.)
Wyeast 2565 (Kölsch) or White Labs WLP029 (German Ale/Kölsch) yeast

Step by Step

Add water to fill to kettle to 6.0 gallons (22.7 L) and bring to a boil. Stir in malt extract away from the heat to avoid scorching. Boil for 70 minutes. Add bittering hops 10 minutes into the boil. Add aroma hops 60 minutes into the boil. Remove from heat, whirlpool 30 minutes. Cool the wort to recommended temperature for the yeast strain, approximately 55 to 70 °F (13 to 21°C). Primary ferment about two weeks. Rack to a secondary fermenter. Lager for about four to six weeks, allowing pressure to build up. Filter; note that an unfiltered beer is officially not considered a Kölsch, according to the Kölsch Convention. Prime or adjust CO_2 to about 2.5 to 3 volumes (about 5 g/L), or bottle condition with 1 cup of corn sugar. Bottle or keg.

Helles
(5 gallon/19 L, all-grain)

OG = 1.047 FG = 1.011
IBU = 20 SRM = 4 ABV = 4.8%

Ingredients

4.5 lbs. (2.0 kg) Weyermann Pilsner malt (or similar continental Pilsner malt) (2 °L)
4.3 lbs. (1.9 kg) Weyermann Extra Pale Pilsner (or similar continental Pilsner malt) (1.5 °L)
4 oz. (0.11 kg) Weyermann Carahell® (10 °L)
4 oz. (0.11 kg) Weyermann Carafoam® (2 °L)
4 oz. (0.11 kg) Weyermann acidulated malt
3.9 AAU Tradition (60 min.) (0.7 oz./20 g of 5.5% alpha acids)
1.3 AAU Hallertau Mittelfrüh (10 min.) (0.3 oz./9 g of 4.25% alpha acids)
0.9 AAU Hallertau Mittelfrüh (0 min.) (0.2 oz./6 g of 4.25% alpha acids)
Wyeast 2206 (Bavarian Lager) yeast or White Labs WLP838 (Southern German Lager) yeast

Step by Step

Step-infusion (or a traditional step-decoction). Mash-in at around 122 °F (50 °C). Rest mash for 20 minutes. Raise temperature to 151 °F (66 °C). Rest mash for 30 minutes. Raise temperature to 147 °F (64 °C). Rest for 20 minutes. Raise temperature to 162 °F (72 °C). Rest for 20 minutes. Raise temperature for mash-out to 172 °F (78 °C) to begin lauter process. Add bittering hops 15 minutes into the boil. Add flavor hops 60 minutes into the boil. Remove from heat, whirlpool for 30 minutes. Add aroma hops at the beginning of whirlpool. Cool wort to recommended temperature for the yeast-strain, approximately 46 to 58 °F (8 to 14 °C). Primary ferment about 1 week. Rack. Secondary-ferment about 10 days. Reduce temperature to 34 °F (1 °C) or lower. Lager at that temperature for about three to four weeks, allowing pressure to build up. Filtration optional. Prime or adjust CO_2 to about 2 to 2.75 volumes (about 4 to 5.5 g/L) or bottle condition with 1 cup of corn sugar. Bottle or keg.

Helles
(5 gallon/19 L, extract with grain)

OG = 1.047 FG = 1.011
IBU = 20 SRM = 5 ABV = 4.8%

Ingredients

6.5 lbs. (3.0 kg) Weyermann Bavarian Pilsner liquid malt extract (2 °L)
4 oz. (0.11 kg) Weyermann Carahell® (10 °L)
3.9 AAU Tradition (60 min.) (0.7 oz./20 g of 5.5% alpha acids)
1.3 AAU Hallertau Mittelfrüh (10 min.) (0.3 oz./9 g of 4.25% alpha acids)
0.9 AAU Hallertau Mittelfrüh) (0 min) (0.2 oz./6 g of 4.25% alpha acids)
Wyeast 2206 (Bavarian Lager) yeast or White Labs WLP838 (Southern German Lager) yeast

Step by Step

Place the crushed grain in a grain bag and steep in 2 gallons (7.5 L) of 156 °F (69 °C) water for 30 minutes. Rinse the grain bag with 2 quarts (1.9 L) hot water. Add water to fill to kettle to 6.0 gallons (22.7 L). Stir in malt extract off heat to avoid scorching. Add bittering hops 15 minutes into the boil. Add flavor hops 60 minutes into the boil. Remove from heat, whirlpool for 30 minutes. Add aroma hops at the beginning of whirlpool. Cool wort to recommended temperature for the yeast strain, approximately 46 to 58 °F (8 to 14 °C). Primary ferment about 1 week. Rack. Secondary ferment about 10 days. Reduce temperature to 34 °F (1 °C) or lower. Lager at that temperature for about three to four weeks, while allowing pressure to build up. Filtration optional. Prime or adjust CO_2 to about 2 to 2.75 volumes (about 4 to 5.5 g/L) or bottle condition with 1 cup of corn sugar. Bottle or keg.

malt. The base malt for both beers is usually quality Pilsner malt of approximately 2 °L, an extra pale Pilsner malt of only 1.5 °L, or a mix of the two. In the case of Kölsch there is also a special Kölsch malt on the market that is made by GlobalMalt. With a Lovibond rating of 3.8 to 4.8 °L, this malt is slightly darker than the Pilsner malts and is available in the United States through Brewer's Supply Group. To give the beer some body for a firm head and plenty of lacy foam, you can also add a small portion of very pale German caramel malts to the grist, such as Carafoam® and Carahell®. This addition should not exceed about 10%. In addition, the Kölsch grist may have just a few percentages (perhaps 5%) of pale wheat malt, which is a hold-over from Kölsch's historic roots in the late-medieval Keutebier — a barley-and-wheat ale from the lowlands of northwestern Europe — and in the Wiess ale of Cologne of the 19th century, which may have had as much as 20% pale wheat malt in the mash.

Yeast

The yeasts for these beers are generally clean-fermenting. For an optimum, crisp beer flavor, they should be kept at or near their lowest temperature tolerance, to keep ester and diacetyl production low. Modern commercial breweries of these beers do not always adhere to this rule, probably to speed up throughput in the cellar tanks, but a homebrewer ought not to abide by such bean counter considerations. The yeast of the Kölsch is a top-fermenting specialty yeast, for which there is really no substitute. Readily available Kölsch yeasts are the low-flocculant Wyeast 2565 (Kölsch I), which the producer states is a good fermentation agent at 55 to 60 °F (13 to 16 °C); as well as Wyeast 2575-PC (Kölsch II), which ferments well at 55 to 70°F (13 to 21 °C). From White Labs, there is also the medium-flocculant WLP029 (German Ale/Kölsch), which has an optimum fermentation temperature of 65 to 69 °F (18 to 21 °C). For helles, any classic Bavarian lager strain is appropriate. Among these are Wyeast 2206 with a temperature range of 46 to

Table 1: Brewing Water Hardness Values in Select European Cities (Average values compiled from various sources)

City	Carbonate Hardness	Total Hardness	Residual Alkalinity
Plzen	1.4 °dH (25 ppm)	2.3 °dH (41 ppm)	0.9 °dH (16 ppm)
Dortmund	16.8 °dH (300 ppm)	42.6 °dH (760 ppm)	5.6 °dH (100 ppm)
Munich	14.3 °dH (255.23 ppm)	15.6 °dH (278 ppm)	10.6 °dH (190 ppm)
Cologne	12.5 °dH (223.1 ppm)	18.8 °dH (336 ppm)	7.6 °dH (136 ppm)

Key: °dH = degrees German hardness; ppm = parts per million

Photo by Istockphoto.com

58 °F (8 to 14 °C) and Wyeast 2308 with a temperature range of 48 to 56 °F (9 to 13 °C). I personally also like the very clean-fermenting Wyeast 2042 (Danish Lager) for Helles. It has a temperature range of 46 to 56 °F (8 to 13 °C). From White Labs, suitable yeasts for Helles are the appropriately named WLP860 (Munich Helles) with a temperature range of 48 to 52 °F (9 to 11 °C) and WLP835 (German Lager X) with a temperature range of 50 to 54 °F (10 to 12 °C).

Hops

The hop choices for these two brews are no surprise: German and noble varieties. Subjectively, I prefer the midly critrus-like Tettnanger for the Kölsch at about 25 IBU and a mix of Hallertauer Tradition and Mittelfrüh at about 20 IBU for the more malt-dominant Helles.

Water

The natural brewing waters of both Cologne and Munich are moderately hard, which makes them theoretically not very suited for use in blonde beers . . . yet, both mighty fine Kölsch and helles brews are made from them. Depending on your local water characteristics, therefore, your brewing water could benefit from some mild acidification. Here is why: critical in the effect of hardness on beers, especially delicate ones, is not the total hardness, but what is called residual alkalinity, which is the relationship between total hardness, on the one hand, and carbonate (as well as bicarbonate) hardness, on the other. High levels of carbonate hardness tend to neutralize acids produced during mashing. This happens through chemical bonding, which causes the mash to become more alkaline, that is, the mash pH-value moves away from the optimum of roughly 5.2 to 5.4 in the direction of neutral, which is pH 7. This carbonate "buffering," in turn, leads to less enzyme efficiency in the mash; it leaches more acrid phenols from the grain husks; and it accentuates hop bitterness. German hardness statistics are always given in "degrees German hardness" (°dH), whereas English texts usually give hardness values in "parts per million" (ppm), which stands for mg of calcium carbonate ($CaCO_3$) per liter. The conversion formula between the two units of hardness measurement is: 1 °dH = 17.848 ppm. The relationship between the different types of hardness in brewing water is usually expressed by the following rough formula: Residual alkalinity (aka "permanent hardness") equals carbonate hardness minus a quotient of total hardness divided by 4. The example for calculating residual alkalinity in Cologne, for instance, is: 12.4 °dH – (18.8 °dH/4) = 12.4 °dH – 4.7 °dH = 7.7 °dH. See Table 1 (above).

For a perspective on hardness magnitudes, it is generally accepted that water of 50 ppm or less of total hardness (such as Plzen's) is extremely soft; water of 50 to 100 ppm is soft; water of 100 to 200 ppm is medium soft/hard; water of 200 to 400 ppm is moderately hard (see values for Munich and Cologne); water of 400 to 600 ppm is hard; and water of 600 ppm

is extremely hard (such as Dortmund's). Note that mineral-poor Plzen water, which is ideal for pale brews, has extremely low hardness values for all three measurements (carbonate and total hardness, as well as residual alkalinity), whereas Cologne and Munich waters, with which Kölsch and helles are made, are comparably much harder.

Harder waters tend to be more suited for highly acidic darker malts because of their buffering potential. However, when they are used for paler brews they tend to benefit from some form of acidification — a phytase rest in the old days, an addition of an acid additive nowadays, or adding some acidulated malt to the mash. To reduce the residual alkalinity of a mash by 10 °dH (or almost 180 ppm), for instance, you need about 6.25 grams of an 80% lactic-acid preparation or 247 grams of acidulated malt per 5-gallon (19-liter) batch of homebrew. As an aside, as the Table 1 shows, Dortmund water is an odd-ball, because it has an extremely high degree of total hardness but a low degree of non-carbonate hardness, which makes it still suitable for pale brews, such as Dortmund Export, without "doctoring" it. Because Kölsch and helles are pale brews, the recipes presented here use small amounts of acidulated malt from Weyermann. Acidulated malt contains about 1% to 2% lactic acid. If your water is naturally soft, you can replace the acidulated malt with more base malt.

Tips for Extract Brewers

First, there appear to be no specialized, pre-formulated liquid malt extracts (LMEs) on the market for Kölsch and helles. Therefore, if you wish to brew these styles with extracts only, you are stuck with a compromise: Get the best Pilsner-type LME available und use the correct yeast to ferment the brew. If you are an extract-plus-grain brewer, use Pilsner LME as a base malt replacement and then steep the specialty malts from the all-grain recipes as you normally would. The Pilsner malt that I prefer for German-style beers is the Weyermann Bavarian Pilsner LME. It comes in an 8.8-lb (4-kg) canister, has between 72% and 79% fermentable extract, and has a color value of 6.2 °L to 7.3 °L (15 to 18 EBC) at OG 1.052 (13 °P). It is unhopped and made from a step-infusion-mashed mixture of Weyermann Pilsner Malt and Weyermann Carafoam®. Less authentic alternatives for this German LME are appropriate amounts of extra light dried malt extract (DME). Also, for the wheat portion in the Kölsch recipe, extract brewers can add about 0.5 lb. (0.23 kg) of wheat DME. BYO

Related Links

- Try homebrewing a German helles with an all-grain step-mash: http://byo.com/story771

- Get pro Kölsch brewing advice: http://byo.com/story1881

2013 LABEL CONTEST WINNERS

For the past several weeks the *BYO* office has been overrun with envelopes and boxes for the annual label contest. This year's judging was the hardest yet, as competitors definitely brought their "A" game and we had to choose from more entries than ever. Entrants utilized not only the normal label canvas but also expanded into the 3-D realm as well as hand painting their bottles. We even received entries from as far away as Brazil and New Zealand. Overall, labels were an eclectic mix, drawing inspiration from a wide range of ideas: a musical instrument, the family dog, a prized piece of artwork, a (sometimes) clever pun and a lost love.

We'd like to thank everyone who entered this year for your dedication to creativity — not only in the brew kettle but also on the bottle. The judging process was not easy, but we had a great time choosing this year's winning designs. Congratulations to all the winners, and thank you to our sponsors for providing all of the great prizes. The process doesn't stop here, either. We hope you're already working on your best designs for next year!

GRAND

JOHN THOMPSON
Encinitas, California

For his "Don't Trip" Belgian-style tripel, John felt intimidated by the style's listing as one of the ten hardest styles to brew by *BYO*. "I wanted the label for 'Don't Trip' to depict the uneasiness I felt with this batch," he said. "The mantra 'don't trip' was uttered at each stage of the [brewing] process." He then spiraled this mantra down the label's staircase so it can be read at any angle.

Prizes: BeerGun from **Blichmann Engineering LLC**; Gift certificate from **My Own Labels**; 50-lb. bag of Pilsen malt from **Briess Malt and Ingredients Co.**; Gift certificate from **High Gravity**; 5-lb. pail of One Step no-rinse cleanser from **LOGIC, Inc.**; 6-Pack bottle kozy from **HomeBrewStuff.com**; Gift certificate from **Quality Wine and Ale Supply**; Gift certificate from **GrogTag**

GOLD

RON CAMPBELL
Stanfield, North Carolina

Ron designed this label featuring actual strings and a fret board resembling a banjo for his neighbor, who owns a music shop called Ron's Pickin' Parlor. "I used the sign at his shop as the guide for the label," Ron said. "The strings were an afterthought!"

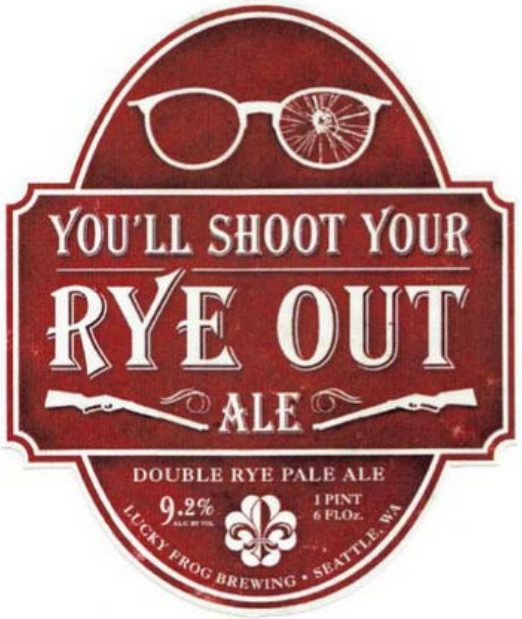
Prizes: BrewMometer from **Blichmann Engineering LLC**; 40 Plate wort chiller with connections from **Keg Cowboy**; Gift certificate from **High Gravity**; 5-lb. pail of Straight-A cleanser from **LOGIC, Inc.**; 6-Pack bottle kozy from **HomeBrewStuff.com**; Gift certificate from **Quality Wine and Ale Supply**; Gift certificate from **GrogTag**

SILVER

KEVIN leDOUX
Seattle, Washington

Inspired by the classic movie "A Christmas Story," Kevin created this label from hand-drawn and manipulated images. "Plus, at 9+%, there is a real and present danger of this happening if more than one bottle is consumed," he said.

Prizes: UNI-STAT II-G temperature controller from **BH Enterprises**; Thermometer from **Hobby Beverage Equipment**; Gift certificate from **Bader Beer & Wine Supply**; Individual bottle kozy from **HomeBrewStuff.com**; Gift certificate from **Quality Wine and Ale Supply**; Gift certificate from **GrogTag**

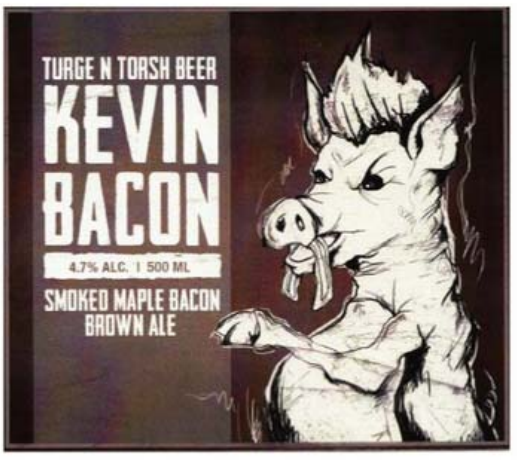


BRONZE

MARIE-PIER BOUCHARD
Carignan, Québec

Marie-Pier created this label for her boyfriend and his brother's maple bacon beer. "The title of the beer was a reminder of the actor, so when I did the label, I drew a pig with a little rock star attitude," she said.

Prizes: Gift certificate from **Maryland Homebrew**; Gift certificate from **Brew Brothers Homebrew Products, LLC**; Gift certificate from **Bader Beer & Wine Supply**; Gift certificate from **Petit Agentur AS**; Gift certificate from **Quality Wine and Ale Supply**; Gift certificate from **GrogTag**



HONORABLE MENTION

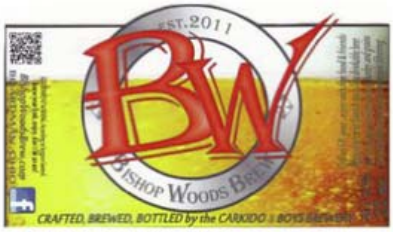
Arielle Katarina • Tampa, Florida
Prizes: FastRack and tray from **www.thefastrack.ca**; Gift certificate from **GrogTag**

Jeremy Sexton
Austin, Texas
Prizes: Gift certificate from **HomeBrewStuff.com**; Gift certificate from **GrogTag**

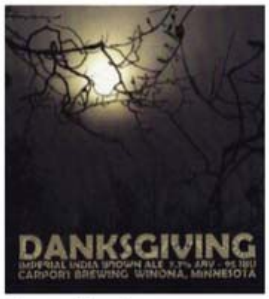
Brian Miller • Sonora, California
Prizes: Beach Blonde ingredient kit from **O'Shea Brewing Company**; Gift certificate from **GrogTag**

Matthew Ducey
Severna Park, Maryland
Prizes: Gift certificate from **myLHBS (myLocal HomeBrew Shop)**; Gift certificate from **GrogTag**

Eric Scheel
Milwaukee, Wisconsin
Prizes: Clean Bottle Express super bundle from **Third Coast Design Works**; Gift certificate from **GrogTag**



Michael Carkido • Poland, Ohio
Prizes: Hops chart poster from **Brooklyn Homebrew**; Gift certificate from **GrogTag**

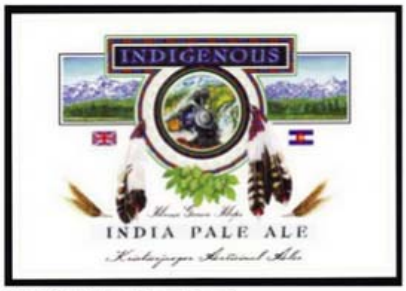


Dave Sanders
Winona, Minnesota
Prizes: FastRack and tray from **www.thefastrack.ca**; Gift certificate from **GrogTag**

Keith Palma • Raleigh, North Carolina
Prizes: DEMON IPA extract kit from **Murrieta Homebrew Emporium**; Gift certificate from **GrogTag**

Gretchen Bracher
Philomath, Oregon
Prizes: Gift certificate from **Falling Sky Brewshop**; Gift certificate from **GrogTag**

Greg Piecora/ Nancy Blauers
Geneva, Florida
Prizes: FastRack and tray from **www.thefastrack.ca**; Gift certificate from **GrogTag**



R. Christopher Vest
Dolores, Colorado
Prizes: Gift certificate from **St. Louis Wine & Beermaking LLC**; Gift certificate from **GrogTag**

Ronaldo Dutra Ferreira
Florianopolis, South Carolina
Prizes: 9 oz. Sorachi Ace hop pellets from **Brew Ha Ha Homebrew Supply**; Gift certificate from **GrogTag**

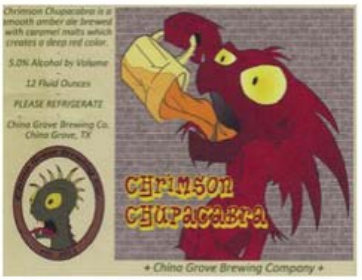
Mike Lanzafame
Union, New Jersey
Prizes: Hops chart poster from **Brooklyn Homebrew**; Gift certificate from **GrogTag**

Caleb Whitenack
Chapel Hill, North Carolina
Prizes: FastRack and tray from **www.thefastrack.ca**; Gift certificate from **GrogTag**

Keith Hartman • Columbia, PA
Prizes: Randall Jr., two signature pint glasses and a copy of *Extreme Brewing* from **Dogfish Head Craft Brewery**; Gift certificate from **GrogTag**

Steven Franks • The Colony, Texas
Prizes: Pint glass, shirt and gift certificate from **Electric Brewing Supply, LLC**; Gift certificate from **GrogTag**

Michael Lane
Las Vegas, Nevada
Prizes: 4-lb. jar of PBW and T-Shirt from **Five Star Chemicals & Supply Inc.**; Gift certificate from **GrogTag**



Duane Winkler • San Antonio, TX
Prizes: Gift certificate from **HomeBrewStuff.com**; Gift certificate from **GrogTag**

Web extra:

Check out this year's Editors' Choice label contest winners:
http://byo.com/story2833

HOT NEW HOPS

BREW A CUTTING-EDGE HOMEBREW

By **Gretchen Schmidhausler**

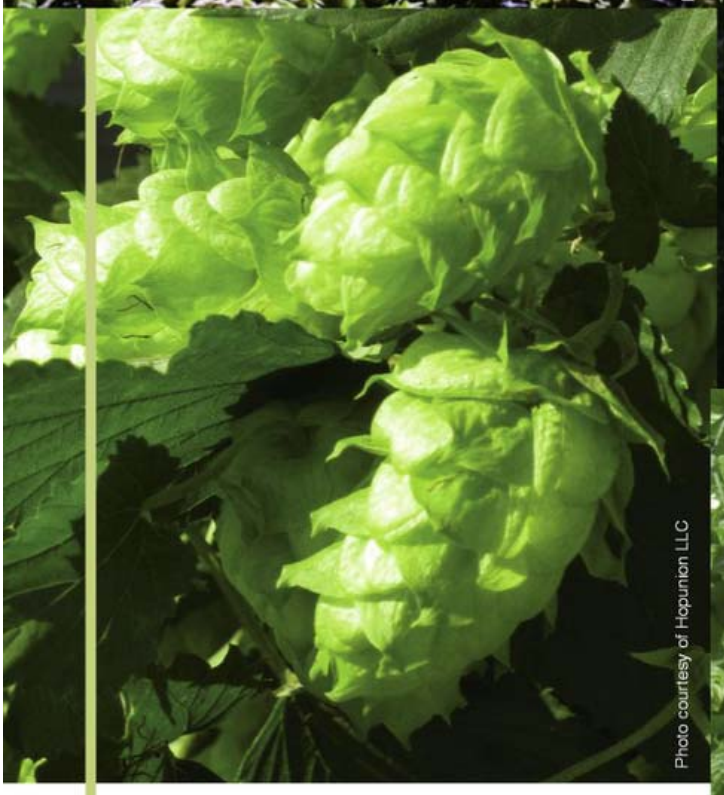
Hops, as we all know, give beer its bitterness while imparting a wide range of flavors and aromas. They also serve very practical functions by contributing to head retention, inhibiting microbial growth and acting as a natural preservative.

Beer is an ancient beverage. It has been made for thousands of years by using basically the same ingredients — cereal grain, yeast, water and, of course, hops, in pretty much the same way. Nevertheless, thanks to enterprising and inventive brewers, our favorite fermented drink continues to evolve.

Hop breeding programs have been responsible for introducing new hop varieties for well over a century. However, in recent years, brewers and beer enthusiasts have also seen more and more innovations in hop growing, including new varieties and hybrids. In fact, there are more new varieties on the market now than perhaps at any other time in brewing history.

Many of the numerous new hop varieties introduced to the market have captured the imagination of brewers eager and excited to work with these new products. With their unique and complex flavor profiles, the newer varieties have inspired original beers and brightened up some classics.

Following the lead of the pros, homebrewers have embraced the new hop varieties, many of which are readily available to hobbyists who thrive on experimentation. So without further ado, turn the page to read about four popular new hop varieties (recipes begin on page 43):



Clockwise starting from top left: Belma™, Calypso, Legacy™ and Mosaic™ hops. These four hops are some of the new varieties now available to commercial and homebrewers in 2013.

Calypso

Like its musical name, Calypso offers exotic and pleasant notes as well as fruity aromas, including apple, pear and fruit punch, for a tropical sensation. Although it is a high alpha hop — 12% to 14% — Calypso is being marketed as a dual-purpose variety that is well-suited to American renditions of pale ale, India pale ale and double IPA.

Calpyso is a product of the Hopsteiner breeding program and is a descendent of Nugget.

At Stone Brewing Co. in Escondido, California (near San Diego), new hop varieties such as Calypso, are thoroughly vetted by Brewmaster Mitch Steele before they are used in large-scale recipes. If they meet with his approval, Steele formulates a small-scale pilot recipe to showcase the new hop. If the resulting brew is a success, Steele will try to work the hop into his existing beers or a special release.

For example, Steele used Calypso as one of two primary dry-hop varieties in Stone 16th Anniversary IPA. It is currently used as one of 11 hops in Stone Enjoy By IPA (see the photo on page 47).

"We like the complexity of flavors Calypso offers: cherry, berries, pear, fresh citrus-lemon and orange, and herbal. It's a complex hop that offers unique flavors," said Steele.

A testament to its adaptability, Washington's Black Raven Brewing uses Calypso, in conjunction with Chinook and Citra®, in the brewery's Bier de Garde, "Raven De Garde." "The clean yet earthy fruitiness of Calypso plays well with the profile of the *Brettanomyces* secondary fermentation this beer undergoes. We have been really happy with the complexity and versatility this hop offers," said Brewer Keil Anderson.

Belma™

Grown exclusively at Puterbaugh Farms in Washington State's fertile Yakima Valley, Belma™ is another new entry into the market. This higher alpha (12.1% AA), dual-purpose hop is characterized by its clean bitterness, citrus, and tropical fruit favors, which include grapefruit, pineapple, strawberries and melons.

"Belma™ has a special history and we hope this is appealing to brewers, as well," said Taylor Gardner, Public Relations Specialist for Puterbaugh Farms Hops Direct. Belma™ is named for a small community founded near the farm in Mabton, Washington in the late 1800s.

"We have had many brewers, large and small scale, give Belma™ a try in their brews. American pale ales, Belgian styles, blondes, and wheat beers have all been successful and have turned around great results thus far," she said.

"We just did a test with Belma™ and got intense berries and Concord grape," said Steele.

A limited, draught-only release by Dogfish Head Craft Brewed Ales recently showcased the hop in its American-style pale ale called Belma™

Continued on page 47

New Hop Blends to Try

The cultivation of hops can be traced back to 736 A.D., to the Hallertau region of Germany, although their use in brewing is not documented until 1079. It wasn't until centuries later that hops made their way to the United States and into the hearts and palates of American beer drinkers.

Today the U.S produces 30% of the world's hops, most of which are grown in the Pacific Northwest's Yakima and Willamette valleys. While continuing to grow tried and true varieties, in recent years, hop production among U.S. growers has been anything but the status quo.

It's an exciting time for brewers as hop farmers and hop breeding programs respond to the growing demands of creative craft brewers, and the increasingly more sophisticated tastes of a thirsty public looking for innovative brews.

In addition to the increasing number of new hop varieties on the market, one major player has taken the inventive approach of creating two customized proprietary hop pellet blends, designed especially for American IPAs and pale ales.

Hopunion in Yakima, Washington (www.hopunion.com) launched Falconer's Flight® in December 2010. Falconer's Flight® (11.4% alpha acids) is a blend of Northwest hop varieties, which include Citra® and Sorachi Ace as well as several (undisclosed) experimental hops and local varieties. Aroma characteristics include distinct tropical, citrus, floral, lemon and grapefruit notes. It is described as perfect for a Northwest-style IPA. It was developed in honor of Northwest brewing legend Glen Hay Falconer, an avid homebrewer turned professional, who brewed at Steelhead Brewery, Rogue Ales, and until his death in 2002, at Wild Duck in Eugene, Oregon. Falconer was known for his innovative brewing techniques and for pushing the envelope of creativity and challenging traditional recipes.

Hopunion donates a portion of Falconer's Flight® proceeds to the Glen Hay Falconer Foundation (visit on the Web at www.glenfalconerfoundation.org), a non-profit dedicated to providing opportunities for professional and aspiring Northwest brewers to further their knowledge and expertise.

Hopunion's other entry into the hop blend market is Zythos™. Originally created in 2011 to extend the timeline of IPA-friendly hop inventories through temporary proprietary-variety hop shortages resulting from cool weather in the Yakima and Willamette Valleys that year, Zythos™ is a customized IPA/Pale Ale style pellet blend. While Zythos™ can be used as a single hop addition, it was designed primarily as a complement to other varieties by imparting distinct tropical (pineapple) and citrus notes with slight pine characteristics. Due to popular demand following its debut in 2011, Hopunion decided to re-release Zythos™ in 2012.

CALYPSO RECIPE

Photo by Charles A. Parker/Images Plus

Calypso American Pale Ale (5 gallons/19 L, all-grain)

OG = 1.053 FG = 1.013
IBU = 43 SRM = 10 ABV = 5.2%

Ingredients

8.2 lbs. (3.7 kg) 2-row pale malt
1.5 lbs. (0.68 kg) crystal malt (40 °L)
1.5 lbs. (0.68 kg) dextrin malt
9.0 AAU Calypso hops
(0.75 oz./21 g of 12.0% alpha acids) (75 mins.)
12.0 AAU Calypso hops
(1 oz./28 g of 12.0% alpha acids) (0 mins.)
1 tsp. Irish moss
Wyeast 1056 (American Ale), White Labs WLP001 (California Ale) or Safale US-05 dry yeast
Priming sugar (if bottling)

Step by Step

Using a single-step infusion mash, dough-in at 154 °F (68 °C) using approximately 1.5 quarts of water to 1 pound of grain. Target mash temperature is 152 °F/67 °C. Hold at that temperature for 60 minutes. Sparge with 168 °F (76 °C) water, collecting a total of 6 gallons (23 L). Add the first hop addition at the beginning of the boil. Boil vigorously for 60 minutes. Add the Irish moss and boil for an additional 15 minutes. Add remaining hop addition at end of boil. Stir quickly but quietly for several minutes. Cover and let rest 10 minutes before transfer.

Chill the wort rapidly to 65 °F (18 °C). Pitch the yeast when the wort is cooled and aerate thoroughly. The proper pitch rate is 10 grams of properly rehydrated dry yeast, two packages of liquid yeast, or one package of liquid yeast in a 2-liter starter. Ferment at approximately 67 °F (19 °C) until the yeast drops clear. With healthy yeast, fermentation should be complete in a week or less. Allow the lees to settle and the brew to mature without pressure for another two days after fermentation appears finished. Rack to a keg and force carbonate or rack to a bottling bucket, add priming sugar, and bottle. For guidance on how much priming sugar to use and for carbonation rates, visit www.byo.com/resources/carbonation

Calypso American Pale Ale (5 gallons/19 L, extract with grains)

OG = 1.054 FG = 1.014
IBU = 37 SRM = 7 ABV = 5.2%

Ingredients

5.7 lbs. (2.5 kg) light dried malt extract
8 oz. (0.23 kg) crystal malt 40 °L
9.0 AAU Calypso hops (75 mins.)
(0.75 oz./21 g of 12.0% alpha acids)
12.0 AAU Calypso hops (0 mins.)
(1 oz./28 g of 12.0% alpha acids)
1 tsp. Irish moss
Wyeast 1056 (American Ale), White Labs WLP001 (California Ale) or Safale US-05 dry yeast

Step by Step

Place crushed grains in a steeping bag. Steep grains at 155 °F (68 °C) in 3.0 qts. (2.9 L) of water. Remove bag and place in colander over the brewpot. Rinse grains with approximately 2 qts. (2 L) of 170 °F (77 °C) water, bringing volume to at least 3.0 gallons (11 L) of wort. Slowly stir in malt extract and continue stirring as wort comes to a boil. Add first hop addition at boil; boil vigorously for 60 minutes, adding additional boiled water as necessary to keep volume at 3.0 gallons. Add Irish moss and boil additional 15 minutes. Add remaining hop addition at end of boil. Stir quickly but quietly for several minutes. Cover and let rest 10 minutes before transfer. Top off fermenter up to 5 gallons (19 L).

Chill the wort rapidly to 65 °F (18 °C). Pitch the yeast when the wort is cooled and aerate thoroughly. The proper pitch rate is 10 grams of properly rehydrated dry yeast, two packages of liquid yeast, or one package of liquid yeast in a 2-liter starter. Ferment at approximately 67 °F (19 °C) until the yeast drops clear. With healthy yeast, fermentation should be complete in a week or less. Allow the lees to settle and the brew to mature without pressure for another two days after fermentation appears finished. Rack to a keg and force carbonate or rack to a bottling bucket, add priming sugar, and bottle. For guidance on how much priming sugar to use and for carbonation rates, visit www.byo.com/resources/carbonation

Tips for Success

American pale ale is one of the best styles to showcase a single hop variety — in this case, Calypso. The key to keeping the beer in style and not pushing into IPA territory, however, is to exercise restraint with your hop additions. If you want to experiment with more or less hops with this recipe, according to *BYO*'s "Style Profile" author Jamil Zainasheff, you want to target a bitterness to starting gravity ratio (IBU divided by OG) of 0.5 to 0.7 for a more balanced beer or 0.7 to 1.0 for a bolder American pale ale.

To get a clean flavor profile in the finished beer, be sure to aerate well. Investing in an aeration stone and air pump setup is a good idea if you homebrew frequently. Also, keep the fermentation temperature steady — no big hot or cold swings — to prevent the yeast from flocculating early or producing off flavors. If you have problems with getting the yeast to attenuate fully, Jamil suggests that you can try raising the fermentation temperature just a few degrees near the end of of fermentation. This may also help clean up some of the intermediate compounds produced during fermentation.

For more about brewing hoppy American pale ales, visit *BYO* online http://www.byo.com/USAHops.

MOSAIC™ RECIPE

Photo by Charles A. Parker/Images Plus

Mosaic™ IPA
(5 gallons/19 L, all-grain)

OG = 1.068 FG = 1.017
IBU = 65 SRM = 8 ABV = 6.6%

Ingredients

11.5 lbs. (5.2 kg) 2-row male malt
1.0 lbs. (0.45 kg) crystal malt 40 °L
12.0 AAU Mosaic™ hops
(1.0 oz./28 g of 12% alpha acids)
(75 mins.)
9.0 AAU Mosaic™ hops
(0.75 oz./21 g of 12% alpha acid)
(30 mins.)
12.0 AAU Mosaic™ hops
(1.0 oz./28 g of 12% alpha acids)
(0 mins.)
24.0 AAU Mosaic™ hops (fermenter)
(2.0 oz./56 g of 12% alpha acids)
(0 mins.)
1 tsp. Irish moss
White Labs WLP001 California Ale,
Wyeast 1056 American Ale or
Fermentis Safale US-05 yeast
Priming sugar (if bottling)

Step by Step

Using a single-step infusion mash, dough-in at 155 °F (68 °C) using approximately 1.5 quarts of water to 1 pound of grain. (Target mash temperature is 152 °F /67 °C.) Hold for 60 minutes. Sparge with 168 °F (75 °C) water, collecting a total of 6 gallons. Add the first hop addition at boil; second at 45 minutes; Boil vigorously. Add Irish moss and boil additional 15 minutes. Add the remaining hop addition at end of boil. Stir quickly but quietly for several minutes. Cover and let rest 10 minutes before transfer.

Chill the wort rapidly to 65 °F (18 °C). Pitch the yeast when the wort is cooled and aerate thoroughly. The proper pitch rate is 11 grams of properly rehydrated dry yeast, two packages of liquid yeast, or one package of liquid yeast in a 2-liter starter. Ferment at approximately 67 °F (19 °C) until the yeast drops clear. With healthy yeast, fermentation should be complete in a week or less. Allow the lees to settle and the brew to mature without pressure for another two days after fermentation appears finished. Add remaining hops to fermenter after primary fermentation for 3 to 5 days. Rack to a keg and force carbonate or rack to a bottling bucket, add priming sugar, and bottle. Visit www.byo.com/resources/carbonation for more on priming and carbonation levels.

Mosaic™ IPA
(5 gallons/19 L, extract with grains)

OG = 1.066 FG = 1.017
IBU = 65 SRM = 7 ABV = 6.3%

Ingredients

7.0 lbs. (3.2 kg) light malt extract
1.0 lb. (0.45 kg) 2-row malt
8 oz. (0.23 kg) crystal malt 40 °L
2.0 AAU Mosaic™ hops
(1.0 oz./28 g of 12% alpha acids)
(75 mins.)
9.0 AAU Mosaic™ hops
(0.75 oz./21 g of 12% alpha acid)
(30 mins.)
12.0 AAU Mosaic™ hops
(1.0 oz./28 g of 12% alpha acids)
(0 mins.)
24.0 AAU Mosaic™ hops (fermenter)
(2.0 oz./56 g of 12% alpha acids)
(0 mins.)
1 tsp. Irish moss
White Labs WLP001 California Ale,
Wyeast 1056 American Ale or
Fermentis Safale US-05 yeast
Priming sugar (if bottling)

Step by Step

Place 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 place it in colander over the brewpot. Rinse the grains with approximately 2 qts. (2 L) of 170 °F (77 °C) water, bringing volume to at least 3.0 gallons (11 L) of wort. Slowly stir in the malt extract and continue stirring as the wort comes to a boil. Add the first hop addition at boil; second at 45 minutes. Boil vigorously, adding additional boiled water as necessary to keep volume at 3.0 gallons. Add Irish moss and boil additional 15 minutes. Add the remaining hop addition at end of boil. Stir quickly but quietly for several minutes. Cover and let rest 10 minutes before transfer. Top off the fermenter up to 5.0 gallons (19 L).

Chill the wort rapidly to 65 °F (18 °C). Pitch the yeast when the wort is cooled and aerate thoroughly. The proper pitch rate is 11 grams of properly rehydrated dry yeast, two packages of liquid yeast, or one package of liquid yeast in a 2-liter starter. Ferment at approximately 67 °F (19 °C) until the yeast drops clear. With healthy yeast, fermentation should be complete in a week or less. Allow the lees to settle and the brew to mature without pressure for another two days after fermentation appears finished. Add remaining hops to fermenter after primary fermentation for 3 to 5 days. Rack to a keg and force carbonate or rack to a bottling bucket, add priming sugar, and bottle. Visit visit www.byo.com/resources/carbonation for more on priming and carbonation levels.

Tips for Success

The sulfate content of your brewing water can affect the character of hop bitterness in your beer. If you find that your water is low in sulfate, you may detect that your hoppy beers seem a little flabby. To remedy this, you can try adding a small amount of gypsum. If you do not know the sulfate content of your water, start very low, with one gram of gypsum per gallon. Generally, you should need no more than three grams per gallon. A little gypsum goes a long way. You can add gypsum to the mash or, if you are brewing with extract, you can add it directly to your boil kettle water before you heat it. If you want to explore more water chemistry, check out Greg Noonan's downloadable "Water Witch" spreadsheet, which helps to tweak brewing water to particular profiles: www.byo.com/resources/brewwater.

LEGACY™ RECIPE

Photo by Charles A. Parker/Images Plus

Legacy™ Stout
(5 gallons/19 L, all-grain)

OG = 1.052 FG = 1.013
IBU = 49 SRM = 50 ABV = 5.0%

Ingredients

6.5 lbs. (2.95 kg) 2-row pale malt
1.5 lbs. (0.68 kg) roasted barley
12 oz. (0.34 kg) crystal malt 40 °L
8 oz. (0.23 kg) black patent malt
12 oz. (0.34 kg) flaked oats
11.7 AAU Galena hops
(1.0 oz./28 g of 11.7% alpha acids)
(75 mins.)
16.8 AAU Legacy™ hops
(2.0 oz./56 g of 8.4 alpha acids)
(0 mins.)
1 tsp. Irish moss
White Labs WLP001 California Ale,
Wyeast 1056 American Ale or
Fermentis Safale US-05 yeast
Priming sugar (if bottling)

Step by Step

Using a single-step infusion mash, dough-in at 154 °F (68 °C) using approximately 1.5 quarts of water to 1 pound of grain. (Target mash temperature is 152 °F/67 °C.) Hold for 60 minutes. Sparge with 168 °F (75 °C) water, collecting a total of 6 gallons (23 L). Add the first hop addition at boil. Boil vigorously for 60 minutes. Add Irish moss and boil additional 15 minutes. Add remaining hop addition at end of boil. Stir quickly but quietly for several minutes. Cover and let the wort rest 10 minutes before transfer.

Chill the wort to 65 °F (18 °C) and aerate thoroughly. The proper pitch rate is 16 grams of properly rehydrated dry yeast, 2.3 packages of liquid yeast or 1 package of liquid yeast in a 2.7-liter starter. Ferment at approximately 68 °F (20 °C) until the yeast drops clear. Allow the lees to settle and the brew to mature without pressure for another two days after fermentation appears finished. Rack to a keg and force carbonate or rack to a bottling bucket, add priming sugar, and bottle. Target a carbonation level of 2.5 volumes. Visit www.byo.com/resources/carbonation for more on priming and carbonation levels.

Legacy™ Stout
(5 gallons/19 L, extract with grains)

OG = 1.052 FG = 1.013
IBU = 49 SRM = 50 ABV = 5.0%

Ingredients

5.0 lbs. (2.27 kg) dark dried malt extract
1.0 lb. (0.45 kg) 2-row pale malt
12 oz. (0.34 kg) roasted barley
8 oz. (0.23 kg) crystal malt 40 °L
4 oz. (0.11 kg) black patent malt
12 oz. (0.34 kg) flaked oats
11.7 AAU Galena hops
(1.0 oz./28 g of 11.7% alpha acids)
(75 mins.)
16.8 AAU Legacy™ hops
(2.0 oz./56 oz. of 8.4 alpha acids)
(0 mins.)
1 tsp. Irish moss
White Labs WLP001 California Ale,
Wyeast 1056 American Ale or
Fermentis Safale US-05 yeast
Priming sugar (if bottling)

Step by Step

Place the crushed grains in a steeping bag. Avoid packing the grains too tightly in the bag, using more bags if needed. Steep grains at 155 °F (68 °C) in 3.0 qts. (2.9 L) of water. Remove the bag and place it in colander over the brewpot. Rinse the grains with approximately 2 qts. (2 L) of 170 °F (77 °C) water, bringing volume to at least 3.0 gallons (11 L) of wort. Slowly stir in the malt extract and continue stirring as the wort comes to a boil. Add first hop addition at boil; second at 45 minutes. Boil vigorously, adding additional boiled water as necessary to keep volume at 3.0 gallons. Add the Irish moss and boil for an additional 15 minutes. Add remaining hop addition at end of boil. Stir quickly but quietly for several minutes. Cover and let the wort rest 10 minutes before transfer.

Chill the wort to 65 °F (18 °C) and aerate thoroughly. The proper pitch rate is 16 grams of properly rehydrated dry yeast, 2.3 packages of liquid yeast or 1 package of liquid yeast in a 2.7-liter starter. Ferment at approximately 68 °F (20 °C) until the yeast drops clear. Allow the lees to settle and the brew to mature without pressure for another two days after fermentation appears finished. Rack to a keg and force carbonate or rack to a bottling bucket, add priming sugar, and bottle. Target a carbonation level of 2.5 volumes. Visit www.byo.com/resources/carbonation for more on priming and carbonation levels.

Tips for Success

There are a lot of similarities between black malt (or black patent malt) and roasted barley (enough to cause confusion among certain brewers) — two malts used in this recipe. Rich Norgrove, Jr., the Head Brewer at Bear Republic Brewing Company in Healdsburg, California, explains that, "Basically, black malt is going to come across as burnt and acrid with a dry character. It is more of an additive, for color and flavor, but it does not lend sugars to impact the specific gravity of the beer. Roasted barley has many of the same characteristics of black malt, though it is far more complex. It actually has some starch that can be converted during the mash, thus impacting the specific gravity. Roasted barley will also lend to the sweetness of a beer."

When working with these dark-colored malts, keep in mind that they can vary considerably from maltster to maltster, varying 100 °L or more for a similar named malt or roasted grain. The key to this beer is the balance between the bitterness of the roasted grains with your hops — in this case, Legacy™ — and also with the sweetness of the crystal malt. If you want to experiment with adding complexity, mouthfeel or increased head retention, you can try adding oats, wheat or Munich malt for up to 5% of the grist. For more about brewing American stout, visit *BYO* on the Web at http://byo.com/story2341.

BELMA™ RECIPE

Photo by Charles A. Parker/Images Plus

Belma™ American Wheat
(5 gallons/19 L, all-grain)

OG = 1.049 FG = 1.012
IBU = 3 SRM = 10 ABV = 4.8%

Ingredients

5.0 lbs. (2.3 kg) lager malt
2.0 lbs. (0.90 kg) 2-row pale malt
2.0 lbs. (0.90 kg) wheat malt
5.85 AAU Galena hops
(0.5 oz./14 g of 11.7% alpha acids)
(75 mins.)
6.0 AAU Belma™ hops
(0.5 oz./14 g of 12.1% alpha acid)
(0 mins.)
1 tsp. Irish moss
White Labs WLP001 California Ale,
Wyeast 1056 American Ale or
Fermentis Safale US-05 yeast
Priming sugar (if bottling)

Step by Step

Using a single-step infusion mash, dough-in at 154 °F (68 °C) using approximately 1.5 quarts of water to 1 pound of grain. (Target mash temperature is 152 °F/67 °C.) Hold for 60 minutes. Sparge with 168 °F (75 °C) water, collecting a total of 6 gallons (23 L). Add the first hop addition at boil. Boil vigorously for 60 minutes. Add the Irish moss and boil for an additional 15 minutes. Add the remaining hop addition at the end of the boil. Stir quickly but quietly for several minutes. Cover the wort and let it rest 10 minutes before transfer. Chill the wort rapidly to 65 °F (18 °C), let the break material settle and rack to the fermenter.

Pitch the yeast and aerate thoroughly. Use 9 grams of properly rehydrated dry yeast, two liquid yeast packages, or make a starter. Ferment cool, 65-66 °F (18-19 °C). With healthy yeast, fermentation should be complete in a week or less. When fermentation is finished, bottle or keg, carbonating the beer to approximately 2.5 volumes.

Belma™ American Wheat
(5 gallons/19 L, extract with grains)

OG = 1.050 FG = 1.013
IBU = 25 SRM = 3 ABV = 4.8%

Ingredients

3.5 lbs. (1.59 kg) light dried malt extract
2.0 lbs. (0.90 kg) wheat dried malt extract
12 oz. (0.34 kg) 2-row pale malt
12.oz. (0.34 kg) wheat malt
5.85 AAU Galena hops
(0.5 oz./14 g of 11.7% alpha acids)
(75 mins.)
6.0 AAU Belma™ hops
(0.5 oz./14 g of 12.1% alpha acid)
(0 mins.)
1 tsp. Irish moss
White Labs WLP001 California Ale,
Wyeast 1056 American Ale or
Fermentis Safale US-05 yeast
Priming sugar (if bottling)

Step by Step

Place crushed grains in a steeping bag. Steep grains at 155 °F (68°C) in 3.0 qts. (2.9 L) of water. Remove bag and place in colander over the brewpot. Rinse grains with approximately 2 qts. (2 L) of 170 °F (77 °C) water, bringing volume to at least 3.0 gallons (11 L) of wort. Slowly stir in malt extract and continue stirring as wort comes to a boil. Add first hop addition at boil; second at 45 minutes. Boil vigorously, adding additional boiled water as necessary to keep volume at 3.0 gallons (11 L). Add Irish moss and boil additional 15 minutes. Add remaining hop addition at end of boil. Stir quickly but quietly for several minutes. Cover the wort and let it rest 10 minutes before transfer. Chill the wort rapidly to 65 °F (18 °C), let the break material settle and rack to the fermenter.

Pitch the yeast and aerate thoroughly. Use 9 grams of properly rehydrated dry yeast, two liquid yeast packages, or make a starter. Ferment cool, 65–66 °F (18–19 °C). With healthy yeast, fermentation should be complete in a week or less. When fermentation is finished, bottle or keg, carbonating the beer to approximately 2.5 volumes.

Tips for Success

Brewing with wheat malt has some special considerations. For all-grain brewers, when milling the grains you will need to mill the wheat malt a bit finer than your other grains. Wheat is a little denser and harder to crack because the kernels are smaller. Make the mill setting tighter than for barley or the wheat will go right through without cracking. However, make sure the milled wheat is large enough to avoid a stuck mash. *BYO*'s Jamil Zainasheff advises that, "if your equipment is prone to stuck mashes, you might want to add a volume of rice hulls equal to the volume of wheat and rye used." For more advice for brewing with wheat malt from Greg Zaccardi at High Point Brewing Co. in Butler, New Jersey, visit *BYO* on the Web at http://byo.com/story753.

Do not assume that just because you are making a wheat beer that this beer should be similar to German hefeweizen. This style should have none of the spicy phenolic notes that are found in German hefe, but instead have a clean, wheat-y profile that is similar to the taste of crackers. The California ale yeasts listed in this recipe will give you a straightforward beer without those banana-like flavors that are found in hefe. You will also notice that the grain bill in this recipe is very simple — lager malt, 2-row and wheat. Resist the urge to experiment with adding specialty grains to this grain bill for this style as they can add too much sweetness or malt character. If you find that you want a bit more fruitiness in your finished American wheat beer, try experimenting with American wheat-specific strains, such as Wyeast 1010 (American Wheat™).

Pale Ale, brewed solely with Belma™. The hops were used at three points during the boil, then added in abundance to the fermenter as a dry hopping addition. Dogfish Head describes its beer as having, "flavors and aromas of slight grapefruit with a little bit of pineapple and melon tossed in the mix combined with a touch of grassiness against a gentle malt background."

Michael E. Smith, owner of HomeBrew in Paradise in Honolulu, Hawaii, made a test batch of beer using Belma™ and it was a hit with customers — so much so that the beer's recipe, Mapunapuna Pale Ale, was added to the store's regular recipe collection.

"It puts a nice spin on the pale ale; customers that don't particularly care for a hoppy beer like it," he said. He's also working on a wheat-based beer and a saison that will brew with Belma™.

Legacy™

The aptly-named Legacy™ from Puterbaugh Farms Hop Direct is another newly-registered variety. Legacy™ is a dual-purpose hop, with clean grapefruit, floral, black currant notes and a spicy aroma. Public Relations Specialist Taylor Gardner notes, "Legacy™ is excellent for brewing ales, lagers and stouts."

Master Brewer Ben Roesch of Wormtown Brewery in Worchester, Massachusetts recently started using Legacy™ in his cask dry hop program.

"We enjoyed the spicy earth and fruity citrus qualities. Legacy™ gives us a unique quality that complements both American and British style beers. Depending on the beer and the amounts, we get blackberries, orange, grass, and tea," said Roesch. (Read more about Roesch by visiting www.byo.com/story2811).

Legacy™ has actually been grown at Puterbaugh Farms since 1963 and is one of its very first varieties, hence the name. Despite its long history, however, the exclusive variety was only recently registered. Puterbaugh Farms is a fourth generation hop farming family and has been growing hops since the 1930s.

Many commercial brewers are experimenting with newer hops. Stone Brewing Co. uses Calypso hops in their "Enjoy By IPA," which is brewed in limited, time-released batches.

Mosaic™

Like the artful design for which it is named, Mosaic's™ aroma is described as enticing, running the gamut from fruity — lime, tangerine, blueberry, pineapple and mango — to grassy, floral, earthy and herbal.

Mosaic™ is a new flavor hop variety developed by the Hop Breeding Company LLC. Named and released in 2012, this variety has a relatively high alpha acids (11.5% to 13.5%) and low cohumulone content (24–26). It is a descendent of Simcoe® and Nugget.

HBC is a joint venture between the hop breeding programs of John I. Haas, Inc. and Select Botanicals Group, LLC (formerly known as Yakima Chief Ranches).

Homebrewers have followed the lead of many well-known US brewers, including Boston Beer Co., New Glarus Brewing Co., Lagunitas Brewing Co. and Russian River Brewing Co. in brewing with Mosaic™.

Boston Beer Co., the brewers of Samuel Adams, for instance, have added Mosaic™ to the Latitude 48 IPA ingredient list. According to the company, Mosaic™ hops were the inspiration for the 2013 batch and, "impart a floral and tropical fruit character and add a fresh, unique flavor to this already-complex brew." (Latitude 48 is named for its use of the select blend of hops from top German, English and American growing regions, all located near the 48th latitude along the "hop belt" of the Northern Hemisphere.)

This previously experimental hop variety (known only as #369) with intense floral notes, came to the attention of Samual Adams founder Jim Koch a few years ago. It was first used to create a limited-edition beer, brewed in collaboration with Dogfish Head.

German "Flavor" Hops

This quartet of new hops, first released to the public in 2011, includes Mandarina Bavaria (7–10% AA), which has a distinct Mandarin orangey flavor and aroma; Hallertau Blanc (9–11% AA) with a winey, floral-fruity character; Huell Melon (7–8% AA), with honeydew melon, apricot and strawberry notes; and Polaris (18–24%), with a unique minty, icy quality.

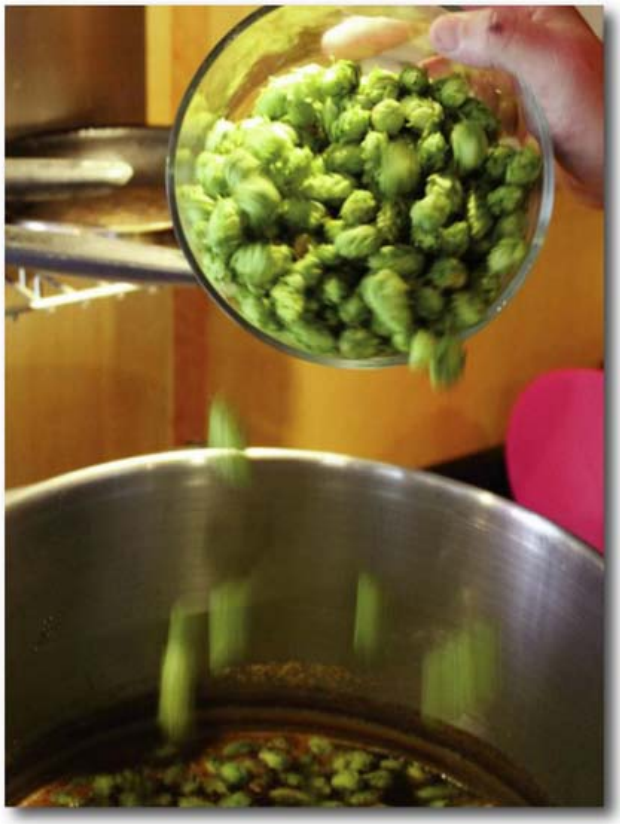
So far, Polaris has proven to be the most popular of the new "flavor" varieties. It is versatile enough to be well-suited to a refreshing Weissbier or to add an interesting twist to a Belgian saison.

Polaris was considered experimental until mid-April of 2012 when it was given its name. Up until then it was being referenced only by a code of numbers. The new varieties were developed at the Hop Research Center in Hüll, Germany. The Center is a partnership between the Bavarian government and the privately-funded Society of Hop Research. Polaris is popping up in commercial beers around the country, such as Hop Polaris from Funkwerks in Fort Collins, Colorado. BYO

FIELD *to* GLASS

Brewing With Fresh Hops

By **Lisa Morrison**



When it comes to brewing, which came first — fresh hops or dried? It's a classic chicken or egg conundrum. But we know this: Somewhere in time, in an unknown location, a brewer plucked fresh hops straight off the bines (not vines — there is a difference) and added them to wort to make beer.

Although there is no documentation that proves either way, one could easily assume that fresh hops might have been used in beer before the now-traditional practice of using dried ones.

It makes sense: We know that hops were relative latecomers to the beer world at a time when a host of different botanicals were utilized in wort to not only produce different flavors, but for medicinal uses as well. The first time someone threw in some hops, which we now know have anti-bacterial properties, the brewer or townspeople might have noticed that particular batch didn't spoil as quickly as some of the other beers. Along the way, hops were undoubtedly dried alongside other botanicals and herbs to be used in beer, medicine and other cooking needs during the months when the ground lay fallow, and it was probably discovered that the hops retained a lot of their potency, once again keeping beer from spoiling. While this is a scenario derived from current knowledge, it is easy to see how hops would begin to rise as a preferred addition to beer in this historic world of no refrigeration.

Whether it was an unknown nod to the original usage or a break from current tradition, over a decade ago, using fresh — or wet — hops in beer started catching the excitement of hobby and craft brewers. A seasonal beer of the most specific kind, beers made from these hops, freshly removed from the bine, are only available during harvest season. And, because of their fragile nature — if hops aren't dried shortly after being harvested, they can mildew quite quickly — wet

hops go straight into wort as soon as possible. So it makes sense that fresh-hop beers originated in locations where hop yards are nearby.

Excitement escalated over using these wet hops as a way to create new seasonal beers — and celebrate the harvest and the agricultural ties to brewing — and a dozen-plus years later, fresh-hop beers are a highly anticipated harbinger of the harvest and of autumn, bringing with them a fresh, bright taste that only newly harvested hops can impart.

"The consumer has embraced them because it's something that happens once a year," said Cam O'Connor, Brewmaster at Deschutes Brewing in Bend, Oregon. "It's a harvest celebration."

The good news is, it's easy for homebrewers to add wet hops to their own brews. And the better news is, thanks to increasing demand, it's also easier for brewers across the country to get those fresh hops — no matter how far from a hop yard they are.

Sourcing Wet Hops

Unless you grow your own (see sidebar on page 55) or know a generous person who does, fresh hops are a little troublesome — and sometimes pricey — to come by, but because of increased interest, the options are getting easier.

Mail-order hops: According to Vaughn Stewart, Project Development Manager for Northern Brewer, Hopunion has been doing a wet hop program for at least the past two years that delivers wet hops straight from the farms to your local homebrew shop.

"The wet hops are harvested, packed in boxes, then shipped via air to participating homebrew retailers, where they are doled out to customers. This is a great way to get commercial-quality fresh hops, including highly-sought-after varieties like Citra® and Simcoe®," he said.

Steve Bader, owner of Bader Beer & Wine Supply in Vancouver, Washington (and author of the recipes in this story that start on page 52), added that this year, Hopunion is

expected to once again offer some of the most sought-after aroma hops as wet hops.

"The truly best varieties are your favorite aroma varieties. Amarillo®, Cascade, Centennial, Chinook, Citra®, Simcoe® are currently the most commonly used fresh hops, and Amarillo®, Citra® and Simcoe® are the trendiest hops to be using these days," Bader said.

It was not known at press time which varieties would be available for the Hopunion program this year, but Duke Geren of FH Steinbart Co. homebrew supply shop in Portland, Oregon, adds one thing to keep in mind when sourcing wet hops is to use varieties that are typically used for aroma hops in the more traditional dry-hop forms.

"Fresh hops tend to have more punch in the flavor and aroma department than dry hops. A fresh-hopped beer just seems to pop with those qualities when used in beer. There are certain melon, citrus and grassy characteristics that are just more intense in fresh-hopped beers," Geren said.

Hit the farm: If you're close to an area where hops are grown — and those regions are expanding again across the country after being relegated to the Pacific Northwest for decades — one of the best ways to source fresh hops is to actually visit the hop yards of larger farms or a boutique hop farm that specializes in producing local hops for a growing number of breweries.

"For a more local flavor, many homebrewers have been turning to small farms," said Stewart. "With enough advance legwork, many of these farms are selling small lots of wet hops to homebrewers at harvest time."

It's quite an experience to see those lovely green gems being harvested off the bines with the heady aroma of hops surrounding you. But don't just think you can show up like you would at a farmer's market and take your pick from the day's harvest like you would a bunch of cucumbers or a watermelon. Wet hops are most often claimed far in advance. Many farmers have relationships with the neighboring breweries that have already taken up the current year's harvest. That being said, it never hurts to call ahead of time and see if you can still score some stragglers.

Know a pro brewer: If you are buddies with a local brewer, you might be able to ride the coattails of their wet-hop arrangements and pay them to order a little extra for you. Note: this is only applicable if you are *really* good friends with the brewer.

Brewing With Wet Hops

According to Cam O'Connor of Deschutes Brewing , the first step in designing a fresh-hop beer is again all about aroma.

"Consider the hop. Think about what the aroma you will get from that hop will be. Do you really want a garlic-stinky socks aroma from your beer? You might. You might not. But know that what you smell in the hop is definitely what you are going to get in the beer," he said.

Keep in mind that fresh hops act a lot like fresh herbs in cooking. Just like you do with fresh herbs versus dry herbs in cooking, because there is more moisture in fresh hops, you will need to

Continued on page 54

Portland U-Brew and Pub Fresh Hop IPA
(5 gallons/19 L, extract with grains)
OG=1.061 FG=1.014
IBU=70 SRM=12.6 ABV=6.2%

Brewers Note: For fresh hops, we estimate the alpha acids to be ½ of the average acids typically associated with that hop after it is dried. This helps us to better calculate IBUs in a fresh hop beer.

Ingredients
6.6 lbs. (3 kg) light liquid malt extract syrup
1 lb. (0.45 kg) rye malt
2 lbs. 5 ounces (1.05 kg) Victory® malt
5 oz. (0.14 kg) 80 °L crystal malt
9.75 AAU Citra® hop pellets (0.75 oz./21 g at 13% alpha acids) (60 min.)
15 AAU Citra® fresh hops (6 oz./170 g of approximately 2.5% alpha acids) (15 min.)
12.5 AAU Citra® fresh hops (5 oz./141 g of approximately 2.5% alpha acids) (5 min.)
5 oz. (141 g) Citra® fresh hops (0 min.)
0.75 cup (150 g) corn sugar for bottling
Wyeast 1056 (American Ale), White Labs WLP001 (California Ale) or Safale US-05 dry yeast

Step by Step
Steep the crushed grains in approximately 2 gallons (7.6 L) of water at 150 °F (66 °C) for 30 minutes. Remove the grains from the wort and wash the grains with 2 qts (2 L) hot water. Bring the wort up to a boil, and add 1 lb. (0.45 kg) of the light malt syrup. Add your Citra® hop pellets and boil for 60 minutes. With 15 minutes left in the boil, add the first addition of Citra® fresh hops. Add the remainder of the 5.6 lbs. (2.54 kg) of liquid malt extract for the last 5 minutes of the boil and stir to thoroughly mix into the beer and avoid scorching the malt extract. When you get the malt extract mixed in, add your second addition of Citra® fresh hops and boil for 5 minutes. At the end of your 60-minute boil turn your heat off, and add your last addition of Citra® fresh hops. Steep the fresh hops in the beer for 5 minutes. Now add the wort to 2 gallons (9 L) of cold water in a sanitized fermenter and top up to 5.25 gallons (19.75 L). Cool the wort to 65 °F (18 °C) and add your yeast. Aerate your wort, and ferment at 68 °F (20 °C) until fermentation is complete.

FRESH HOP RECIPES

By **Steve Bader**

All-Grain Option

Replace the liquid malt extract with 9.5 lbs. (4.31 kg) of 2-row pale malt. Mash at 150 °F (66 °C) for 60 minutes, and mash out at 168 °F (75 °C) for an additional 5 minutes, then collect about 6.5 gallons (24.5 L) of wort. Boil for 30 minutes without any hop additions, then boil 60 minutes with your first additions of Citra® hop pellets. Add the first addition of Citra® fresh hops with 15 minutes left in the boil. Add your second addition of Citra® fresh hops for the last 5 minutes of the boil. Turn off your burner, and now steep your last addition of fresh hops for 5 minutes, then cool your wort, fill your fermenter and ferment at 68 °F (20 °C) until fermentation is complete.

Fresh Hop Black IPA (Cascadian Dark Ale)

(5 gallons/19 L, extract with grains)

OG=1.064 FG=1.016
IBU=60 SRM=33 ABV=6.3%

This beer is malty, smooth, with strong hop bitterness, and a wonderful fresh hop aroma to round it out. The use of Midnight Wheat (a dark grain without the harsh bitterness of many dark malts) gives this beer a lack of astringency common in dark beers. Then kick the hop aroma up a notch with the fresh hops and you will love this beer!

Ingredients

6.6 lbs. (3 kg) light liquid malt extract syrup
1.0 lbs. (0.45 kg) light dried malt extract
10 oz. (0.28 kg) Special Roast malt
0.5 lb. (0.22 kg) 10 °L crystal malt
0.75 lb. (0.34 kg) Briess Midnight Wheat malt
0.25 lb. (0.11 kg) wheat malt
6.5 AAU Warrior® hops (0.5 oz./14 g of 13% alpha acids) (60 min.)
8.0 AAU Cascade Hops (1.0 oz./28 g of 8.0% alpha acids) (60 min.)
1 tsp. Irish moss
8.0 AAU fresh Cascade Hops (5 oz./141 g of 1.6% alpha acids) (0 min.)
0.75 cup (150 g) corn sugar for bottling
White Labs WLP001 (California Ale) WLP001 or Wyeast 1056 (American Ale) or Safale US-05 yeast

Step by Step

Steep the crushed grains in approximately 2.5 gallons (9.5 L) of water at 155 °F (68 °C) for 30 minutes. Remove the grains from the wort. Bring the wort up to a boil, and add 1.0 lbs (0.45 kg) of the light dried malt extract. Now add the Warrior® hops, first addition of Cascade hops, Irish moss and boil for 60 minutes. Add the 6.6 pounds (3 kg) of liquid malt extract for the last 5 minutes of the boil and stir to thoroughly mix the wort and avoid scorching the malt extract to the bottom of your kettle. At the end of your 60-minute boil turn your heat off, and add the fresh Cascade hops. Stir the fresh hops into the beer for 5 minutes. Add the wort to about 2 gallons (7.5 L) of cold water in your sanitized fermenter, and top up to 5.25 (19.75 L) gallons. Cool the wort to 65 °F (18 °C) and add your yeast. Aerate your wort, and ferment at 68 °F (20 °C) until fermentation is complete.

All-Grain Option:

Replace the liquid and dried malt extracts with 11.5 lbs (5.2 kg) of 2-row pale malt. Mash at 155 °F (68 °C) for 60 minutes, then mash off at 168 °F (75 °C) for an additional 5 minutes and collect about 6.5 gallons (24.5 L) of wort. Boil for 30 minutes without any hop additions, then boil 60 minutes with the Warrior® and first addition of Cascade hops and Irish moss. Turn off your burner, and now steep the fresh Cascade hops for 5 minutes. Cool your wort, fill your fermenter and ferment at 68 °F (20 °C) until fermentation is complete. Bottle or keg as usual.

Deschutes Hop Trip Fresh Hop Beer Clone

(5 gallons/19 L, extract with grains)

OG=1.059 FG=1.017
IBU=42 SRM=14 ABV =5.4%

Ingredients

6.6 lbs. (3 kg) light liquid malt extract
0.5 lbs. (0.22 kg) light dried malt extract
14 ounces (0.39 kg) Caramunich® 60 °L malt
11 ounces (0.31 kg) Dextrin malt
4 ounces (0.11 kg) Briess Extra Special malt
1 tsp. Irish moss
3.3 AAU Nugget hops (0.25 oz./7 g at 13% alpha acids) (60 min.)
2.6 AAU Centennial hops (0.25 oz./7 g at 10.5% alpha acids) (60 min.)
5.25 AAU Centennial hops (0.5 oz./14 g) at 10.5% alpha acids) (30 min.)
1 lb. (0.45 kg) fresh Crystal hops (steeped 5 min.)
0.75 cup (150 g) corn sugar for bottling
Wyeast 1187 (Ringwood Ale), White Labs WLP005 (British Ale) or Windsor Dry yeast

Step by Step

Steep the crushed grains in approximately 2 gallons (7.6 L) of water at 150 °F (66 °C) for 30 minutes. Remove the grains from the wort and wash the grains with 2 qts. (2 L) hot water. Bring the wort up to a boil, and add 0.5 lbs (0.22 kg) of the light dried malt extract. Now add your Nugget hops and first addition of Centennial hops and boil these hops for 60 minutes. 30 minutes into the boil, add your second addition of Centennial hops and Irish moss. Add the 6.6 pounds (3 kg) of liquid malt extract for the last 5 minutes of the boil and stir to thoroughly mix in the beer and avoid scorching the malt extract to the bottom of your kettle. At the end of your 60-minute boil turn your heat off, and add your 1 pound (0.45 kg) of fresh hops. Stir the fresh hops into the beer for 5 minutes. Add the wort to about 2 gallons (9 L) of cold water in your sanitized fermenter, and top up to 5.25 (19.75 L) gallons. Cool the wort to 65 °F (18 °C) and add your yeast. Aerate your beer, and ferment the beer at 68 °F (20 °C) until fermentation is complete.

All-Grain Option:

Replace the liquid and dried malt extract with 11 lbs (5 kg) of 2-row pale malt. Mash at 157 °F (69 °C) for 30 minutes, and mash off at 168 °F (75 °C) for an additional 5 minutes, then collect about 6.5 gallons (24.5 L) of wort. Boil for 30 minutes without any hop additions, then boil 60 minutes with your Nugget and first addition of Centennial hops. Add the second addition of Centennial hops and Irish moss for the last 30 minutes of the boil. Turn off your burner, and now steep your 1 lb. (0.45 kg) of fresh hops for 5 minutes, then cool your wort, fill your fermenter and ferment at 68 °F (20 °C) until fermentation is complete.

Tips for success

Brewing with fresh hops can leave a lot of hop material behind, which can clog up your equipment. Add hops using a muslin brewing bag or a "hop spider" to make things easier. To build your own hop spider, visit: http://byo.com/story2427.

use more of them to achieve the desired results.

"Depending on who you talk to, fresh hops are used at a ratio of five-to-eight to one versus dry hops," Geren says. "So, for example, where a recipe might call for two ounces of late-addition dry hops, you would instead use 10 to 16 ounces (283 to 454 g) of fresh hops."

And the "late addition" part is key, according to most of the experts polled for this story.

"Part of this is due to unknown alpha acid levels (in the fresh hops), and part is that it better captures and preserves the delicate flavor and aroma elements that make these hops so special," Stewart said.

O'Connor warns that using fresh hops early in the boil for bittering can impart an undesirable vegetal quality.

"We've played around with using fresh hops for bittering," he says. "But for Hop Trip, for example, we use (dried) Nugget (hops), I believe, for bittering and all fresh hops for aroma."

Stewart and Geren recommend adding the hops in the last 10 to 20 minutes of the boil for the maximum amount of aroma retention, but neither say it's wise to dry-hop beers with wet hops because of the risk of contamination.

"Better still, a 'hot stand' or 'hop stand' can be conducted, where the heat to the boil kettle is turned off, the fresh hops are added, and the lid is replaced on the kettle," Stewart said.

"The hops stay in the just-below-boiling wort for 30 to 60 minutes. It is believed that this temperature extracts rich volatiles more thoroughly, and may even be used in lieu of dry-hopping."

That being said, Geren advises to experiment and have fun with those lovely fresh green globes that arrive only once a year.

"Don't be afraid to color outside the box," Geren said about taking risks with fresh hops. "There are no hard and fast rules when it comes to homebrewing or using fresh hops. Don't be afraid to experiment or try something unconventional. You just might stumble upon something extraordinary. "

And one final note: remember to keep good notes when you are brewing with fresh hops, because you won't be able to tweak your recipe for a whole year until hop harvest comes around again. Also, using a scale to weigh the hops is the best way to record the hop usage. Measuring them by the cup (or other dry measure) is inconsistent depending on the growing season — packed vs fluffy, size of cones changing, etc. Weight, however, is always the same.

Related Links

• For more about hop stands and post-boil hopping, check out Dave Green's story in the March-April 2013 issue of *BYO*: http://byo.com/2808.

• For more information about dry hopping your homebrews, visit http://byo.com/569

Grow Your Own Hops

If you live in the right climate, the best way to source fresh hops is to grow your own. Hops can grow across at least the northern half of the mainland United States, provided there is ample moisture and sunshine and well-drained soil with a lot of compost — and maybe even deeper south with protection from the heat and sun, as well as a solid green thumb.

Hops require a minimum of six to eight hours of sunshine a day; southern-facing areas often are best. The bines can grow as much as a foot a day and can reach higher than 25 feet (~8 m) and weigh more than 20 pounds (9 kg), so plan for a vertical space and a sturdy trellis.

There are several sources for mail-order hop rhizomes. You can find a directory of hop rhizome suppliers at www.byo.com/stories/issue/item/2809-2013-hop-rhizome-supplier-directory

But even with perfect conditions, don't expect your rhizomes to produce a lot of hops the first couple of years — so plan your fresh-hop beers accordingly.

"Hops really start to produce after the third year, so don't expect much out of the first couple of years," said Jason Webb of Portland U-Brew and Pub. "And don't worry, either. You can plan to use your few fresh hops with other hops, but you won't be able to make a fully fresh hop beer the first year, for sure."

Hops are ready to be picked when they feel slightly papery on the outside but are still springy when squeezed. When torn apart, they should have a lot of yellow-colored resin inside — that's the lupulin that imparts the flavor and aroma. Time is of the essence, as you don't want the hops to get past their prime, so make sure you have plenty of friends, homebrew and gloves (the bines have small yet nasty barbs) ready to join in the picking party. To take full advantage of your harvest, you will want to get your brew kettle going at the same time.

"It can't get any fresher than the day you round up some friends to pick hops," Steve Bader of Bader Beer and Wine Supply in Vancouver, Washington said of harvest time. "It is a pretty slow and tedious process, so lots of friends are a good thing to have around."

For more about growing hops in containers (for those without a yard), check out: http://byo.com/story1872 BYO

Choosing Glassware to Showcase Your Brew

By **Ruth Miller**

TULIP

SNIFTER

CHALICE

GOBLET

FLUTE

You worked hard to perfect that beer style you love, and now you want to show the world (i.e. your family, friends, and drinking buddies) your success and share the goods. Choose the appropriate glassware to highlight all of its unique character — it's science, not snobbery — and it works. Standard 16-oz. (473-mL) shaker tumblers are fine when you're at the bar where breakage and theft are issues, but at home your beer deserves to be presented in a manner that shows off all of its attributes.

Illustrations by Chris Champine

Style-specific glassware is beneficial from a scientific aspect: beer contains volatile esters that are not only aromatic, but make up 80% of the flavor you perceive. They are a result of yeast types, fermentation temperatures, hop aromas and other brewing factors — as most homebrewers are aware. Carbonation serves as the "delivery system" to get these characteristics to your olfactory senses intact before they disseminate into the air. When served in a glass that releases these volatiles, showcases aromatics, and encourages lively and stable carbonation, the flavor experience can be greatly enhanced.

Here are some basic types of glassware that are style-appropriate. Whatever the glass, there is history and science behind why they are shaped the way they are. Let's explore them by style . . .

Tulip

This form has a medium stem to facilitate grasping for swirling, with a slight bulb tapering to a flared lip. This glass is great for estery or hoppy beers with a long-lasting head. The bulb concentrates the volatiles, which then work their way up to, and support the head. The flare allows the head to stay intact, allowing delivery of aromatics, but also for the beer to slip underneath onto the tongue without interference. Since the head is the "cap" there is minimal dispersion of aroma as it hits the tongue. Many have etched pinpoints on the bottom of the bowl called "nucleation sites" that encourage bubbles to continuously form for head stability. The bowl also helps trap the wonderful aromas while enjoying your beer and after the glass is emptied.

Snifter

This form is best for high-gravity, low-carbonation beers and barrel-aged versions. A short stem allows the warmth of the hand to encourage the volatiles to "bloom" — in these styles the aroma delivery is achieved through the evaporation of alcohol since the carbonation may be low or absent. The rim tips inward rather than flaring out to capture the volatiles inside a more contained space, which allow the nose to sniff directly. This is also useful for highly-hopped beers in order to get the full aromatic effect of the hops used. Using a snifter for beers with a lot of carbonation can be problematic — they trap the head, which makes it difficult to sip the beer beneath the foam without getting it all over or up one's nose! Like the tulip, the bowl allows for swirling to release volatiles by surface evaporation, and preserves the aromas to be appreciated after the glass is empty.

Goblet

This form is typical of Belgian styles and has a medium-to-tall stem with a graceful ovoid-shaped body. Beers that are vinous in character benefit from this wine-glass shape. The stem keeps the hand's warmth isolated from the beer to maintain optimum temperature while swirling, and the gently curved bowl is easy to sip from, allows lacing to stick longer and delays its eventual slide down the interior for great visual effect. The rim is thin to prevent sensory interference of thick glass for a seamless transfer to the tongue. It is elegant to hold and drink from, and gives the beer a refined and sophisticated look that is appealing.

Chalice

This form is an historical nod to the origins of Trappist styles, imitating the shape of ecumenical vessels used by European beer-brewing religious orders. They tend to be over-sized, heavy and faceted or otherwise decorated with gilt trim and/or emblems of religious or brewing significance. They have thick, blocky stems that are easier to grasp with so much weight in the top-heavy bowl. Some are so large they require two hands to grasp, but are so thick that transferred warmth isn't an issue. They are mostly used to serve Trappist styles as a tribute to their origins, and have the same tasting attributes as their more svelte sister, the goblet. Drinkers may find that a thick rim gets in the way of beer reaching the tongue, but many versions have the shape without the bulk.

Flute

This form has a tiny stem with a straight-sided body flaring from very small at the base to a bit bigger at the top. Like traditional flutes used for Champagne, these glasses are used to keep the "bubble elevator" visual effect going for as long as possible. Effervescent dry or sour beers like gueuze and lambics showcase this, and allow the sliding of the beer up and down the sides as it is tipped to rejuvenate the carbonation with every sip. Low carbonation beers benefit from the "tipping" effect to create turbulence that rouses bubbles and delivers aromatics to the nose and mouth simultaneously in a

WEIZEN

MUG

Continued on page 59

BYO – Basic Brewing Glassware Collaborative Experiment

by James Spencer

Walk into a fancy wine bar and order a glass of vino, and they'll serve it to you in glassware specific to that varietal of wine. It's said that there are Belgian beer bars that refuse to serve you beer if they don't have the glass specifically tailored for the brand of beer you're buying. American breweries are now designing their own glassware scientifically tested to enhance the qualities that set their beers apart.

But does glassware really make a difference when serving beer? Is all of this fuss worth the trouble, or are we okay just slurping our favorite brews out of the good old shaker pint glasses that the corner pub slides down the bar every weekend night? That's the question we sought to answer in this *Brew Your Own — Basic Brewing* collaborative experiment on glassware.

We invited *Basic Brewing* listeners and *Brew Your Own* readers to join us in comparing different styles of glassware side-by-side. We asked them to compare the look, smell and taste of the same beer served in different glassware of their choosing.

I asked Steve Wilkes, my podcast co-host, to select a beer and some glassware to put to the test. Steve chose a Pilsner glass; a brandy snifter; and a Tripel Karmeliet tulip glass.

Steve's beer of choice was Old Rasputin Imperial Stout from North Coast Brewing Company. Mine was Avery's Maharaja Imperial IPA.

The differences in the glassware became apparent almost immediately. The tall, narrow Pilsner glass created a large amount of foam on both beers, and that foam hung around for a long time. The brandy snifter had almost no head after the pour, while the tulip glass sat somewhere in the middle.

The combination of the persistent head on the Pilsner glass with its shape may have played against it in this test. We found the aroma to be significantly less in the Pilsner glass, perhaps due to the foam cap and the fact that the opening was much narrower than the other two, preventing our noses from having access to any aromas that may have been escaping.

In our opinion, the brandy snifter came out on top in aroma and flavor, with the tulip glass again fitting in the middle of the three. This surprised me because I expected the wider opening of the tulip glass to feature the aroma better.

Listeners and readers who participated each took different approaches.

Jonathan LeMarbre from Smith Falls, Ontario, put three beers to the test in a variety of glasses, sampling a homebrew IPA, homebrew nut brown ale, and Sugar Shack Ale from Barley Days.

"Glass styles, for me, did affect my drinking experience in aroma and viewing experience," Jonathan says. "However, glassware did not, as I suspected, change flavor profile at all, as I am sure most other beer geeks would already know. The only drinking change was in the release of carbonation, which the Innis and Gunn Pokal and the wheat beer glass did very well for head formation, but if you don't want a rapid flattening of your beer, then it would best be avoided in these glasses."

Jonathan advises, "Just because a beer may come with a specifically manufactured glass doesn't mean that is what you should always serve it in."

Scott Koué from Detroit, Michigan, sampled Roscoe's Hop House Amber Ale and Lion Imperial Ceylon in three beer glasses (including a plastic "kegger" cup) and two cocktail glasses. He gives the nod to the containers designed for beer.

"The big surprise was how well the plastic picnic glass held up," Scott says. "The glasses that didn't create head had so much residual carbonation that they really fizzed up in the mouth, and the CO_2 bubbles on the tongue really masked a lot of flavor. It seemed that beer needed a larger container to let the smell 'fill up the space' and be noticed."

Tom Wallace of Charlottesville, Virginia, sampled Chimay Cinq Cents in a Chimay chalice and a Pilsner glass. Tom and his wife, Meghan, favored the Pilsner glass over the one designed for the Chimay brand.

"The Pilsner glass preserved the fine-bubbled beer head throughout the entire drinking session, while the coarser chalice head dissipated within a few minutes," Tom says. "Our general impressions were that the chalice glass presented the best aroma, which was a light citrus character overlayed by a rich yeasty character. The Pilsner glass developed a smooth rich mouthfeel that became almost silky at the end, while the chalice glass presented a coarser, more abrupt, mouthfeel."

Zot O'Connor sampled a homebrew IPA and Firestone Walker Double Barrel IPA in shaker pint and nonic pint glasses, which feature a bulge below the rim. Zot reports the nonic pint had "20 to 50 times" the aroma of the standard shaker, which he felt positively impacted the flavor of the beers.

"The bulge changed the aroma of the beer dramatically for a hoppy beer and affected the perceived taste of the beer," Zot says. "I now cringe when I drink a hoppy beer in anything else, especially the bottle."

Glassware does seem to make a difference, at least to the majority of our experiment participants. Finding the exact pairing between beer style and glassware style is where it gets tricky. But finding our own preferences is the fun part.

For more reader/listener results, visit http://byo.com/story2835

narrow space that concentrates and accentuates them.

Weizen or Weisse

This form has unique appeal in terms of shape — I call it the "Barbie Doll Effect." It is extremely tall, curvaceous and bulges out enticingly at the top (you get the picture). The glass is very thin to show off the unique color and turbidity of wheat beers, and the bulb at the top gives their enormous, rocky head all the attention it is due as its crowning glory. Since most wheat beers in Europe come in larger bottles, these glasses are typically of the 0.5-liter capacity, marked with a line and a full 2 inches (5 cm) above it to show off that pillow-y white head. Because the glass is so tall, the lacing that remains on the sides takes a long time to dissipate and leaves a rich wheaty aroma behind in the empty glass. There are smaller, less hefty versions, but they cannot match the grandeur of the full-size examples.

Mug or Stein

Most of these forms are of German origin and reflect the cultural history of beer as a social libation. They tend to be heavy, either straight-sided or barrel shaped, and always with a prominent handle to facilitate serving and hefting. They need to be thick and sturdy in order to survive endless clinking and-handling of multiples during service (think of the St. Pauli Girl with handfuls of mugs). Most are of the 0.5-liter size, again with corresponding fill line and generous headroom, but the famous 1-liter giants made of dimpled glass are not seen very much stateside. These are vessels born of necessity, and they perform their function of delivering large amounts of colder, crisp styles with plenty of head to the lips of drinkers in social situations very well. Most are glass, but antique ceramic steins have metal lids that were added to keep leaves, bugs and other detritus out of the beer in the outdoor *biergartens* and were personally-owned by the imbiber. These personal steins are often decorated with family crests, hunting scenes and other personalized motifs.

STANGE

PILSNER

Stange

These glasses are small, short, and straight sided with no flare in order to concentrate the volatiles, and are used to serve several styles that are indigenous to the towns where they were born. Some used for rauchbier are as small as 0.25 liter, as few people want more than that of a smoked beer. They increase in size to the Kölsch glass at 0.4 liter, and the gose glass of 0.5 liter. These glasses cannot be stacked and are tippy, so are more of a traditional relic of their pedigree where they are served than as typical barware. The word *stange* means "stick" and these tall, slender cylinders are used to serve these more delicate beers, amplifying malt and hop characteristics in a tightly-confined space for maximized sensory perception.

NONIC PINT

THISTLE

Pilsner

This form is tall, slender and flares from a small, thick base to a wider lip like a trumpet. The German version is solid, while the "pokal" version has a short stem. This glass is all about showcasing the clarity of these styles, so a slimmer profile allows the drinker to see clear through the beer. The base or stem keeps hands from warming up lager styles that are served on the colder side. Since the aromatics of these styles tend to be delicate and more nuanced, the tall shape helps concentrate them for delivery to the imbiber's nose as they sip. It also allows plenty of room for a nice fluffy head.

Nonic/Imperial Pint

This glass is a product of the United Kingdom (UK) where sessionable, low-gravity beers are more the norm, and a large capacity glass like the nonic is appropriate. An Imperial pint is 20 ounces (0.6 L), and the larger format became the standard capacity in taprooms all over the the UK. It has a wide flat base with sides that flare out just a little, with a prominent bulge about an inch below the rim to enable a good grasp. Since ales of this region are traditionally served at warmer cellar and cask temps anyway, no handle or stem is necessary. This is a glass shaped for large pours of ales that, what they lack in alcohol, they make up for in aromatics. A wide rim allows them to be perceived with nothing in the way between the glass and the drinker's nose and tongue. They have markings that allow the drinker to choose quarter, half, three-quarter and full pours.

Thistle

This form originated in Scotland, and is uniquely-shaped to mimic the national flower of Scotland. It has a round base, short to medium stem, topped with a pronounced ovoid bulb and flared sides rising from it. Whisky-tasting glasses are simply smaller versions of this unusual style. Although more of a national tribute than a drinking vessel with practicality in mind, it makes Scottish ales, barleywines and wee heavys look very festive. The accentuated bulb allows the hand to warm the beer, releasing the volatiles yet holds the aromatics long after the glass is empty, but the flared sides make it easy to smell and sip off the rim.

Glass Choice and Care

Inexpensive sets of glassware styles are available at retail and cover all the bases to showcase a variety of beer styles. Keeping your glassware clean — including hand-washing, thorough rinsing and towel drying — will make them work all the better. Automatic dishwashing detergents that use sheeting chemicals tend to leave a film, wear off logos and etch glassware over time; and any residue will kill head in a glass. Presenting your homebrew in glassware that plays up its best qualities, and increases your enjoyment can be a good investment, don't you think? BYO

Recipe Creation

Make it your own

by Terry Foster

Many of you will reach a point where you want to construct your own recipe from scratch, even though there is a huge range of recipes already available in books, magazines, on the web, and from your homebrew supplier. There is a lot to be said for sticking to an established recipe, but this is a hands-on craft we practice and there comes a time when you want to expand your brewing skills and create a brew that is entirely your own. A previous article, "Balanced Recipe Formulation" (*BYO* March-April 2007) described how to do this, and I shall not try to improve on on it because I do not have enough space in this column. Instead, I want to come at recipe formulation from a somewhat different angle and give you some insight as to how I approach the matter and how I put together a recipe for a beer of mine that I call "Small IPA."

Ask the questions

Before you start, you must determine what you hope to achieve. The following questions should be helpful:

1. What kind of beer do you really want to brew?
2. What original gravity (OG) and alcohol by volume (ABV) do you want in the brew?
3. Are there any special flavors you want to confer on the brew?
4. What kind of balance do you want in the finished beer?
5. What level of hop bitterness suits this beer best?
6. Which hop variety would you like to use?
7. Do you want the beer to have a lot of hop character and aroma, and should some of this come from dry hopping?
8. What yeast strain is going to work best for you?

Let's look at these questions in more detail. Number one is obviously the key to the whole process, and you need to have a clear aim in mind. If you don't know what you're trying to make, you will never know if you made it! So you have to decide whether you want to produce a clone, or something similar to a commercial beer you like, whether you want to enter it into a competition, or if you just have a set of flavors in your mind that suits your palate. In the first two cases you can find a lot of pertinent information from things like the brewer's website or the style guidelines put out by the Beer Judge Certification Program (BJCP). The last possibility requires more thought on your part, and decisions such as whether you simply want to make a "house drinking beer," or want to try something entirely new in the way of spices or other flavorings. In such cases, you will need to answer the other questions very carefully.

Question number two should be straightforward to answer and help you choose what malts to use. Note that base malt choice may be decided largely by the style of beer you have chosen — say English 2-row pale for an English bitter, or Pilsner malt for a pale lager. From consideration of the above paragraph, you will pretty much have defined your beer's OG. For example, a "drinking beer" is going to fall in the range of 1.035-1.050 (8.8-12.4 °P), while an imperial stout will be around 1.080 (19.3 °P) and up. Alcohol content is approximately equal to the difference between OG and finishing gravity (FG). Therefore the alcohol level reflects the fullness, sweetness or even dryness of the beer. For low- to medium-strength ales, a useful rule of thumb is the FG is usually about one-quarter the OG. If you want a fuller, sweeter beer, you need to shoot for a slightly higher FG than that. That could be achieved by using specialty malt such as caramel/crystal, which will contribute some non-fermentable matter, or by using a low-attenuating yeast strain. For a dry-fin-

> "There is a lot to be said for sticking to an established recipe, but this is a hands-on craft we practice and there comes a time when you want to expand your brewing skills and create a brew that is entirely your own."

Photo by Les Jörgensen

ishing beer, you would want a slightly lower FG (higher ABV), so you should keep non-fermentable matter down by mashing at a slightly lower temperature than usual, say 148-150 °F (64.4-65.6 °C), or use a well-attenuating yeast.

The third question requires that you decide whether you need to add specialty malts, and which ones. Obvious examples are caramel malts, brown malt for a licorice flavor, Belgian biscuit malt for biscuity notes, Briess Victory® for a bready-like character, and, of course, black and chocolate malts for roasted flavors. Do remember that all of these malts will also add color and should not be overdone; select the amount and nature of such malts with color in mind. Other flavorings such as spices, coffee, or chocolate might also be in your mind; it's best to start at a low addition rate and work your way up in subsequent brews if necessary.

Number four is a little trickier to answer, since balance in a beer depends on the type of beer you are brewing. Bland, run of the mill commercial beers are balanced in that no single flavor sticks out. But a dry stout should have a definite roasty bitterness, and an IPA should have noticeable hop bitterness and character. The simple way to look at it is that in a balanced beer no single flavor dominates all others, and the beer has "drinkability" (also difficult to define, but you'll know it when you taste it). Again, my advice is to be circumspect and not add heaps and heaps of a potentially powerful-tasting ingredient initially.

You can answer questions five, six, and seven together to keep things simple. If you are brewing to style, the level of hop bitterness and hop flavor and aroma are pretty much decided for you. But if you are making your own unique beer, you have to make a decision on these things for yourself. If you like a lot of bitterness, add plenty of high-alpha hops, but remember the comments on balance above. Similar considerations apply to hop character and aroma, but bear in mind that just because you like such flavors; they do not necessarily work well with all beers. Beer styles have evolved because certain flavors complement each other, and wild deviations from such combinations can easily result in something undrinkable.

Hop variety selection is no simple matter with so many varieties available today. Which one(s) you select depends on your own experience and preference. If you are not sure, geography rules — English hops for English beers, German hops for German styles, and American hops for American beers. If you are considering dry hopping, I would counsel caution that it does not work well with all kinds of beers. Dry hopping is best suited to bitters, pale ales and IPAs. If you still want to try it in your developing recipe for another kind of beer, then work out the recipe, brew the beer without dry hopping it, evaluate it, and if you still think it's worth doing, dry hop the second batch.

The last question is that of yeast strain selection.

Again, you may have some preference, but you should choose according to the beer type you have in mind. There may be other flavor considerations, such as using an English strain if you want an estery, fruity character, or a "neutral yeast" if you are looking for a very clean-tasting beer. If you are not sure which to opt for, I suggest a good browse on the supplier's website before choosing your strain.

Plan it out

Once you have answered the questions above, you need to plan out the recipe and determine how much of each ingredient you will need to reach the OG and IBU levels you want. This means you need to know what yields you get from your base and specialty malts. If you are unsure, use the *BYO* Recipe Standardization based on 65% extract efficiency, and given in every issue of *BYO* (see page 2). This is simple if you are making an all-malt extract beer since efficiency doesn't come into it — what you put in is what you get, though you will have to calculate how much extract you need in order to hit your target gravity. Put your malt bill together from this, then calculate how much hops you need to reach the target level of bitterness. You can do this by experience if you have made similar beers in the past, or you can calculate the weight of hops needed, making an assumption as to your own hop usage — I generally reckon on 25% usage of added alpha acid as a first approximation and go from there in the next brew. For more on this, see my techniques article in the September 2011 issue of *BYO*.

A simpler route to working out the recipe is to use a brewing calculation program. If you are up to it, putting together your own brewing spreadsheet is also a good way to go. A great advantage of both these approaches is that they make it easy to do a "what if?" test. In other words, they permit you to quickly see what happens to parameters such as OG, IBU, and even approximate beer color when you change the amounts of an ingredient, or add a new one. They also allow you to keep a permanent record of the brew recipe. It is always important to keep careful notes of a brewing, but it is particularly so when you are trying to develop a new recipe that may require a little tweaking after your first shot.

The recipe

I very much liked an IPA we brewed at Brü Rm@BAR in New Haven, Connecticut, and wanted to do something similar at home. But, it was about 7% ABV, and I wanted a lower ABV for a session beer (hence the name Small IPA). Therefore, I opted for an OG of 1.045 (11.2 °P), and an FG of 1.011-1.013 (2.8-3.3 °P), so an ABV around 4.3-4.5%. Seeking balance, I aimed at giving it a malty flavor by using substantial amounts of both pale (8.3 °L) Munich malt and Vienna malt. I also added a good amount of Briess Victory®

malt for more malt fullness and the addition of some bready character as well. I mashed the grains at 152 °F (66.7 °C), high enough to help provide a little extra palate fullness. I opted for a variety of hops, starting with Simcoe® in the boil to give me about 35 IBU – enough bitterness to taste, but low enough to retain a good balance with the malt body. I wanted some Anglo-American character, so I late-hopped with US Goldings at 90 minutes, but went back to all-American hops by dry hopping in the secondary with Amarillo®. Lastly, I used an ESB yeast because that also tends to enhance malt character.

The result was an excellent, full-bodied beer bursting with hop character, and with great drinkability. It doesn't fit any style really; it's not strong enough for an IPA, it's too red for a pale ale, and too hoppy for a regular bitter. But it's good! BYO

Small IPA
(5 gallons/19 L, all-grain)

OG = 1.045 (11.2 °P)
FG = 1.012 (3.1 °P) IBU = 35
SRM = 18 ABV = 4.3%

Ingredients

2.9 lb. (1.3 kg) 2-row pale malt
2.5 lb. (1.13 kg) Munich malt (8.3 °L)
2 lb. (0.9 kg) Vienna malt
9.3 AAU Simcoe® hops (0.78 oz./ 22 g at 12% alpha acids) (90 min.)
1 oz. (28 g) US Goldings hops (0 min.)
2 oz. (57 g) Amarillo® hops (in secondary)
Wyeast 1968 (London ESB) yeast

Step by Step

Mash grains at 152 °F (66.7 °C) for 60 minutes. Run off and sparge with water at 160-170 °F (71-76.7 °C) to collect 5.5-6 gallons (21-23 L) of wort. Bring to a boil, add Simcoe® hops and boil 90 minutes, adding US Goldings hops as heat is turned off. Let stand 30 minutes, run off and cool to around 70 °F (21 °C), oxygenate or stir vigorously for several minutes, then pitch yeast, preferably as a previously prepared 1 qt. (1 L) starter. Ferment at 65-70 °F (18-21 °C) for 5-7 days. Rack to secondary, adding Amarillo® hops in a weighted, sanitized hop bag. Leave for 7-14 days, then rack and bottle or keg, priming or carbonating in the usual manner.

Clarification of Beer

Keys to keeping things clear

by Chris Bible

Clarification is an important part of the brewing process. Haze or cloudiness in beer is caused by the presence of suspended solids within the beer. These suspended solids may be yeast cells, protein solids from cold or hot break, or possibly may be the result of the formation of an insoluble colloid-complex from soluble proteins and tannins (polyphenols) during the fermentation process. These kinds of colloidal-complexes (haze) are often soluble at room temperature, but much less soluble at the cooler temperatures at which beer is typically served. Hazes like this are called "chill haze."

Curing cloudy beer

There are several ways to cure cloudy beer. One way is to filter the beer, however, filtering can remove flavor and color-producing compounds from the beer, and is also likely to increase the rate of oxidation of the beer. Another widely used method for clarifying beer is to allow the suspended solids to settle from the beer by simply allowing the force of gravity to act on the suspended particles for a sufficient amount of time.

A discrete particle settling in water (or beer) accelerates until the drag force reaches equilibrium with the driving force. Once this happens, the settling velocity becomes constant; this equilibrium velocity is referred to as the "terminal velocity". At terminal velocity the settling velocity of a discrete particle is given by the equation:

$$v = \left[\frac{2g(\rho_s - \rho)V}{C_D A \rho}\right]^{0.5}$$

Where:

v = settling velocity (m/s)
g = acceleration due to gravity (9.8m/s^2)
ρ_s = density of the particle (kg/m^3)
ρ = density of the liquid (kg/m^3)
V = volume of the particle (m^3)
A = projected area in the direction of motion (m^2)
C_D = drag coefficient

If we take the liberty and assume that the solid particle that is settling out of the fermented beer is spherical, then the above equation simplifies to:

$$v = \left[\frac{4g(\rho_s - \rho)d}{3C_D\rho}\right]^{0.5}$$

Where:

d = settling particle diameter (m)

If we take one additional liberty and assume that the settling velocity is such that the fluid flow around the particle is laminar (not turbulent), then we can substitute:

$$C_D = 24/Re$$

into the above equation (Where Re = Reynolds number for this specific settling situation) to get an actual, useful equation:

$$v = \frac{g(\rho_s - \rho)d^2}{18\mu}$$

Where:

μ = dynamic viscosity of the liquid (kg/m-s)

With this equation we can finally predict the settling time required to remove the particulate from our fermentation vessel. All we need to know is the density of the settling particle, the density of the liquid, the diameter of the settling particle and the viscosity of the liquid.

As an example: Assume the density of the settling particle = 1984 kg/m^3, the density of the fermented beer = 1012 kg/m^3, the diameter of the settling particle = 3 microns (3 x 10^{-6} m) and the viscosity of the fermented beer is 1.5 centipoise (1.51 x10^{-3} kg/m-sec). Then we get:

> "Haze or cloudiness in beer is caused by the presence of suspended solids within the beer."

Photo by Charles A. Parker/Images Plus

$$v = [(9.8\ m/s^2)(1984\ kg/m^3 - 1012 kg/m^3)(3 \times 10^{-6}\ m)^2]/[18(1.51 \times 10^{-3}\ kg/m\text{-}sec)] = 3.15 \times 10^{-6}\ m/s$$

This means that it will take a 3 micron diameter, spherical particle approximately 317,000 seconds (88 hours or 3.67 days) to settle one meter. Colloidal matter will take a very long time to settle out on its own. Fortunately there are ways to speed up settling.

Speeding up the clarification process

Increasing particle diameter, d

Settling rate is proportional to the square of the diameter of the particle. Doubling the particle diameter will result in a factor of four increase in the settling rate. The rate of settling can therefore be increased if the particle diameter is increased. This principle is exploited particularly by natural clumping of particles that occur by protein coagulation during and after wort boiling and by yeast clumping together during flocculation. The process of clumping is also enhanced by using fining agents and clarification aids, which cause the individual particles to stick together. This increases the effective diameter of the particles and accelerates the settling process.

Increasing density difference, ($\rho_s - \rho$)

The rate of sedimentation is proportional to the difference in density between the suspended particle and the liquid. This is indicated by the ($\rho_s - \rho$) term in the settling velocity equation. Unfortunately there is very little that a brewer can do to alter the difference in density between the wort/beer and the suspended particles. One interesting point to note is that the density of the solids will remain relatively constant while the density of the liquid usually decreases with increases in temperature. Hotter liquid is less dense, so warming of the system should theoretically result in a slightly faster settling velocity. In practical terms, however, the density variation of the liquid with temperature is very small, so this method of increasing settling velocity is of no value to the brewer.

Decreasing viscosity

The settling velocity equation indicates that decreasing viscosity, μ, of the liquid should proportionally reduce the settling time for the suspended particles. Liquid viscosity usually decreases with increase in temperature, so increasing the temperature of the system should, theoretically, result in a more rapid settling rate. Unfortunately, adjustment of viscosity is not really a viable option for the brewer. The viscosity of the beer or wort is dependent upon many factors including the protein and dextrin content of the liquid, and the total amount of dissolved solids and residual sugars within the liquid. These things are also responsible for sensory attributes in the beer including body and mouthfeel.

Because of this, it is really not possible to adapt the viscosity in order to cause the particles to settle faster.

Increasing the settling force (gravity), g

The "g" term in the equation refers to the acceleration due to gravity on the Earth. The acceleration due to gravity on earth is 9.81m/s^2. There is nothing that anyone can do to change this. It is possible, however, to increase the force that is driving the sedimentation process by replacing the gravitational force of the earth with a much stronger "g-force" that is produced by some mechanical means.

A much stronger force can be induced mechanically by causing the liquid/particle system to experience angular acceleration. This can be done by pumping the liquid into a tangential entry vessel as is done with cyclones or whirlpools. It can also be done by rotating the liquid/particle system very rapidly in a machine such as a centrifuge. Centrifuges are capable of generating forces that are many thousands of "g's". Since the settling rate is proportional to the settling "g" force, this can greatly increase the rate of removal of the suspended solids from the liquid.

Prevention of haze in beer

Prevention is always better than cure when it comes to haze. Hazes, particularly chill-hazes, in beer are often caused by formation of colloidal protein-tannin species within the beer. To prevent the formation of this colloidal haze, the brewer needs to remove enough of either the complex-forming proteins or tannins to prevent the formation of the insoluble colloidal-complex. Throughout the history of brewing, many different fining agents and clarification substances have been used to assist in this effort. A table of these substances with the mechanism of removal is given on the *BYO* website at http://byo.com/story2838 as Table 2.

Those clarification agents all (except for the first two, Papian and tannic acid) generally "adsorb something" as the method of preventing chill haze and improving the clarification of beer. This adsorption is the result of surfaces charges on the molecules that comprise the clarification aid attracting opposite surface charges on the protein or tannin molecules. Opposite charges attract, and the protein or tannin becomes physio-chemically bound to the surface of the clarification agent.

After this initial adsorption step, the whole "clump" of protein-or-tannin-covered-clarification-aid settles out of suspension or "flocculates." The clarification aids cause the suspended matter to form larger particles. Because particles settle out of suspension at a rate that is proportional to the square of the diameter of the particles:

$$v \propto d^2$$

Larger particles result in a much more rapid clarification of the beer.

Two Small Builds

Reminder rings, filling hooks made easy

by Tim Hack

As homebrewers, we all create our own "small builds" — the minor tweaks we make to improve our brew setups. They're not the flashy pieces of equipment that take thousands of dollars to buy or days to build. They're not going to take our setup from extract to all-grain, or from a 3-gallon (11.3 L) in-house to a 10- or 20-gallon (38 or 76 L) garage setup. They're the small stuff that just makes the brew day a little easier, quicker or less accident-prone. Things like the filling hook that allow you to fill your brewpot or carboy without having to hold the hose and reminder rings so you don't forget your secondary additions.

They're the small items that may alleviate some frustration and make brewing more enjoyable. These items can often be created using scraps lying around the house. If you don't have the parts on hand, they are so inexpensive that it often costs more in gas for the trip to the hardware store than it does to buy the required parts.

For this article, I will detail the construction of two small builds — reminder rings and filler hooks. Both are useful tools to add to your collection of brewing equipment.

Two weeks after brew day, I don't always remember the recipe with everything else going on. The idea for reminder rings came out of my forgetting to dry hop or add spices. Reminder rings are also helpful when brewing 10- or 20-gallon (38 or 76 L) batches and experimenting with dry hopping and spice additions on that same base brew.

I've tried Sticky Notes and tape, but the Sticky Notes get lost, the tape can leave residue, and if you have a blowout they become hard to read with wet beer coating them. The reminder rings go on your primary fermenter so you see them when you're about to transfer to your secondary fermenter. I use them on the necks of glass carboys and plastic Better Bottles, or they can be set on top of a bucket around the airlock.

A filling hook is an essential device to hold your hose in place so you can fill your kettles and carboys without the hose falling out. Nothing ruins a brew day like pouring perfectly good wort down the driveway when it should be going into a carboy or boil kettle. Filling hooks can also help direct your stream so you don't aerate your wort on the hot side or so you do going into your carboy.

Use these ideas as they are, or tweak them to fit your own setup peculiarities or fabrication skill level, and you'll have a couple less things to worry about on brew day.

As always, be careful with tools and materials. Saws are sharp and torches are hot.

> "Nothing ruins a brew day like pouring perfectly good wort down the driveway when it should be going into a carboy or boil kettle."

Parts & Tools

Reminder Rings:

3- to 4-inch diameter PVC pipe, 1-2 feet (0.3-0.6 m) long
Chop saw, miter saw or hack saw
Markers or paint pens

Copper Filler Hooks:

½-inch copper Pipe, 6-18 inches (0.15-0.45 m) long
(2-3) ½-inch copper 90-degree elbows
(1) ½-inch copper 45-degree elbow
(1) ½-inch copper male adapter
Plumbing solder and Plumbing flux
Propane or map gas torch

CPVC Filler Hooks:

½-inch CPVC pipe, 15-20 inches (0.4-0.5 m) long
(2) ½-inch CPVC 90-degree elbows
(1-2) ½-inch CPVC 45-degree elbows
(1) ½-inch CPVC male adapter
(1) CPVC valve (optional)
CPVC cement and primer

REMINDER RINGS

1. CUT RINGS IN 1-INCH SECTIONS

I decided to use 1-inch (2.5-cm) rings of PVC pipe on the neck of a glass or Better Bottle carboy. The rings themselves are made by cutting about an inch or so off the end of the pipe, over and over. The inch works nicely since you can stack several rings on each carboy. Remember, safety first as always - keep your fingers away from spinning blades and make sure you have enough material so you don't have your fingers close to the blade when it decides to pull instead of cut. If you don't have a chop saw, a hacksaw will work just fine. I've found that 3- to 4-inch PVC is large enough to fit loosely around the neck of either type of carboy or around the airlock on a bucket.

2. LABEL RINGS

You'll also need some permanent markers or paint pens. I prefer different colors for different labels to keep them separate. I'm sure some of you are more artistic or have a spouse that could even make them a work of art. If you want simple, a black Sharpie will do the trick. You can make labels for your additions like: Dry Hop, Fruit, Honey, and Spices. Multiples of each are handy when you have more than one brew fermenting at a time. You could also simplify to, "Check Brew Sheet" if you want. That way you'd just refer back to the sheet. If you go that route, I'd suggest highlighting secondary additions on your brew sheet so you don't miss spices while remembering the dry hops. The rings can easily be stored on a spare bungee if you have wire rack shelving or a hook near your fermentation area.

3. USE WHEN BREWING

Say you're adding honey, peaches and some Sorachi Ace hops into your secondary; three 1-inch (2.5 cm) rings labeled "Honey," "Fruit," and "Dry Hop" would fit just fine. You can see in the picture that four to six would fit fine while still being able to see your airlock to check bubble speed and liquid levels. Since you're only using an inch or so for each, you don't need to have a whole 10-foot (3-m) PVC pipe. Shorter pipe pieces will help those without trucks since a 5-foot (1.5-m) pipe should fit in just about any car made. Cut pieces of PVC pipe are available at most hardware stores.

FILLING HOOKS

1. DESIGN TO MEET YOUR NEEDS

Pictured are a couple examples of copper hot side filler hooks. One that fits on a standard soup pot and one that fits to a keggle. Especially on the keggle version, dry-fit the parts together to make sure you can get it on and off. There is a bit of a twist after the 45 degree elbow so that it will hook on and off easily but still aim the wort towards the side so you don't aerate too much going into your boil pot. The soup pot version has the pre-loaded solder on the elbows. This made things easy since I just heated the two elbows (a street 90 and a regular 90) and soldered both at the same time. This avoids overheating one joint while trying to get the other one to solder.

2. USE COPPER FOR HOT FILLING

For filler hooks being used on the hot side of things, I recommend using copper pipe. As with all copper pipe used for consumption purposes, use proper silver solder, not the lead-based stuff you use for electronics. It was suggested that I try the pre-loaded solder joints recently and I find for this build, they work wonderfully since there isn't much room between joints. There are different types of kettles, keggles, fermentation buckets and carboys, so I'll be fairly generic on the idea and let you figure out what fits your setup best based on the pictures. Most brew setups use half-inch pipe thread for their connections. All of the pipe used in these hooks is half-inch pipe and half-inch pipe thread.

3. USE CPVC FOR COLD FILLING

On the cold side of things, CPVC works just fine and provides a semi-flexible solution to filling carboys and fermentation buckets. I prefer it to PVC for consumable liquids transfer, especially if your wort ends up a little warmer than expected. On this one, I put a shut off valve on the CPVC hook so that I can fill multiple carboys easier. If I make a 10-gallon (38 L) batch and want to split it into my 7-gallon (26.5 L) bucket and my 6½-gallon (24.5 L) carboy, it's easier to shut off at the carboy and transfer to the next vessel than to shut down the pump or shut-off valve back at the keggle. As always, dry-fit first and then make sure to use pipe cement suitable for CPVC. A number of small holes can be drilled into the inside piece of pipe so that you aerate your wort while filling. You could also eliminate the last 45 elbow and point it straight down to get some splash effect. BYO

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Yeast Have Hearts

Biology and homebrewing

Christopher Wood • Columbia, South Carolina

> "As brewers, we just set the dinner table. The yeast 'cook' the meal ... and it tastes good!"

With six years experience as a yeast cell biologist, and 10 as a homebrewer, I appreciate the intricacies of yeast. These single-cell organisms have many notable attributes including the ability to make bread and beer, as well as being an excellent organism to study how human cells function. If you remember from high school biology class, cells are comprised of various compartments such as the nucleus (central region of activity, similar to a brain), the mitochondria (supplies energy), and the lysosome (destroys unwanted molecules), just to name a few. These general features of cells are also found in yeast and are one of the many reasons why they make great model organisms to use in biomedical research. Working as a cell biologist, I test the limitations of yeast every day. As a homebrewer, I'm doing the same thing. As homebrewers, we are all scientists.

I began homebrewing soon after college when a friend introduced me to the process, but it wasn't until I started my career that I truly appreciated the importance of yeast in the development of a beer's character. I have found that the yeast strain used for fermentation has a major impact on the flavor and aroma of a beer. Two beers can be brewed with the same ingredients and fermented at identical temperatures, but taste and smell completely different when using different yeast strains. Check for yourself next time you brew a batch of beer; split it in half and ferment each with a different kind of yeast. You will be amazed how different the beers turn out and will understand exactly what I am talking about. This is why brewers more versed in the craft of brewing beer claim that yeast "make the beer," we as brewers just provide the necessary ingredients. After years of using yeast in homebrewing, I completely agree. As brewers, we just set the dinner table. The yeast "cook" the meal ... and it tastes good!

What you might not know about yeast is that they have hearts. Well, not in the literal sense of course, but they do share similarities with the cells that make up the heart. Let me explain; a few years back my research mentor suggested I write a grant to the American Heart Association to ask for financial support for my yeast cell biology research. At the time, I thought he was crazy. How was I supposed to convince the American Heart Association that yeast could be used to study heart disease? They don't even have hearts! As it turns out, with some hard-nosed research and a little creativity, it wasn't as crazy as it seemed. My research uncovered that quite a few of the basic processes that occur in yeast also occur in human heart cells. For instance, the way human cells take in nutrients like calcium, sodium and potassium share many similarities to yeast cells. When specific defects in this process occur in cells found in the heart, it leads to problems with the frequency of heartbeats and, in extreme cases, life-threatening arrhythmias can occur. This similarity as well as many others proved to me that yeast is an invaluable tool in heart disease research.

As it turned out, the American Heart Association found my cell biology research in yeast as important to the advancement of heart disease research as I did. In fact, they liked it so much that they continued to fund my research for three years!

Next time you pitch yeast into your fermenter, know that these microscopic organisms are capable of so much more than fermenting your favorite homebrew.

Happy brewing, scientists. BYO

Photo Courtesy of Christopher Wood

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