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JULY-AUGUST 2011, VOL.17, NO.4

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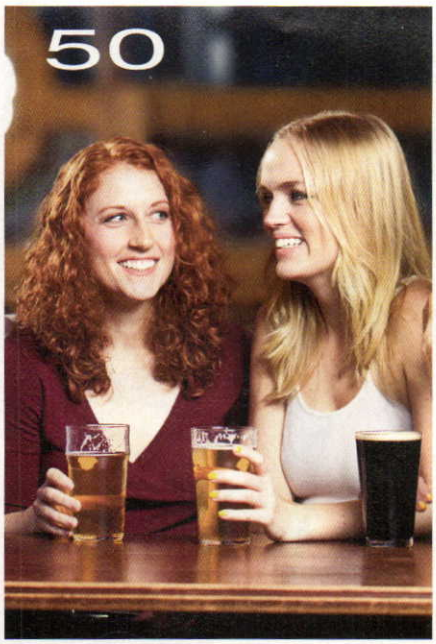

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BYO RECIPE STANDARDIZATION

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

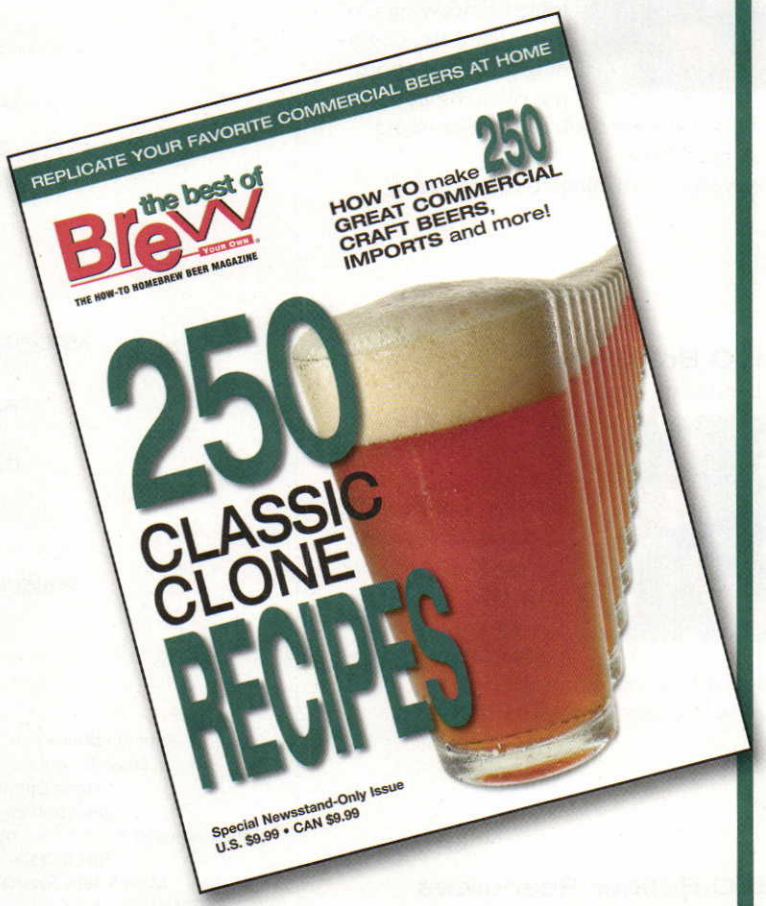
Hops:
We calculate IBUs based on 25% hop utilization for a one hour boil of hop pellets at specific gravities less than 1.050.

250 CLONE RECIPES IN ONE GREAT SPECIAL ISSUE!

FEATURES
132 pages of recipes & know-how to brew 250 commercial craft and import beers

the best of Brew Your Own
THE HOW-TO HOMEBREW BEER MAGAZINE

250 CLASSIC CLONE RECIPES



Replicate your favorite commercial beers featuring the best clone recipes from the last fifteen years of BYO.

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- 250 recipes provided for all-grain and extract brewers - includes 150 recipes from the now out-of-print "150 Classic Clone Recipes" plus 100 more clone recipes!
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At just $9.99 ($9.99 CAN) retail, you won't find a more valuable recipe collection to brew beers like the pros make!

This special newsstand-only issue is available at better homebrew retailers or order today by calling 802-362-3981
Also available online at brewyourownstore.com

* Attention homebrew supply shop owners - call us today at 802-362-3981 to discuss volume discounts to resell the BYO 250 Classic Clone Recipes issue in your shop

what's happening at BYO.COM

BYO Blogging

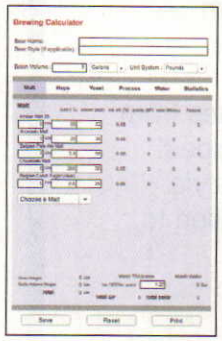
Join Jamil Zainasheff, as he transitions from acclaimed homebrewer to professional brewmaster at his new brewery, Heretic Brewing Co. Start from the beginning and read about the planning and elbow grease it took to start brewing this past May.
www.byo.com/blogs/blogger/Jamil/

BYO BrewCasts

Listen in as Chris Colby, Jamil Zainasheff, John Palmer, James Spencer and others discuss homebrewing and conduct scientific beer-making experiments. Conversations and podcasts are updated regularly on our website.

www.byo.com/resources/brewcast

BYO Reader Resources (Calculator)



In the heat of the summer, when homebrew is being made and consumed in great quantities, don't forget to make use of *BYO*'s many online brewing charts and tools. Get all the information you need to make every batch great, including taking advantage of our brewing calculator.
www.byo.com/resources/brewing

Cover Photo: **Charles A. Parker**

Brew Your Own — The How-To Homebrew Beer Magazine

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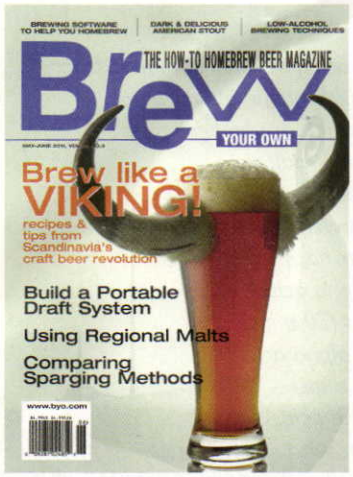
Volume 17, Number 4: July-August 2011



Extract Version for Viking Brews?

Long time subscriber here. Just reading the current issue on the Scandinavian styles, and was disappointed by the fact that there was no recipe for extract with grains as you normally print. Can you help me out with this? I am pureblood Norwegian, so this is pretty important to me. Let me know, and keep up the good work!

Scott Amdahl
via email

Author (and BYO *Advertising Sales Coordinator) Dave Green responds: "At* BYO*, we try to provide both all-grain and extract versions of every recipe. Many of our published recipes are supplied as all-grain recipes and we convert them into an extract alternative. For any beer recipe in which the majority of the extract is provided by pale malt, the conversion is straightforward. ("Extract" in the previous sentence refers to all the dissolved solids in the wort that contribute to the specific gravity of the beer. This includes fermentable carbohydrates, unfermentable carbohydrates, and other solids. Basically, "extract" means the "stuff" brewers get from their malts and grains. It should not be confused with "malt extract," which is condensed wort.) Most of the pale malt is removed from the ingredient list and replaced with an equivalent amount of either liquid or dried pale malt extract. The specialty malts remain the same as in the all-grain recipe.*

This approach works well for a wide variety of recipes and we can use this approach when the base malt for a recipe is pale malt (or pale ale malt), Pilsner malt, Munich malt or wheat malt as there are malt extracts for each of these kinds of base malt.

There are, however, some all-grain recipes that cannot be converted to an extract equivalent. For example, recipes that contain a large amount of starchy adjuncts cannot be converted to extract to because a large amount of base malt would be required to supply the enzymes to degrade the starch. (We do try to provide partial mash recipes when an all-grain recipe contains a small amount of a starchy adjunct. And sometimes a starchy adjunct can be replaced by a simple sugar and yield acceptable results. For example,

contributors

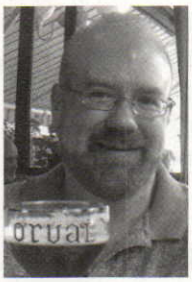
Michael Tonsmeire is a homebrewer and fermentation enthusiast living in Washington, DC. He is the blogger behind The Mad Fermentationist (www.TheMadFermentationist.com) where he discusses a wide variety of topics related to fermentation — not just beer, but also sake, vinegar, cider and cheese. He is a big fan of sour beers.

On page 44 of this issue — along with coauthor and fellow beer blogger Nathan Zeender (see www.desjardinbrewing.com) — he discusses the growing fascination Amercian brewers have with saison, the Belgian farmhouse ale. The article includes advice and recipes on brewing different versions of this style at home.

Christian Lavender is an Austin, Texas area homebrewer and the founder of HomeBrewing.com, a website that helps brewers find the best prices on homebrewing kits and homebrew supplies. He also runs kegerators.com, a website for those looking for home draft equipment. You can ask him draft-related questions at the site's "ask an expert" section, which can be found at www.keg-erators.com/ask-an-expert.php.

In the November 2010 issue of *Brew Your Own*, he explained how to build a kegerator-friendly hop filter (similar to a Randall).

On page 65 of this issue, in his second article for *BYO*, he demonstrates how to build a 10-gallon (38-L) fermenter from a rubber-jacketed half-barrel keg.



Gordon Strong is President of the Beer Judge Certification Program (BJCP), the organization that trains homebrew judges and sanctions homebrew contests. Strong led the development of the currently used 2008 BJCP Style Guidelines. An active homebrewer, he won the Ninkasi award — the award for the most points scored at the National Homebrew Competition — for the last three years.

Strong has recently published a book, "Brewing Better Beer," (2011, Brewers Publications), geared towards advanced homebrewers.

On page 50 of this issue, Gordon discusses session beers and presents advice and recipes from homebrewers with an obsession for sessions.

flaked maize in a recipe can be replaced with the equivalent amount of corn sugar and still yield a beer that is very similar.) In addition, recipes that contain large amounts of base malts with no malt extract equivalent cannot be converted to extract. For example, a recipe in which the base malt is smoked malt (as two of the three Scandinavian recipes without extract options are) cannot be converted to extract unless a smoked malt extract exists. At the time of publication, we were not aware of any smoked malt extract being available to homebrewers. Later, however, we learned that Weyermann makes a smoked malt extract from their rauchmalz. (A search of the Internet did not reveal any US homebrew shops that carried this product, but it could likely be special ordered. Some homebrew shops in Europe, Australia and New Zealand carry it.)

So basically, we try to provide both an all-grain and extract version of every recipe. However, sometimes this isn't possible. If you can find some smoked malt extract, here are extract recipes for two of the Scandinavian clones in the May-June issue:

Norwegian Wood (Haandbryggeriet)
(5 gallons/19 L, extract with grains)
OG = 1.060 FG = 1.010
IBU = 28 SRM = 22 ABV = 6.7%

Ingredients
5 lb. 14 oz. (2.66 kg) Weyermann smoked malt extract
1 lb. 6 oz. (0.62 kg) liquid Munich malt extract
19 oz. (0.55 kg) Weyermann CaraAmber® malt
18 oz. (0.5 kg) British amber malt
11 oz. (0.3 kg) British pale malt
0.3 oz. (8 g) Northern Brewer (mash hop)
1.8 AAU Northern Brewer hops (60 mins)
(0.21 oz/6 g of 8.5% alpha acids)
5.9 AAU Centennial hops (20 mins)
(0.6 oz./16 g of 9.75% alpha acids)
5.6 AAU Cluster hops (0 mins)
(0.8 oz/22 g of 7% alpha acids)
2 branches of fresh juniper with green berries
Wyeast 3638 (Bavarian Wheat) or White Labs WLP315 (Bavarian Weizen) yeast (3 qt./3 L yeast starter)

Step by Step
Place the crushed pale, amber and CaraAmber® malts in a large steeping bag. Mix the 2 juniper branches and mash hops in with steeping grains. "Steep" at 151 °F (66 °C) in 3.75 qts. (3.6 L) of water for 45 minutes. (This is actually a partial mash.) Rinse the grain bag with 2 qts. (~2 L) of 170 °F (77 °C) water. Combine "grain tea," roughly half of the malt extracts and water to make at least 3 gallons (11 L)

of wort. Boil for 60 minutes, adding hops at times indicated. Stir in remaining malt extract in the final 15 minutes of the boil. Cool wort and transfer to fermenter. Top up to 5.0 gallons (19 L) and pitch yeast. (Be sure to make the yeast starter to get a proper pitch rate to limit the amount of banana esters formed.) Fermentation temperature is 68–70 °F (20–21 °C).

Tanngnjost & Tanngrisnir clone
(Närke Kulturbryggeri)
(5 gallons/19 L, extract with grains)
OG = 1.071 FG = 1.014
IBU = 27 SRM = 14 ABV = 7.5%

Ingredients
5.5 lbs. (2.5 kg) Weyermann smoked malt extract
2.75 lbs. (1.25 kg) liquid Munich malt extract
1 lb. (0.45 kg) Munich malt
1 lb. (0.45 kg) Carapils® malt
1 lb. (0.45 kg) wheat malt
13 oz. (0.36 kg) sucrose (15 mins)
7.5 AAU Northern Brewer hops (60 mins)
(1.0 oz./28 g of 7.5% alpha acids)
4.3 AAU Hallertau Mittelfruh hops (1 min)
(1.3 oz./38 g of 4.25% alpha acids)
~4 twigs female juniper twigs with berries
Lager yeast
(your choice, 4 qt./~4 L yeast starter)

Step by Step
Place approximately 4 qts. (~4 L) of water in your brewpot. Toss in the juniper twigs, bring to a boil and boil for 5 minutes. Remove twigs and cool juniper water to 162 °F (72 °C). Place crushed grains in a large steeping bag and "steep" (partial mash, really) in juniper water for at 151 °F (66 °C) for 45 minutes. Remove bag and rinse with 2 qts. (~2 L) of 170 °F (77 °C) water. Combine "grain tea," roughly half of the malt extracts and water to make at least 3 gallons (11 L) of wort. Boil for 60 minutes, adding hops at times indicated. Stir in sugar and remaining malt extract in the final 15 minutes of the boil. Cool wort and transfer to fermenter. Top up to 5 gallons (19 L) and pitch yeast. (Be sure to make a large yeast starter to get a proper pitching rate for this big lager.) Fermentation temperature is 50–52 °F (10–11 °C). After a brief diacetyl rest, lager beer at 40 °F (4.4 °C) or lower for at least two months.

[Note: the original recipe uses Gotland smoked malt, which is smoked with birch. Weyermann smoked extract is made with rauchmalz, which is smoked with beechwood. Both are smoky, but the character is a bit different.] BYO

homebrew nation

READER PROFILE

Brewer: Rev. Dr. Daniel Kanter

Hometown:
Dallas, Texas

Years brewing: 17

Type of brewer:
All-Grain, from the very first batch.

Homebrew setup (volume, style, efficiency):
8 gallon (30 L) pots, old-school 3-pot-3-gas burner, gravity fed system; all-grain; 5.5 gallon (21 L) batches.

Currently fermenting:
What I call the Seattle Slew Brew. After having some Manny's Pale Ale (from Georgetown Brewing Company) with a cousin in Seattle, I tried to figure out a modified (higher alcohol) clone of their fresh-tasting ale; the result is the Slew Brew.

What's on tap: Christmas ale, Vienna lager, classic English pale, and an English extra special bitter.

How I started brewing:
As a student at the University of Vermont, I stumbled into a brewshop one day. I immediately became interested in getting started with my own homebrewing, but did not have the time or space, so the idea simmered until years later a seminary colleague of mine in Berkeley, California invited me over to talk theology and drink homebrew. My colleague was an all-grain brewer, and he took me through the brewing process. I brewed Belgian ales for a while to justify the religious aspect of my new-found hobby. As time went on, I got so into homebrewing that I went to work for a commercial craft brewery in Berkeley. I ended up brewing throughout seminary, into my first settlement in Boston, Massachusetts and continued on when I moved to Dallas. Brewing is like prayer: it takes me down a notch and forces me to pay attention.

READER RECIPE

The Vicar's English Extra Special Bitter

5.5 gallons/21 L (all-grain)
OG = 1.062 FG = 1.018
ABV = 5.8

Ingredients
10.5 lbs. (4.7 kg) English 2-row pale malt
0.75 lbs. (0.34 kg) medium crystal malt (55–70 °L)
0.75 lbs. (0.34 kg) amber malt
7.5 AAU Challenger pellet hops (1.0 oz./28 g at 7.5% alpha acids) (60 min.)
2.4 AAU Centennial pellet hops (0.25 oz./7 g at 9.75% alpha acids) (60 min.)
3.75 AAU Kent Goldings pellet hops (0.75 oz./21 g at 3.75& alpha acids) (30 min.)
1 tsp. Irish moss (15 min.)
Wyeast 1968 (London ESB) yeast

Step by step
Using a single infusion mash, mash in at 156 °F (69 °C) with 3 gallons (11 L) of water. (If necessary, adjust your water with gypsum). Sparge for 45 minutes to reach 5.5 gallons (21 L). Transfer to heat and bring to a boil. Total boil time is 60 minutes. Add Challenger hops at the start of boil. Add the Kent Goldings at 30 minutes left in the boil. Add the Irish moss with 15 minutes left in the boil.

Chill the wort rapidly to 68 °F (20 °C) and pitch the yeast (I use a starter). Ferment at 72 °F (22 °C) for ten days, then transfer to the secondary. Hold at 72 °F (22 °C) for another week. Then package and condition.

byo.com brew polls

What is your favorite style of IPA?

American 51%
Imperial 22%
English 17%
Black 10%

social homebrews

Join *BYO* on Facebook: www.facebook.com/BrewYourOwn

Follow *BYO* on Twitter at: @BrewYourOwn

what's new?

Brewers Supporting Agriculture (BSA) from Valley Malt Hadley, Massachusetts

Modeled after the Community Supported Agriculture (CSA) concept, which has recently been growing in popularity, this BSA offers crops from local farmers to customers wanting locally grown brewing ingredients. Affordably priced at $200/share, the share itself consists of two 50-pound (23-kg) sacks of organic 2-row pale ale or Pilsner malt, 5 pounds (2 kg) of bi-monthly specialty malt, a reusable, hand-made organic cotton malt sack and an entry into Valley Malt's 1st annual homebrew competition.
http://www.valleymalt.com/Valley_Malt/malt_of_the_month.html

New Candi Syrup Products From Candi Syrup, Inc.

Candi Syrup will be releasing four candi syrup products this summer for use in brewing a range of Belgian-style ales and beyond. Candi Syrup, Inc. brewing syrups are created using a blend of beet and palm (date) sugars and are readily fermentable due to a more balanced approach to fermentable sugars. Increased volumes of more complex sugars can slow or even hinder the metabolic capacity of your yeast especially in high gravity Belgian Ales. These syrups are pH specific to brewing and keep your wort well within the ideal range of pH for best fermentation performance.www.candisyrup.com

calendar

July 8–9
13th Annual Indiana State Fair Brewers' Cup
Indianapolis, Indiana

The Indiana State Fair Brewers' Cup is one of the country's largest competitions. The Brewers of Indiana Guild is a big supporter of the competition, and the event features many sponsors and prizes. See the website for entry guidelines.
Entry Deadline: June 24
Phone: (317) 253-1617
Email: tstilabower@comcast.net
Web: http://www.brewerscup.org/

July 30
Mead Free or Die
Londonderry, New Hampshire

Mead Free or Die is a mead only competition. The competition is structured to award medals for each of the subcategories of mead, as well as a best of show — with a total of 29 awards. Join in and meet up with some fellow meadmakers this year in scenic New Hampshire.
Entry Fee: $6
Entry Deadline: July 16
Phone: (603) 234-9582
Email: fairbrother@moonlightmeadery.com
Web: http://www.meadfreeordie.com/

August 13
Blues 'N' Brews Homebrew Competition
Hubbardston, Massachusetts

The Fitchburg Order of Ale Makers (FOAM) present the 10th Annual Blues 'N' Brews Homebrew Competition. The judging contest itself will be held on August 13, and awards will be announced in conjunction with the 2011 Blues 'N' Brews Festival on August 20th. This competition is BJCP sanctioned event.
Entry Fee: $6
Entry Deadline: August 5
Phone: (978) 399-9194
Email: hamesbest@gmail.com
Web: http://mikedunn.net/foambrew/bnb.html

homebrew drool systems

Fair Wx Brewing

Andy Cook • Aurora, Colorado

After a year of extract brewing my girlfriend bought me an all-grain cooler set up. I brewed on that for about a year and a half before I saw Lonnie's Brutus 10. That's when I knew I had to build a rig like that right away. I excitedly showed it to my girlfriend, and she told me that if I bought her a ring she would pay for the build!

This all sounded great to me because I was already thinking about asking her to marry me anyway, and this was just the icing on the cake. So, about six months later, in May of 2009, while hiking to the top of a mountain, I asked her to be my wife.

About a month later I began work on my new rig, and five months after that it was ready for its first brew day. The first brew my wife and I made was Vanilla oatmeal stout, which is among our favorite beers to brew. The day flew by with only a few hiccups — and a couple things got changed on the new brew rig — but since then we have brewed a lot of great beers, including beer for our own wedding.

Photo 1

The name of my brewery is Fair Weather Brewing. I am a pilot and almost everything that has to do with flying has an acronym, like weather (Wx), for instance. So, that is what I used in my brewery name.

Photo 2

Here is the control panel, which monitors the mash and hot liquor tank (HLT) temperatures and keeps them within two degrees (F) of the target temperature by firing the burners via solenoid valves and a pilot light.

Photo 3

The brewery is a two-tier direct fire recirculation configuration that requires only one pump. The mash is constantly recirculated past a temp probe that monitors mash temperature.

Photo 4

The hose can then be moved from the bottom of the mash tun to the HLT in order to start the sparge and lautering process. A siphon sprayer is used for the recirculation and sparge.

beginner's block

PITCHING RATE BASICS

by betsy parks

To transform wort into beer, you need to add yeast, but how much? When you branch out and start developing your own beer recipes, you must be sure to use enough yeast to fully ferment your batch of beer.

What are pitching rates?

"Pitching rate" is a term used to describe the amount of yeast added to wort. And the amount (or rate) depends on the original gravity of your beer and your fermentation temperature. The higher the original gravity, the more yeast you will need. This is because high-gravity worts cause stress on the yeast. And the colder you plan to ferment, again, the more yeast you will need. This is because the cooler temperatures slow down the yeast activity, thus slowing down both the reproduction and fermentation rate.

Why are they important?

It is important to have a solid idea of what your pitching rate should be because underpitching can result in slow or stuck fermentations and/or off flavors, which may lend fruity, solventy, sulfury and other aromas.

Calculating

So how do you know how much yeast to add? The general consensus is to add more yeast than you need, to be on the safe side, but that doesn't mean that you need to go overboard. And there are also times that you may want to pitch less yeast to achieve a certain profile in your beer — such as more fruity characteristics. The best plan is to know what to pitch before your brew day.

Yeast are measured in millions and billions of cells, and on average you want to pitch around 1 million cells of viable yeast for every milliliter of wort for every degree Plato. You can then calculate up or down depending on what kind of beer you are brewing — less for an ale or more for a lager, less for a low gravity and more for a high gravity. Shoot for around 0.75 million cells of viable yeast for an ale and 1.5 million for a lager, for every milliliter of wort, for every degree Plato. Even easier to remember, according to *BYO*'s Jamil Zainasheff (at mrmalty.com), you generally need about 15 billion cells for each degree Plato or about 4 billion cells for each point of OG when pitching into a little over 5 gallons (19-L) of wort.

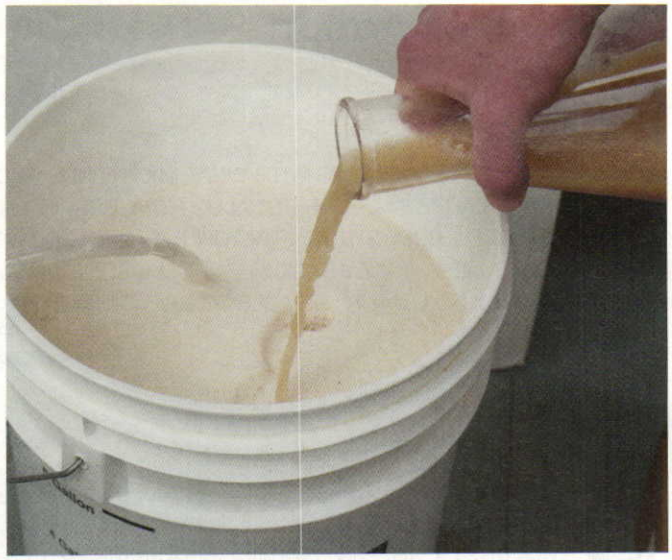


Photo by Les Jörgensen

Pitching rates are also almost always calculated to degrees Plato, a different measurement of gravity than specific gravity. One degree Plato is equal to about 1.004 specific gravity units (4 "points"), so you can convert that measurement by dividing the OG by 4 to get an approximation of Plato. For example, converting a beer with a 1.115 SG is as follows: 115/4 = 29 °Plato.

Yeast companies list the amount of cells on their packaging, or you can look for information on the manufacturer's website, so that you can either buy enough yeast or determine if you might want to make a yeast starter to increase the cell count.

There is a lot of information out there about how to calculate pitching rates, which can get confusing. But as a homebrewer you can estimate more than a commercial brewer, so if you don't feel like doing the math, relax . . . someone else has probably already done it for you by creating a pitching chart — such as those in *How to Brew* by John Palmer, or on the Web at www.byo.com /resources/pitching

hop profile

CZECH SAAZ

Saaz is a classic aroma hop that has been grown in the Czech Republic for centuries. One of the four "noble" varieties, its alpha acids are around 3 - 4.5 percent, and it lends distinct but mild floral, spicy, herbal and grassy aromas and flavors to light style beers, most notably Pilsner Urquell. Possible substitutions are US Saaz (higher AAU) or Polish Lublin.

we WANT you

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by marc martin

DEAR REPLICATOR,

I HAVE STARTED EXPERIMENTING WITH WHAT MY FRIENDS AND RELATIVES DESCRIBE AS "BIZARRE INGREDIENTS" IN MY HOMEBREWS. I HAVEN'T FOUND MANY COMMERCIAL BREWS THAT STRETCH THE LIMITS, HOWEVER, THERE IS ONE THAT INTRIGUES ME: A HONEY BASIL ALE FROM BISON BREWING IN BERKELEY, CALIFORNIA. I WOULD LOVE TO BE ABLE TO BREW THIS BEER.

ROBERT SAMUELSON
SACRAMENTO, CALIFORNIA

Bill Owens, of the famous Buffalo Bill's Brewery in Hayward, California, founded Bison Brewing in 1989. About this same time, Daniel Del Grande was buying ingredients at The Oak Barrel homebrew shop and brewing in college. Upon graduation he became a successful geo-technical civil engineer — but the yearning for brewing great beers never waned and he dreamed of his own brewery.

That dream became reality in 1997 when he bought Bison Brewing from Bill. Realizing he needed a formal brewing education, he attended and graduated from the American Brewers Guild pro-brewer program. He continued to operate a successful two-person, ten-barrel system until rising lease costs forced him to close the brewpub in 2003. He continued to produce his beers in only 500 square feet of the original brewery until 2007 when the city decided that zoning laws wouldn't allow a "production only" brewery. Today he busies himself overseeing contract production of his organic beers at breweries like Mendocino Brewing in Ukiah, California.

Honey Basil Ale is is based on a light amber ale grain bill. Cascade hops are used to offset the residual sweetness, and a dense, white creamy head tops this beautiful golden, amber ale. The malty nose exhibits hints of basil with honey in the background. Basil is also present in the flavor, but well in balance with the base malt. He recommends a thin low temperature mash to create maximum fermentability for a dry finish.

Now Robert, enjoy Honey Basil Ale year round when you "Brew Your Own." For further information visit their website at www.bisonbrew.com or call 510-697-1537. BYO

Bison Brewing Company Honey Basil Ale
(5 Gallons/19 L, extract with grain)

OG = 1.052 FG = 1.010 IBU = 19 SRM = 6 ABV = 5.5%

Ingredients

3.3 lbs. (1.5 kg) Briess light, unhopped, liquid malt extract
2 lbs. (0.9 kg) light dried malt extract
1 lbs. (0.45 kg) two-row pale malt
0.75 lbs. (0.34 kg) crystal malt (20°L)
0.70 lbs. (0.31 kg) Carapils® malt
0.5 lbs. (0.22 kg) honey (last 5 min.)
0.6 oz. (17 g) scored basil leaves (last 10 min.)
0.6 oz. (17 g) scored basil leaves (end of the boil)
5.75 AAU Cascade pellet hops (60 min.) (1 oz./28 g of 5.75 % alpha acid)
½ Tsp. Irish moss (last 30 min. of the boil)
½ tsp. yeast nutrient (last 15 min. of the boil)
Wyeast 1056 (American Ale) or White Labs WLP 001 (American Ale) yeast
0.75 cup (150 g) of corn sugar to prime (if bottling)

Step by Step

Steep the crushed grain in 1.75 gallons (6.6 L) of water at 148 °F (64.4 °C) for 30 minutes. Score the basil leaves at least five times with a paring knife. Remove grains from the wort and rinse with 3 quarts (2.8 L) of hot water. Add the liquid and dried malt extracts and bring to a boil. While boiling, add the hops, Irish moss, yeast nutrient, basil leaves and honey as per the schedule. During the boil, use this time to thoroughly sanitize a fermenter. Now 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 for two weeks and enjoy your Honey Basil Ale.

All-grain option:

This is a single step infusion mash adding 7.75 lbs. (3.5 kg) of 2-row pale malt (to total 8.75 lbs./4 kg) to replace the malt extracts. Mix the crushed grains with 3.75 gallons (14 L) of 170 °F (77 °C) water to stabilize at 148 °F (64 °C) for 60 minutes. Sparge slowly with 175 °F (79 °C) water. Collect approximately 6 gallons (23 L) of wort runoff to boil for 60 minutes. Reduce the 60-minute hop addition to 0.8 oz. (23 g) Cascade hop pellets to allow for the higher utilization factor of a full wort boil. The remainder of this recipe and procedures are the same as the extract with grain recipe.

Saison

Facts about farmhouse ales

by Betsy Parks

ORIGINALLY BREWED TO QUENCH THE SUMMER THIRST OF FARM WORKERS, SAISON IS STURDY ENOUGH TO LAST FOR A FEW MONTHS, BUT NOT OVERPOWERING. IN THIS ISSUE, WE ASKED THREE SAISON BREWERS TO SHARE SOME INSIGHT FOR BREWING THIS ELUSIVE FARMHOUSE ALE.

The base beer of our saison, Guava Grove, was designed to be a true-to-style saison. I didn't want any frills so I decided not to use spices — I wanted the yeast strain to create those unique spiced flavors. We decided to use local ingredients to make the beer our own, so we add guava to generate a secondary fermentation. This adds a tart character to the beer and also speaks for our local Cuban culture.

We use German Pilsner malt for our base malt, domestic white wheat, Belgian Caravienne and a small percentage of domestic flaked corn. I like the quality of the German Pilsner malt that we use and the authenticity of the Belgian Caravienne.

We brew Guava Grove with a simple, single infusion mash. We have a HERMES coil in our hot liquor tank but I don't see the need to employ multistep infusion. We mash at 149–150 °F (65–66 °C). Low temperature mash rests aid attenuation so we incorporate that in our process.

Whether you brew at home or on a big scale, I think that attenuation is important for a saison. We use a small amount of corn in our saison to help aid attenuation. Keeping the hop bill fairly simple is a good plan so that you aren't beating back the yeast byproducts or coming over the top of any spices. Fermenting the yeast strain you choose at the appropriate temperature is also important.

Saison is a style that offers some flexibility and room for creativity. Find a good recipe and make small tweaks to it to make it your own.

Wayne Wambles, Head Brewer at Cigar City Brewing Co. in Tampa, Florida. Wayne is a self-taught homebrewer who turned commercial. He started brewing beer at home in early 1996. He was hired at Cigar City in 2008.

Hennepin was developed to be true to style in the sense that it is a grain bill typical of saisons, it is fermented with a Belgian yeast strain and is fairly hop driven. This style is fairly wide-ranging, though, so "true" to style has somewhat limited meaning. The spicing really makes it original and unique.

It is brewed with Pils and pale malts and corn and sugar as adjuncts. We use all domestic grains for this brand because they are very high quality and cheaper than importing from Europe. That said, we do use imported specialty malts in other brands: some of these are very unique in flavor and character.

We do nothing to specifically increase sourness but we do use acid and gypsum to adjust mash pH. We ferment with our house yeast strain, which came from Belgium. For homebrewers, however, there are specific strains available for saisons, which should work well if used in the strains' recommended conditions. Fermentation temperatures vary depending on the specific strain, but typically you want to ferment a saison with warmer temperatures — in the upper 70s Fahrenheit or mid-20s Celsius for the fruity/phenolic characters.

For homebrewing, my advice is to mash to achieve a fairly-high degree of fermentability, use a Belgian yeast strain and use a highly fermentable sugar as adjunct. Typically saisons have some other type of adjunct such as wheat or corn. Target your bottle carbonation to be fairly high: 3–3.5 volumes of CO_2. Saisons should be fairly crisp, refreshing beers.

Phil Leinhart, Brewmaster at Brewery Ommegang in Cooperstown, New York. Phil Leinhart took on the office and responsibilities of Ommegang Brewmaster in January, 2008. He has been in the commercial brewing industry for more than twenty-four years.

Ron Jeffries, Brewmaster, owner and founder of Jolly Pumpkin Breweries in Dexter, Ann Arbor and Traverse City, Michigan. Ron began studying brewing science around 1991 with one eye always towards opening his own brewery. He began brewing professionally in 1995, and was finally able to open his own brewery (Jolly Pumpkin Artisan Ales) in the summer of 2004.

A lot of our beers fall into the traditional saison category. We wanted to follow some traditional guidelines. However, with that said, I don't see the need to recreate something that's already out there, and our saisons are original expressions. Generally, there are no real guidelines to saison — it was originally brewed by people who had their own local ingredients so they used what they had available. I think the style was probably imposed later.

Additionally, we age all of our beers in oak with natural bacteria and a souring note. We package it young with not a lot of oak, and the sourness continues to develop in the bottle, which is what I think farmhouse ale would have traditionally been like as there was not a lot of sanitation back then.

In the brewhouse, when you're mashing, a saison should be very well attenuated. We tend to mash at about 147 to 149 °F (64 to 65 °C) for an hour to max out the enzymatic reactions. Not everyone mashes for this long, but I think it's worth the wait. We also use a little bit more of a wetter mash — not super wet like soup, but wetter. A dryer mash will give you more extract, but a wetter mash will give you more fermentability.

All of our yeast here is a wild yeast strain. Our house strain started out as a commercial strain, but we cropped it and trained it. At home, look for strains that will give you the flavor characteristics you're looking for — spice notes or ester profiles as well as strains that work well at the temperatures you will be able to ferment in. Again, attenuation is pretty critical — you need to make sure that the yeast is going to attenuate for you. Spicing can be great, we do it and it's fun to play with, but should all be done in balance.

If you want to brew saison, check out the book *Farmhouse Ales* by Phil Markowski. Then, find a commercial beer that you really like and learn about how that beer is built. You don't have to make a unique crazy beer at first. You can learn the style by researching a great saison and then recreating it. BYO

Brewing Water

Lager conditioning, yeast biology

by Ashton Lewis 

Q WE HAVE A WHOLE-HOUSE R/O (REVERSE OSMOSIS) WATER TREATMENT SYSTEM IN OUR CURRENT HOME. THE WATER TASTES GOOD BUT THE BEER WE HAVE MADE FROM IT SEEMS, PERHAPS, LESS COMPLEX AND LESS BRIGHT THAN BEER WE'VE MADE WITH NON-R/O TAP WATER IN PREVIOUS RESIDENCES. IS THERE A STANDARD SET OF MINERALS/ADDITIVES THAT COULD BE ADDED TO MAKE THE R/O WATER APPROPRIATE FOR MOST BEERS, OR IS THE ONLY WAY TO SELECT ADDITIVES TO TEST THE WATER AND THEN CRAFT THE MINERALS TO BE ADDED BASED ON THE BEER STYLE WE ARE PLANNING TO BREW?

DEBBIE SELLMEYER
PASADENA, MARYLAND

A I have spent the last 20 years brewing beer using pure water, either from RO or distillation, and to me this has become the norm. I like brewing with RO because it takes variability away from water and gives the brewer a blank slate, but as you point out that slate needs to be decorated.

The most important mineral in brewing water is calcium. Calcium interacts with polypeptides and phosphates from malt to affect mash pH, it stabilizes alpha-amylase, is involved in break formation in wort and also influences yeast. You can add calcium from two primary sources; calcium sulfate (gypsum) and calcium chloride. Sulfate and chloride both affect beer flavor and sulfate accentuates bitterness and dryness while chloride is known to give beer a rounder and fuller palate. I like using a blend, and I target a calcium level in most of the beers I formulate of somewhere between 25 and 100 mg/L. If you want an assertive mineral character to your beer you may want to use calcium levels up to 200 mg/L.

While calcium, and to a lesser extent magnesium, causes mash pH to go down, or become more acidic, the carbonate and bicarbonate ions cause mash pH to increase. Most beers brewed in the world tend to be lighter in color and do not benefit from carbonate in water. Darker beers, however, incorporate dark malts into their recipes and these malts frequently result in mash pH that is too low. The ideal mash pH range is 5.2–5.4 and if the pH is too low carbonate species will help move the pH back into this window. When using RO water it is easiest to use sodium bicarbonate as the source of "carbonate" since calcium carbonate is not soluble in water unless the water is acidified. Sodium bicarbonate, on the other hand, is much easier to use. If you want to brew a stout using RO water you probably want to target about 50 mg/L of bicarbonate

> "The most important mineral in brewing water is calcium."

using sodium bicarbonate.

I named two more flavor active ions in the previous paragraph: magnesium and sodium. Magnesium is one of the key components found in Burton water, although the term "Burtonize" has somehow evolved to mean simply heaping in a pile of gypsum to water. Real Burton water is quite high in magnesium, which is significant because magnesium has a pronounced bitter/metallic flavor and that does indeed affect beer flavor. Magnesium is also a laxative. Most beers in the world do not have much magnesium and I would not intentionally add more than about 50 mg/L of magnesium from magnesium chloride if I were experimenting with this particular salt. Sodium is also flavor active and some people automatically have a negative opinion of sodium because who wants salt in beer . . . or perhaps I should have asked why the German beer Gose has salt added to it in high doses? As it turns out, sodium is not perceived as salty in beer until the content exceeds about 40 mg/L. At lower levels it influences the perception of sweetness and palate fullness. I add about 10 mg/L of sodium with Kosher salt when brewing a variety of beers, especially pale lagers.

Minerals are not the only thing to consider adding to RO water. Lactic acid can be added to adjust mash and wort pH if the pH is too high and the affect that lactic acid has on flavor is completely different than achieving the same change in pH using calcium salts. Yes lactic acid is tart, but that is not what it does to beer flavor when used to make small modifications to pH in the brewhouse. Lactic acid adds complexity and makes a crisper, brighter beer when used in styles that can suffer from what winemakers call flabbiness or lacking in the acidity department.

You asked a question about the most abundant ingredient used to brew beer. Water is also the ingredient that is least clearly communicated amongst brewers because a standard set of terms is not used. The following table hopefully makes some of my answer easier to understand.

Salt	Common Name	Grams Added	Ounces Added	Ca^{+2} mg/l	Cl^{-} mg/l	SO_4^{-2} mg/l	Na^{+} mg/l	HCO_3^{-} mg/l
$CaCl_2$	Calcium Chloride	1.31	0.05	25.0	22.2	-	-	-
$CaSO_4$	Gypsum	2.03	0.07	25.0	-	60	-	-
$NaHCO_3$	Baking Soda	0.65	0.02	-	-	-	9.4	25.0
NaCl	Table Salt	1.20	0.04	-	38.6	-	25	-

Note: The above concentrations assume that the salt is added to 18.9 gallons of water.

Q I'VE BEEN BREWING ALES FOR A WHILE AND WANT TO TRY MY HAND AT A FEW LAGER RECIPES I'VE CREATED. IF I WERE TO DO MY PRIMARY FERMENTATION AT 50 °F (10 °C), AND MY SECONDARY AT 45 °F (7 °C), WOULD I HAVE TO LET THE BEER WARM TO ROOM TEMPERATURE TO BOTTLE WITH PRIMING SUGAR? I KNOW ALE YEAST GOES DORMANT IN THE FRIDGE AT LOW TEMPERATURES, BUT LAGER YEAST THRIVES IN THOSE CONDITIONS. SO I AM NOT SURE IF THE BOTTLES WOULD CARBONATE AT A TEMPERATURE RANGE BETWEEN 40–50 °F (4–10 °C)?

NIC ASHLEY
RALEIGH, NORTH CAROLINA

A Since you are new to brewing lagers, I would focus 100% of my attention to primary fermentation and how the yeast behaves when fermented at cooler temperatures. Ale brewers are accustomed to having aggressive behavior during primary fermentation and the aroma coming from the fermenter is usually quite nice. Lagers are a different creature all together. Lager fermentation activity is often perceived by the eye as weak, and aromas like rotten egg and burning match are not uncommon. These two features often take some time to get to know. It's important to have some experience so that you know what works.

So your first priority is to get your hands around the primary fermentation so you recognize "normal" from "odd" and so you know what times and temperatures seem to work for the strain or strains you select. I would not get worked up about bottle conditioning because the strain used in bottle conditioning typically has very little effect on beer flavor; there is simply so little sugar that is metabolized by the yeast during conditioning that the small amount of flavor compounds excreted from the cells during that stage of the game pales in comparison to what is produced during the primary fermentation. Some yeast strains added for conditioning, like *Brettanomyces*, are a different story and can have dramatic effects on beer during extended aging.

If you feel more comfortable adding a small amount of ale yeast and conditioning at room temperature, I would go ahead and do that — knowing that you are in the stages of learning. If you want to go full throttle from day one and naturally carbonate with lager yeast, that will work, too, since historically carbonation was one of the several important changes that occurred during lagering. The thing that you do need to bear in mind is that when lager brewers use the kräusen method they add fresh yeast after primary fermentation is complete, which helps fermentations finish and also helps for a more rapid and effective maturation process. If you do not kräusen you probably should consider adding a small dose of fresh yeast when bottling (about 20 mL of yeast slurry will provide around 1 million cells/mL) and consider conditioning at room temperature to make sure that your beer comes into condition.

Q I AM SITTING IN CLASS, THINKING ABOUT FERMENTATION. I KNOW THAT WE AERATE THE COOLED WORT TO PROMOTE HEALTHY YEAST PROPAGATION AND A QUICK START TO FERMENTATION. IF ALCOHOL IS ONLY PRODUCED DURING ANAEROBIC METABOLISM, AT WHAT POINT DOES THE CONVERSION FROM AEROBIC TO ANAEROBIC METABOLISM OCCUR DURING THE FERMENTATION PROCESS, AND HOW MUCH ALCOHOL IS LOST DUE TO SUGARS BEING USED FOR OXIDATIVE PHOSPHORYLATION IN AEROBIC METABOLISM?

JACOB HORNICK
HERSHEY, PENNSYLVANIA (PENN STATE UNIVERSITY COLLEGE OF MEDICINE)

A The first thing that you need to read up on is the Crabtree Effect. The basic message from Crabtree's work is that yeast metabolize glucose following the decarboxylation of pyruvate and production of ethanol, that is, by fermentation, when glucose levels are higher than about 0.4%, even when the growing culture is aerobic. More current research suggests that yeast actually metabolize glucose both by fermentation (ethanol production) and by the tri-carboxylic acid cycle (the TCA cycle, the Kreb's cycle or oxidative phosphorylation) when the culture is aerobic. The TCA cycle produces 38 moles of ATP from every mole of glucose, compared to 2 moles of ATP when glucose is fermented.

In the parlance of practical brewing, this means that a growing culture of yeast, even when oxygen is present, ferments glucose and produces alcohol. While most biochemists and yeast microbiologists seem to agree that some glucose can be (and at times is) aerobically metabolized during the relatively brief aerobic phase of brewery fermentations, the culture is much more heavily weighted towards fermentation. Another very practical fact to consider is that brewing yeasts are normally harvested and reused after fermentation and usually do not have fully developed mitochondria, the cellular organelles responsible for respiration. This means that glucose is not "wasted" on excessive ATP production.

This is not meant to imply that oxygen is not important in brewery fermentations. Just because yeast cells metabolize glucose by fermentation does not mean that oxygen is not used in other ways. When yeast cells grow, one of the very key building blocks required are the raw materials of cell membranes, namely sterols and unsaturated fatty acids. These building blocks require oxygen and the growing yeast obtain this oxygen from the wort and incorporate it into membranes. Indeed, oxygen is important to growing cells.

In contrast to how brewery yeasts are typically grown, consider the propagation of baking yeasts. Bakery yeasts are grown by keeping glucose levels low using fed propagations that are aggressively aerated to keep up with the very high oxygen demands of cell densities that approach 300 million cells/mL. One of the main goals when growing baking yeast is to yield cells with high levels of glycogen. When baking yeast is hydrated the carbon dioxide being produced comes from the metabolism of glycogen stored in the cell.

The long and short of this answer is, Gay-Lussac's 1810 discovery that yeast metabolize one mole of glucose to yield two moles each of carbon dioxide and ethanol is a good rule to apply to a brewery fermentation, even by what we know 200 years later. BYO

Cream Ale

Crisp, light and refreshing

by Jamil Zainasheff

My friends know I am fond of saying that I love every beer style if the example I am drinking is really well made, and the same is true for cream ale. For this style, however, I need to add one other caveat, which is the right drinking situation. I must be in the mood for something light and refreshing, but with alcohol as well. For me, the best occasion is when I have some sort of mind numbing chore to complete in the heat of the day — like pulling weeds. I used to think that cream ale was a "lawn-mower" beer, but common sense will quickly tell you that power tools and alcohol do not mix. It is harder, however, to injure yourself pulling a few weeds.

Cream ale is a crisp, clean, dry beer, like an American standard lager with a little too much malt presence. I am surprised at the number of times I have had people ask about adding vanilla to a cream ale. Cream ale has absolutely no relationship to cream soda. Cream ale should never be sweet and it should never have vanilla flavor. Think of it as being similar to a mass market American-style lager, but made with ale yeast.

Cream ale should always be clean, crisp and refreshing. This is a moderate alcohol beer (4.2 to 5.6% ABV) with a light to medium body and medium to high carbonation. Appearance ranges from pale straw to gold with brilliant clarity. Good examples will exhibit a slight malt and hop character. Hop flavor and aroma are always low and should not overwhelm the malt character.

The grist for brewing this style often consists of either domestic two-row, six-row or Pilsner malt, and either corn or rice as an adjunct. You want the beer to have a subtle malty note. One trick that I find useful in this style is using half domestic two-row and half continental Pilsner malt. Pilsner malt lends a slightly sweet, grainy malt character to a beer. If you are an extract brewer, use an extract that includes at least some Pilsner malt. A beer like this does not have specialty malts to hide behind, so little tricks like this can stand out in a crowd. When all the other beers at the table have minimal malt character, the one with a touch of grainy flavor and aroma stands out as maltier. I would not bother using six-row malt, as long as you are not using a very high level of adjuncts (>30%).

About 20 to 30% of the fermentable sugars should be made from non-malt sources. Some brewers prefer to use a corn-based adjunct, although almost any non-malt adjunct will do. I prefer to use rice, as it has a very clean flavor. However, if you are trying to impress some judges, you might want to stick with corn. The Beer Judge Certification Program (BJCP) style guide says, "A sweet, corn-like aroma and low levels of dimethyl sulfide (DMS)are commonly found."

Unfortunately, some judges will read "commonly found" as a requirement for corn and DMS. If you are in such a situation, you might want to stick with using corn for your adjunct. You can also use simple sugar to help get a crisp, dry finish. Simple sugar, such as table sugar, will ferment more completely than rice or corn converted in your mash or rice based syrups (which are mostly maltose). If your cream ale does not ferment dry enough, consider replacing 10% of the malt with simple sugar the next time you brew your cream ale.

Hold the total adjunct use to 30% or less of the fermentables. A good target for this style is around 20%.

Many brewers want to add specialty grains to this style, such as crystal or Munich malts, but you should not add specialty grains as they can add too much sweetness or too much malt character for this style. If you are not getting enough malt character

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Cream Ale by the numbers

OG:	1.042–1.055 (10.5–13.6 °P)
FG:	1.006–1.012 (1.5–3.1 °P)
SRM:	2.5–5
IBU:	15–20
ABV:	4.2–5.6%

Photo by Jim Witmer

Weed Puller Cream Ale
(5 gallons/19 L, all-grain)

OG = 1.050 (12.4 °P)
FG = 1.009 (2.2 °P)
IBU = 18 SRM = 3 ABV = 5.4%

Ingredients
4.41 lb. (2 kg) Best Malz Pilsner Malt (2 °L) (or similar)
4.41 lb. (2 kg) Great Western 2-row malt (2 °L) (or similar)
1.76 lb. (800 g) flaked rice (0 °L)
3.36 AAU Liberty pellet hops (0.84 oz./24 g at 4% alpha acids) (60 min.)
1.68 AAU Liberty pellet hops (0.42 oz./12 g at 4% alpha acids) (1 min.)
White Labs WLP001 (California Ale), Wyeast 1056 (American Ale) or Fermentis Safale US-05 yeast

Step by step
Mill the grains and dough-in targeting a mash of around 1.5 quarts of water to 1 pound of grain (a liquor-to-grist ratio of about 3:1 by weight) and a temperature of 149 °F (65 °C). Hold the mash at 149 °F (65 °C) until enzymatic conversion is complete. You might want to extend your mash time, due to the lower mash temperature. 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 (24.4 L) and the gravity is 1.039 (9.7 °P).

The total boil time will be 90 minutes. Add the bittering hops 30 minutes after the wort starts boiling. Add Irish moss or other kettle finings with 15 minutes left in the boil. Add the last hop additions just one minute before shutting off the burner. Chill the wort rapidly to 65 °F (18 °C), let the break material settle, rack to the fermenter, pitch the yeast and aerate thoroughly.

Use nine grams of properly rehydrated dry yeast, two liquid yeast packages, or make a yeast starter. Ferment at 65 °F (18 °C). When fermentation is finished, carbonate the beer to approximately 2.5 volumes.

Weed Puller Cream Ale
(5 gallons/19 L, extract)

OG = 1.050 (12.4 °P)
FG = 1.009 (2.2 °P)
IBU = 18 SRM =3 ABV = 5.4%

Ingredients
5.84 lb. (2.65 kg) Pilsner liquid malt extract (2 °L)
1.14 lb. (520 g) rice syrup (0 °L)
3.36 AAU Liberty pellet hops (0.84 oz./24 g at 4% alpha acids) (60 min.)
1.68 AAU Liberty pellet hops (0.42 oz./12 g at 4% alpha acids) (1 min.)
White Labs WLP001 (California Ale), Wyeast 1056 (American Ale) or Fermentis Safale US-05 yeast

Step by Step
I use the lightest colored extract available at my local homebrew shop to brew cream ales, but feel free to substitute any high quality malt extract of a similar flavor and color from a different supplier. Always choose the freshest extract that fits the beer style. If you cannot get fresh liquid malt extract, it is better to use an appropriate amount of dried malt extract (DME) instead, since it does not oxidize nearly as fast and tends to be fresher.

Mix enough water with the malt extract to make a pre-boil volume of 5.9 gallons (22.3 L) and a gravity of 1.043 (10.6 °P). Stir the mixture thoroughly to help dissolve the extract and bring it to a boil.

Once the wort is boiling, add the bittering hops. The total wort boil time is 1 hour after adding the bittering hops. Add the Irish moss or other kettle finings with 15 minutes left in the boil. Add the last hop additions just one minute before shutting off the burner. Chill the wort rapidly to 65 °F (18 °C), let the break material settle, rack to the fermenter, pitch the yeast and aerate thoroughly.

Use nine grams of properly rehydrated dry yeast, two liquid yeast packages, or make a yeast starter. Ferment at 65 °F (18 °C). When fermentation is finished, carbonate the beer to approximately 2.5 volumes.

Web extra:

Ready to brew more beer? Check out BYO's online recipe directory:

www.byo.com/stories/recipeindex

from domestic two-row and Pilsner malt, then you should review your fermentation. Poor fermentation will result in a beer that is "flabby" and it masks the character of the grain. The same can happen with yeast strains, as some will leave more malt character behind than others. Keep in mind that high quality malt is only apparent when you have high quality fermentation. This beer is more about the clean malt and fermentation flavors so don't hide that with specialty malts. Almost any amount of specialty grain is too much in this style.

> "Cream ale should always be clean, crisp and refreshing. This is a moderate alcohol beer (4.2 to 5.6% ABV) with a light to medium body and medium to high carbonation."

Cream ale has a light to medium body. All-grain brewers should target a mash temperature around 149 °F (65 °C), which results in a lower concentration of non-fermentable sugars. For extract brewers, most light colored extracts will ferment out to the right level. If your extract does not attenuate enough, you should first review your fermentation parameters. If everything checks out, on your next batch of cream ale, experiment with replacing a portion of the malt extract with simple sugar.

Hop character in cream ale is restrained, usually no more than low levels with a floral aroma and flavor, but almost any pleasant hop flavor and aroma will work well. The important thing is to not allow the hop character to overwhelm the malt character.

Keep everything restrained and keep everything in balance. It can be too easy to overwhelm the malt and fermentation character with hops. You want the drinker to get a hint of malt character in there, along with the hop bittering, flavor and aroma. A bittering addition at the beginning of the boil is all that is required of this style, but you can add some late hops if you do not overdo it. One small late addition of ¼ to ½ ounce (7 to 14 g) per 5-gallon (19-L) batch is plenty.

Bittering ranges from low to medium, although medium is a bit generous for most good examples. Perhaps in the driest examples of cream ale the bittering may seem at medium levels. Remember, the goal is

to keep the beer refreshing, crisp and highly drinkable. Too much or too little bitterness or sweetness can impact drinkability and send the beer into a different style. The bitterness-to-starting gravity ratio (IBU divided by OG) ranges between 0.3 and 0.4.

The right fermentation character for this style is clean and neutral ale fermentation. While all fermentation results in some ester production, even clean ales have more esters than most lagers. That is the key difference here. Cream ale is not quite like a clean lager, but somewhere in between lager and ale. Most American-type yeast strains should give acceptable results. I prefer the clean character of White Labs WLP001 (California Ale) and Wyeast 1056 (American Ale). An interesting alternative to those strains is to use a Kölsch yeast. This can pro-

Cream Ale Commercial Examples

Anderson Valley Summer Solstice Cerveza Crema
Anderson Valley Brewing Co.
Boonville, California
www.avbc.com

Carlsbad Cream Ale
Port Brewing Co.
Carlsbad, California
www.pizzaport.com

Genesee Cream Ale
Genesee Brewing Co.
Rochester, New York
www.geneseecreamale.com

Kiwanda Cream Ale
Pelican Pub and Brewery
Pacific City, Oregon
www.yourlittlebeachtown.com/pelican

New Glarus Spotted Cow
New Glarus Brewing Co.
New Glarus, Wisconsin
www.newglarusbrewing.com

Nitro Cream Ale
Squatters Pubs and Beers
Salt Lake City, Utah
www.squatters.com

Rooster Cream Ale
Deschutes Brewery
Portland, Oregon
www.deschutesbrewery.com

Sleeman Cream Ale
Sleeman Breweries
Guelph, Ontario
www.sleeman.ca

Terrapin Golden Ale
Terrapin Beer Co.
Athens, Georgia
www.terrapinbeer.com

Wanderlust Cream Ale (Pete's Wicked)
Pete's Brewing Co.
San Antonio, Texas
www.petes.com

duce a touch of sulfur and that adds a little lager-like character to the beer without it seeming like a lager. What about lager yeasts? Well, this is an ale, not a lager. If you ferment the same wort with a good American lager yeast, it should turn out very similar to an American lager. If you ferment it with a lager yeast that leaves more malt character, then it might pass as an under-hopped German lager. Sure, there are commercial examples produced with lager yeast, but I wonder if the fine distinction between ale and lager is sometimes lost on some folks.

Whatever yeast you use, remember that your fermentation conditions affect what flavors and aromas the yeast produce. Pitching rate, oxygen level, nutrients and temperature are like dials on your control panel of fermentation flavor. Starting with a healthy pitch of yeast, aerating or oxygenating and controlling temperatures are the keys to getting a well attenuated beer that allows the subtle malt flavors to shine through. When using a clean American yeast like White Labs WLP001 (California Ale) and Wyeast 1056 (American Ale), I like to ferment in the mid-60s °F (~ 18 °C). Lower temperatures (and environmental stress in general) tends to produce more sulfur in most yeasts, so watch that you do not push fermentation temperatures too low. You may find a higher or lower temperature gives you the ideal result, so do not be afraid to tweak the parameters until you get it right. BYO

> "Cream ale is not quite like a clean lager, but somewhere in between lager and ale. Most American-type yeast strains should give acceptable results."

Jamil Zainasheff hosts a "style" related podcast on the Brewing Network, *and co-wrote the homebrew recipe collection,* Brewing Classic Styles *(2007, Brewers Publications) as well as* Yeast: The Practical Guide to Beer Fermentation *(2010, Brewers Publications). He writes "Style Profile" in every issue.*

Web extra:

Follow Jamil's blog as he opens his own commercial brewery, Heretic Brewing:

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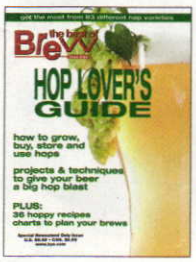

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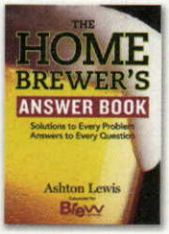

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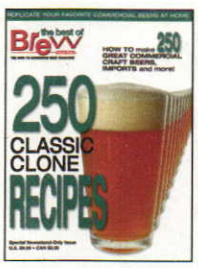

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HOMEMADE SODA

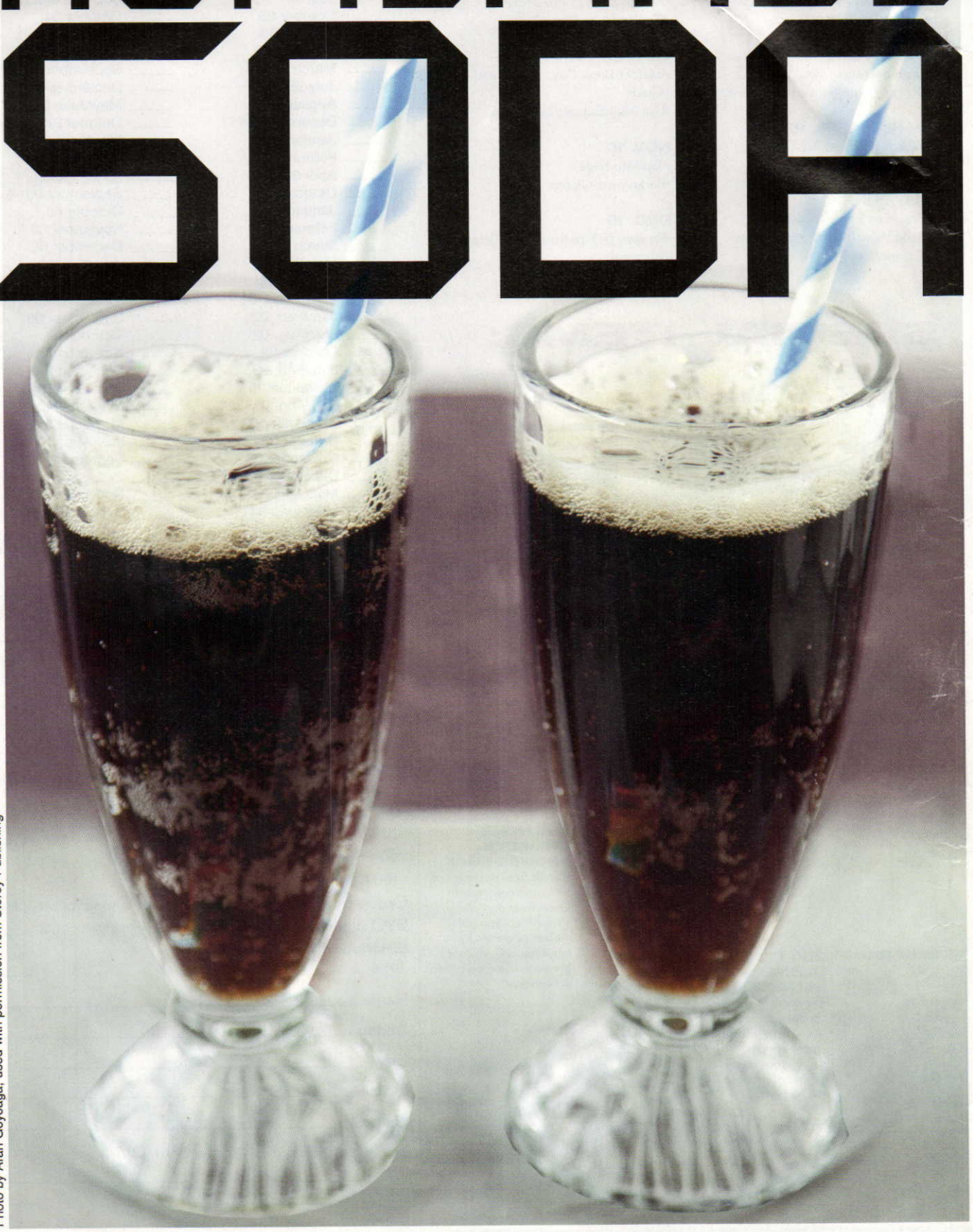
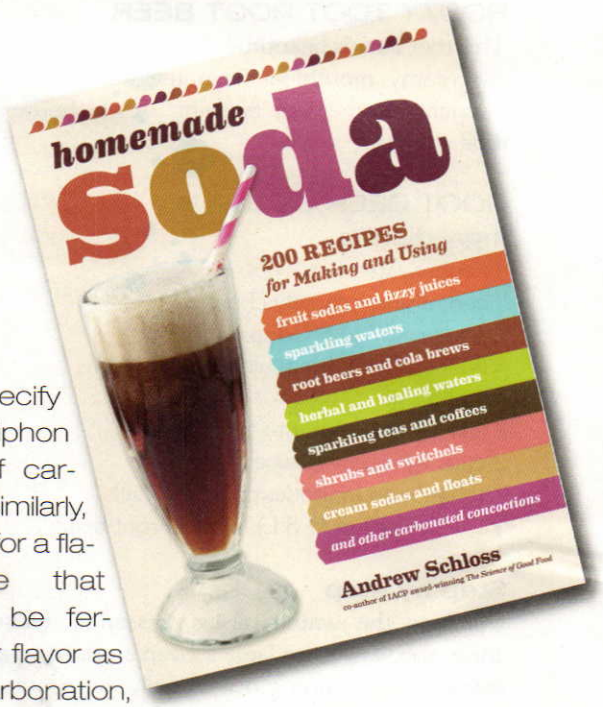


Photo by Aran Goyoaga, used with permission from Storey Publishing

For a change, or a "brewing" project the kids can enjoy, try making soda.



We are all used to the instant gratification of store-bought sodas, and you may have the impression that making sodas at home is overly time-consuming and technically beyond your reach. Nothing could be further from the truth. In some cases it's almost ridiculously easy, and the results will beat commercial sodas hands-down, every time.

Homemade soda always starts with a flavor base. Some flavor bases are quick and simple. Others require more preparation and ingredients. Once prepared, the base can be used right away or refrigerated for spur-of-the-moment refreshment any time. I size the recipes for simple flavor bases for a single glass to give you flexibility. For flavor bases that are more complex, or those that can be used to make a variety of sodas, I give recipes for making them in bulk.

Once you have your base, it is time to add bubbles and turn your syrup into soda. I use three different methods of carbonation:

- seltzer
- siphon
- fermentation

For easy homemade soda that does not require any special equipment, you can simply mix your flavor base with bottled seltzer and drink up. Carbonating soda with a siphon is also very easy, but you do need that specialized gear. Or you can brew your soda in bottles with yeast: the least expensive but most time-consuming method.

I have included with each recipe instructions for each carbonation method that is appropriate for it. Not all sodas can be carbonated by all methods. A carbonated fruit juice, for example, would be weakened by a dilution of water or seltzer, so its recipe may specify only the siphon method of carbonation. Similarly, the recipe for a flavor base that needs to be fermented for flavor as well as carbonation, such as a honey soda, will specify only the fermentation method.

The carbonation trapped in a bottle of homebrewed soda is far greater than the pressure in a bottle of homebrewed beer, and for that reason the standard-weight bottles used for bottling home brewski are not strong enough for homebrewed soda — they are likely to explode.

Screw-top plastic soda bottles are readily available and far safer. Because they expand as the carbonation in the bottle grows, they provide a built-in gauge for judging the degree of carbonation in the bottle. When they feel rock hard, the soda is ready to be refrigerated. Screw tops can be reused, but they should not be used more than three times. After that, their rate of failure rises exponentially.

"Homemade soda always starts with a flavor base. Some flavor bases are quick and simple. Others require more preparation and ingredients."

Story by **Andrew Schloss**

ROOTY TOOT ROOT BEER

This root beer is beautifully balanced and rich-tasting. It gets its creamy mouthfeel from the addition of maltodextrin (available from most brewing supply houses and natural food stores).

ROOT BEER SYRUP

Ingredients:

4½ cups water
¼ cup raisins, coarsely chopped
2 ounces (57 g) dried sassafras root
¼ ounce (7.1 g) dried wintergreen leaves
4 star anise
½ vanilla bean, cut into three pieces
2 cups light brown sugar
2 tablespoon maltodextrin (optional)
Yield: 1.0 gallon (3.8 L) brewed root beer

Step by step

Combine the water, raisins, sassafras, wintergreen, star anise, and vanilla in a large saucepan. Bring to a simmer over medium heat, stirring occasionally; let simmer, uncovered, for 15 minutes.

Blend the brown sugar and maltodextrin (if using), and gradually add the mixture to the simmering root infusion, stirring until the sugar dissolves. Then remove from the heat, let cool for 30 minutes, and strain. This syrup will keep in the refrigerator for up to 2 months.

TO MIX WITH SELTZER

Ingredients:

½ cup root beer syrup
1½ cups seltzer
Yield: 1 serving

TO CARBONATE WITH A SIPHON

Ingredients:

3 cups water
1 cup root beer syrup
Yield: 3 servings

Step by step

Combine the water and syrup in a 1-quart soda siphon. Charge with CO_2 according to the manufacturer's directions. Siphon-charged sodas can be stored in the siphon in a refrigerator for up to 5 days. Disperse into tall glasses filled with ice, and serve.

TO BREW

Ingredients:

3 quarts (2.8 L) lukewarm (80–90 °F/27–32 °C) water
1 quart (~1 L) root beer syrup

⅛ teaspoon Champagne yeast (*Saccharomyces bayanus*)
Yield: 1 gallon (3.8 L)

Step by step

Combine the water and syrup in a large container. Test the temperature; the mixture should be at a warm room temperature, from 75 to 80 °F (24–27 °C). (If it is too hot, let it sit until it cools a bit. If it is too cold, warm it over low heat.) Add the yeast and stir until it is completely dissolved.

Pour the mixture into sanitized plastic bottles using a sanitized kitchen funnel, leaving 1¼ inches (3.2 cm) of air space at the top of each bottle. Seal the bottles. Store for 2 to 4 days at room temperature. When the bottles feel rock hard, the soda is fully carbonated.

Refrigerate for at least 1 week before serving; drink within 3 weeks to avoid overcarbonation.

MIXOLOGY

• **Root Beer Beer**

Combine equal parts chilled root beer and dark beer.

SOUR CHERRY COLA

I brewed this cherry cola using dried sour cherries in place of some of the citrus that is the usual cola flavoring. The cherry flavor is both more subtle and more pervasive.

CHERRY COLA SYRUP
Ingredients:

1 quart (~1 L) water
1 cup dried sour red cherries, finely chopped
Finely grated zest and juice of 2 oranges
3 large (5-inch/13 cm) cinnamon sticks, broken into small pieces
2 tablespoons dried bitter orange peel
2 teaspoons coriander seed
¼ teaspoon finely grated nutmeg
1 teaspoon gum arabic (optional)
2 pounds (0.91 kg) sugar
¼ cup browning sauce, such as Kitchen Bouquet
½ teaspoon vanilla extract
¼ teaspoon almond extract
Yield: enough for 5 quarts (4.7 L) brewed cola

Step by step

Combine the water, cherries, orange zest, cinnamon, bitter orange peel, coriander seed, nutmeg, and gum arabic (if using) in a large saucepan. Whisk together until the gum arabic dissolves. Stir in the sugar and bring to a boil, stirring until the sugar dissolves. Boil for 1 minute.

Remove from the heat and stir in the orange juice, browning sauce, vanilla, and almond extract. Let cool, then strain. This syrup can be stored in the refrigerator for up to 2 weeks.

TO MIX WITH SELTZER
Ingredients:

½ cup cherry cola syrup
1½ cups seltzer
Yield: 1 serving

Step by step

Pour the syrup into a tall glass. Add the seltzer and stir just until blended. Add ice and serve.

CARBONATE WITH A SIPHON
Ingredients:

3¾ cups water
¾ cup cherry cola syrup
Yield: 3 servings

Step by step

Combine the water and syrup in a 1-quart (~1 L) soda siphon. Charge with CO_2 according to the manufacturer's directions. Siphon-charged sodas can be stored in the siphon in a refrigerator for up to 5 days. Disperse into tall glasses filled with ice, and serve.

TO BREW
Ingredients:

4 quarts (3.7 L) lukewarm (80 to 90 °F/27–32 °C) water
1 quart (~1 L) cherry cola syrup
⅛ teaspoon Champagne yeast (*Saccharomyces bayanus*)
Yield: 5 quarts (4.7 L)

Step by step

Combine the water and syrup in a large container. Test the temperature; the mixture should be at a warm room temperature, from 75 to 80 °F (24–27 °C) Add the yeast and stir until it is completely dissolved.

Pour the mixture into sanitized plastic bottles using a sanitized kitchen funnel, leaving 1¼ inches (3.2 cm) of air space at the top of each bottle. Seal the bottles. Store for 2 to 4 days at room temperature. When the bottles feel rock hard, the soda is fully carbonated. Refrigerate for at least 1 week before serving; drink within 3 weeks to avoid overcarbonation.

GINGER GINGER ALE

The combination of fresh and dried ginger gives this ginger ale an extra layer of flavor, a potent floral aroma, and minimal heat.

Ingredients:

3½ quarts (~3.5 L) water
3 ounces (85 g) fresh gingerroot, coarsely grated
1 (1-inch/2.5 cm) length dried ginger
1 pound (0.45 kg) sugar
1 tablespoon apple cider vinegar
⅛ teaspoon Champagne yeast (*Saccharomyces bayanus*)
Yield: 1 gallon (3.8 L)

Step by step

Combine the water, fresh ginger, and dried ginger in a large saucepan. Bring to a simmer over medium heat, stirring occasionally. Let simmer, uncovered, for 15 minutes. Then add the sugar and vinegar, stirring until the sugar dissolves.

Remove from the heat and let cool until the mixture reaches warm room temperature, from 75 to 80 °F (24–27 °C). Strain out the ginger. Add the yeast, stirring until it is completely dissolved.

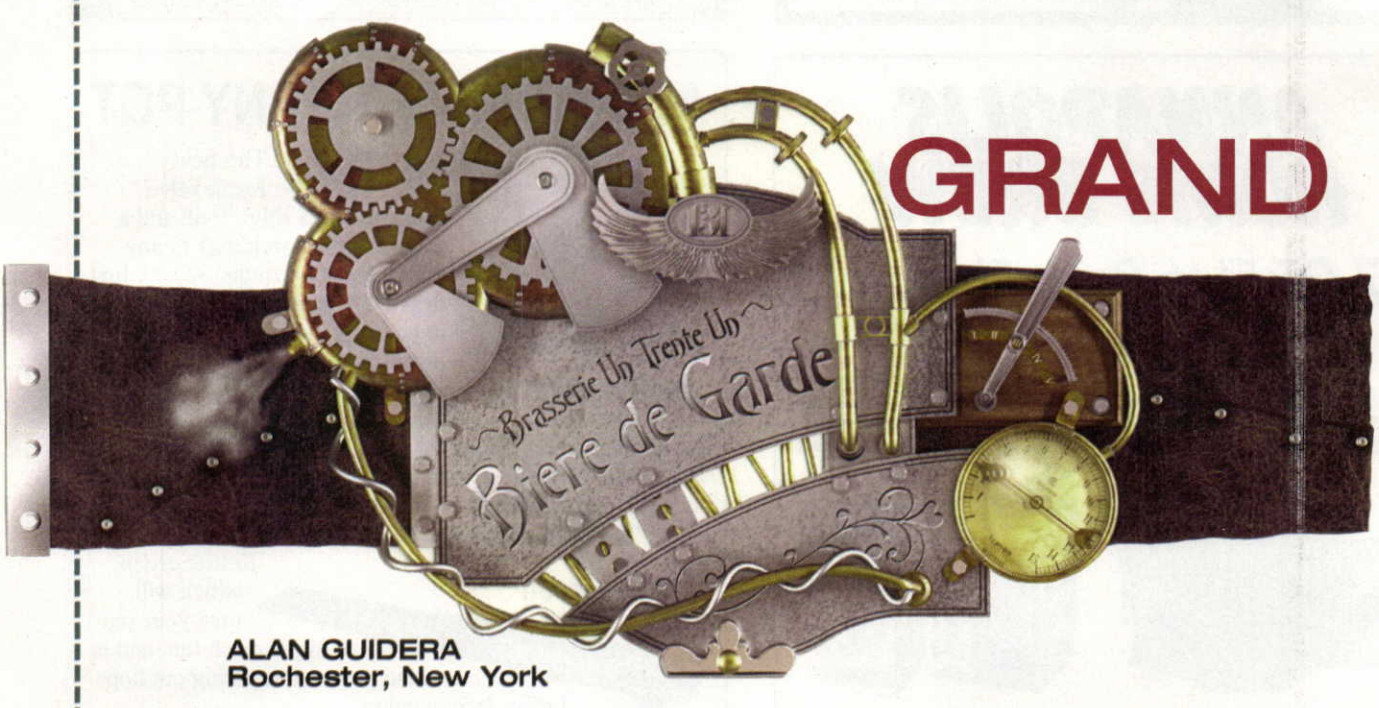
Pour the mixture into sanitized plastic bottles using a sanitized kitchen funnel, leaving 1¼ inches (3.2 cm) of air space at the top of each bottle. Seal the bottles. Store for 3 to 5 days at room temperature. When the bottles feel rock hard, the soda is fully carbonated. Refrigerate for at least 1 week before serving; drink within 3 weeks to avoid overcarbonation. BYO

This story is excerpted with permission from the book "Homemade Soda," © by Andrew Schloss, released this summer by Storey Publishing, 2011.

2011 LABEL CONTEST WINNERS

When it comes to homebrewers, creativity doesn't stop at the grain bill. If a homebrew is an expression of a brewer's taste, then the label is surely an expression of their vision. This year we received a record number of entries — from North America and beyond — for our annual label contest, and the competition was fierce. As always, it is difficult for our judges to choose the best of the best among so many worthy entries, but we battled it out to choose our favorites. This year, we were suckers for a "steampunk" design, loved the lines of a dark chocolate and vanilla stout label, felt the fire from a hop explosion and said "yes" to a seabird IPA. Thank you all for your amazing artwork, we can't wait to see what's to come next year! And thank you to all our sponsors for providing great prizes!

GRAND



ALAN GUIDERA
Rochester, New York

To capture the French, earthy feel of his biere de garde, Alan came up with a Jules-Verne-approved design. "I have been interested with the style of steampunk for a while as it incorporates technical, artistic and historic details, which appeal to my architecture background," he said. "Plus, the alternate history concept/European Victorian-era sci-fi genre is just plain cool."

PRIZES: 10 gal. converted Igloo cooler mash tun with a stainless false bottom as well as a T-shirt and lanyard from **Adventures in Homebrewing**; One lb. of whole hops from **Home Brew Shop (Chico, CA)**; Gift certificate from **High Gravity**; Gift certificate from **Homebrewers Outpost & Mail Order Co.**; Gift certificate from **My Own Labels**; Gift certificate from **Quality Wine and Ale Supply**; A Carboy Cleaner from **Carboy Cleaner**

GOLD

JON LARSON
Portland, Oregon

Jon wanted something "elegant" to show off a series of his imperial stouts, and this one is for his dark chocolate and vanilla version. "I would have sent the bottle, but it is all gone!" he said.

PRIZES: Gift certificate from **Bader Beer & Wine Supply**; Bronze beer opener & case from **Hobby Beverage Equipment**; Gift certificate from **Homebrewers Outpost & Mail Order Co.**; Beach Blonde ingredient kit from **O'Shea Brewing Company**; Party Pig set-up package from **Quoin Industrial**; Stainless steel boil braid hop strainer from **Synergy Metalworking**; Gift certificate from **Quality Wine and Ale Supply**

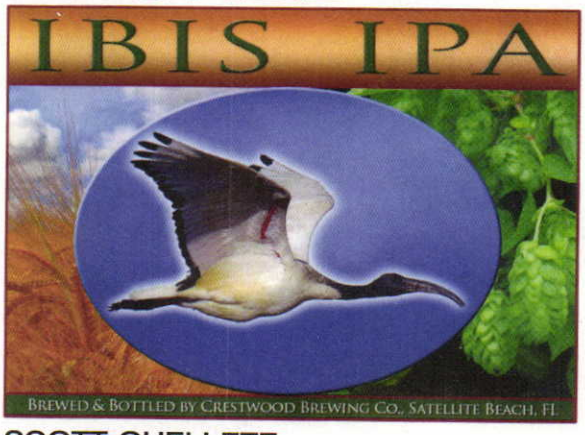
SILVER

SHANE DUBAY
Chicago, Illinois

Depicting a volcanic explosion of hops, Shane's label for his imperial IPA took the design one step further with wax. "The wax seal was another touch to loosely imply lava," he said.

PRIZES: 50 lb. bag of Pilsen malt from **Briess Malt and Ingredients Co.**; "The Beer Book" from **Home Brew Party**; Gift certificate from **Homebrewers Outpost & Mail Order Co.**; 30 quart brew kettle from **Polar Ware Company**; Stainless steel boil braid hop strainer from **Synergy Metalworking**; Gift certificate from **Quality Wine and Ale Supply**; A Keg Cleaner from **Carboy Cleaner**

BRONZE



SCOTT OUELLETE
Satellite Beach, Florida

Scott doesn't actually bottle his homebrews, he kegs. "I print labels out on card stock then mount them to refrigerator magnet material and stick them on the fridge door above the tap," he said, including this design his IPA honoring the Ibis, a common bird in Florida.

PRIZES: Gift certificate from **The Brewer's Apprentice**; Gift certificate from **Homebrewers Outpost & Mail Order Co.**; Gift certificate from **Old West Homebrew Supply**; Stainless steel boil braid hop strainer from **Synergy Metalworking**; Gift certificate from **Quality Wine and Ale Supply**; A Large Carboy/Sanke Keg Cleaner from **Carboy Cleaner**

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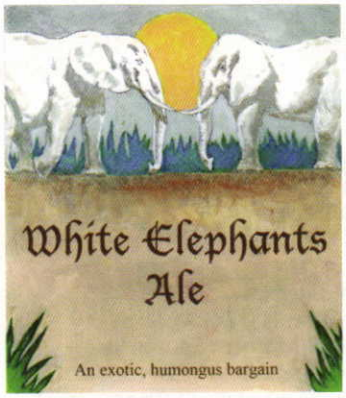

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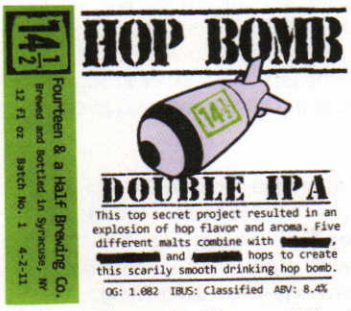

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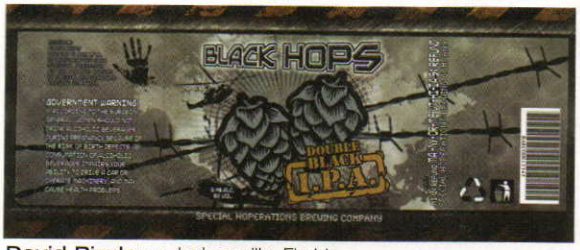

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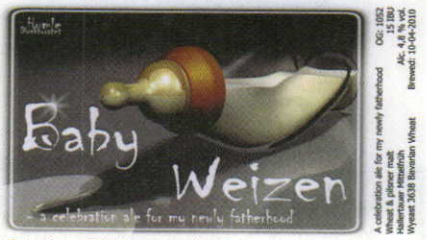

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WIT

It may be hard for modern homebrewers to think of a time when witbier was virtually unknown. Today, it is one of the more popular Belgian style beers, if not the most popular Belgian beer style. There are many well-known commercial examples and it shows up quite frequently as a spring or summer seasonal at many brewpubs. Witbier has its own subcategory (16A, the first of five in category 16, Belgian and French Ale) in the Beer Judge Certification Program (BJCP) guidelines and the methods and "mythology" of brewing witbier are widely discussed on internet brewing forums.

However, it wasn't so long ago that this cloudy, tangy and delicately spiced beer was a bit of a mystery. And it wasn't too long before that the style had ceased to be produced by any breweries in its native land and was unheard of in North America. In fact, this beer style that is now so popular could have disappeared completely if not for the efforts of one man (see the sidebar on page 41 for more).

Depending on who you ask, the original version of this style can be traced back from anywhere between 400 years ago to as far back as the 11th Century. Some beer historians even believe that its early recipes may have been the first to include hops as its primary bittering ingredient. Its production began in Northern Europe and eventually became localized to the city of Leuven, Belgium and its surrounding communities. As with many other brewing regions located in Europe, the mid 1900s were a rough time. World War II and its aftermath had lasting affects on the availability of raw materials needed to brew, not to mention any damage that may have been inflicted on the area itself. By 1955 the last of the breweries that produced witbier (Tomsin) had to close their doors and some feared that it may never be produced again.

Never say never. In 1966, a man named Pierre Celis brought the style back to life and began producing it in a hayloft located just outside of Leuven. This beer is still produced today and can be found in stores all across the U.S. carrying the name of the town he created it in, Hoegaarden.

At present there are many commercial examples that are readily accessible to us. Some of the better ones you can try that'll give you an understanding of what a good witbier can taste like are: St. Bernardus Witbier (Belgium), Allagash White (US), Avery White Rascal (US), Hitachino Nest White (Japan), Blanche de Bruxelles (Belgium),

BIER

THE STYLE THAT GOT A SECOND CHANCE

Story by **Justin Burnsed**

Sterkens White Ale (Belgium), Celis White (US), Unibroue Blanche de Chambly (Canada) and of course Hoegaarden (Belgium). If you can't find any of those, I'm sure you can get your hands on a Shock Top (AB-InBev) or a Blue Moon (SAB Miller-Coors).

What's in Wit's Name?

The origin of the name witbier is nothing fancy. Its literal translation from the Dutch language to English is "white beer." You can also just refer to it as a wit and most beer people will know what you're talking about. I guess the obvious question now is what makes the beer white? There are a couple contributing factors to this phenomena, which I will get into shortly, but first let's discuss what characteristics the style brings to the goblet.

Witbier Characteristics

At first sniff, the aroma of a witbier should be slightly sweet, grainy, a little spicy with mild tartness. Citrus and floral notes are commonly present, as can be other intriguing background notes from the variety of specialty ingredients that can be used. Hop aroma should be very low to none and diacetyl levels should be non-perceivable. The important thing to remember that none of these characteristics should be dominant. Harmony is very important.

The flavor of the beer should also carry this idea of balance amongst the ingredients. Witbiers are traditionally light, refreshing and have just enough extra flavor components to keep things interesting. A little sweetness is expected, but it is kept in check by a bit of tartness. Other flavors that are common are that of citrusy fruitiness married with spiciness from coriander. Bitterness is typically very low (10–20 IBU) and hop flavor should be low to none.

The appearance of a witbier is as the name suggests, as close to white as you can get up to a pale gold color (2–4 SRM). The fact that the beer is intentionally made cloudy also enhances its "whiteness" so to speak. Head retention should be very good and won't be a problem if it is brewed correctly. The mouthfeel of the beer is a bit of a brain teaser. It's one of the only styles that makes an attempt to be

WIT RECIPE

Get Wit The Program
(5 gallons/19 L, all-grain)
OG = 1.049 FG = 1.012
IBU = 15 SRM = 5 ABV = 4.8%

Ingredients
5 lbs. 2 oz. (2.3 kg) Belgian Pilsner malt (2 °L)
2.25 lbs. (1.0 kg) wheat malt
2.25 lbs. (1.0 kg) flaked wheat
0.50 lbs. (0.23 kg) flaked oats
0.50 lbs. (0.23 kg) rice hulls
1.8 AAU Saaz Hops (60 min) (0.50 oz./14 g of 3.6% alpha acids)
3.6 AAU Saaz Hops (15 min) (1.0 oz./28 g of 3.6% alpha acids)
1 tsp Irish moss or 1 Whirlfloc tablet (15 min)
0.50 oz (14 g) bitter orange peel (10 min)
0.25 oz. (7.1 g) ground coriander seed (10 min)
White Labs WLP400 (Belgian Wit Ale) or Wyeast 3944 (Belgian Witbier) yeast
1 cup (200 g) priming sugar

Step by Step
Mill the grains with the exception of the rice hulls, flaked wheat and the flaked oats. Dough in using 3.5 gallons (13 L) of water with a target mash holding temperature of 152 °F (67 °C). Hold the mash temperature for approximately 60 minutes or until the conversion is complete. Raise the temperature of the mash to 168 °F (76 °C) and begin sparging with 170 °F (77 °C) water until you collect 6 gallons (23 L) of wort in the kettle. The total wort boiling time for this recipe is 60 minutes. At the onset of a full rolling boil, add your first scheduled hop addition. When there are 15 minutes remaining in the boil, add the second hop addition along with your Irish moss or Whirlfloc tablet to help with precipitation of the hot break. At 10 minutes remaining, add both the ground coriander seed and the bitter orange peel.

Cool the wort to 70 °F (21 °C), transfer to your fermentation vessel and aerate the wort adequately. Add the contents of your yeast starter to the chilled wort. Ferment around 70 °F (21 °C) until the final gravity is reached, which should be in 5 to 7 days. Rack to a secondary vessel and allow the beer to mature another 5 to 7 days around the same temperature. Your beer is now ready to rack into a keg or bottles along with the priming sugar.

Get Wit The Program
(5 gallons/19 L, extract with grains)
OG = 1.049 FG = 1.012
IBU = 15 SRM = 8 ABV = 4.8%

Ingredients
2.75 lbs. (1.25 kg) wheat liquid malt extract
2.75 lbs. (1.25 kg) Pilsner liquid malt extract
1.75 lbs. (0.79 kg) Belgian Pilsner malt (2 °L)
0.25 lbs. (0.11 kg) flaked wheat
0.25 lbs. (0.11 kg) flaked oats
1.8 AAU Saaz Hops (60 min) (0.5 oz./14 g of 3.6% alpha acids)
3.6 AAU Saaz Hops (15 min) (1.0 oz./28 g of 3.6% alpha acids)
1 tsp. Irish moss or 1 Whirlfloc tablet (15 min)
0.50 oz. (14 g) bitter orange peel (10 min)
0.25 oz. (7.1 g) ground coriander seed (10 min)
White Labs WLP400 (Belgian Wit Ale) or Wyeast 3944 (Belgian Witbier) yeast
1 cup (200 g) priming sugar

Step by Step
Mill the Belgian Pilsner malt, but be sure not to mill the flaked wheat or the flaked oats. Place them all into a grain bag and steep using 3 quarts (2.8 L) of 152 °F (67 °C) water for 45 minutes. Rinse the grain bag with an additional 2 quarts (1.9 L) of water and allow it to drip into the kettle for about 15 minutes. Add enough water for a pre-boil volume of 6 gallons (23 L). Stir in both malt extracts and begin the boil.

The total wort boiling time for this recipe is 60 minutes. At the onset of a full rolling boil, add your first scheduled hop addition. When there are 15 minutes remaining in the boil, add the second hop addition along with your Irish moss or Whirlfloc tablet to help with precipitation of the hot break. At 10 minutes remaining, add both the ground coriander seed and the bitter orange peel. [If you can't manage a 60-minute, 6-gallon (23-L) boil, try to boil at least 3.5 gallons (13.0 L) for 60 minutes and withhold half of the malt extract until late in the boil.]

Cool the wort to 70 °F (21 °C), transfer to your fermentation vessel and aerate the wort adequately. Add the contents of your yeast starter to the chilled wort. Ferment around 70 °F (21 °C) until the final gravity is reached, which should be in 5 to 7 days. Follow the remaining instructions for the all-grain recipe.

light-medium in body, but also maintain a fairly noticeable level of creaminess to it. The high level of carbonation helps you achieve this by keeping those creamy unfermentables at bay with some extra tongue tingle. A little dryness in the finish can also be expected.

The Grist and Mashing

The grain bill for the style isn't terribly complex, but if you want to brew it at home using traditional ingredients, it could end up being a little more work than you're used to. Most old school recipes call for the use of 50% Belgian Pilsner malt, 45% raw wheat as the base grains and also a 5% addition of raw oats. The Pilsner malt is a non issue, but the other two can certainly gum things up a bit, literally. The raw oats will require you to boil (or cereal cook) them for about 15–20 minutes prior to adding them to the main mash. This is needed to gelatinize the starch so that the enzymes from the Pilsner malt would be able to act on them in the mash tun. The raw wheat does not need this treatment as the gelatinization temperature of wheat starch is below usual mash temperatures.

Also, given the high protein and starch content of these unmalted grains, a step mash with varying temperature rests would likely need to be used to break some of them down to keep the wort from being too viscous and provide more fermentable carbohydrates. Then there is lautering, which could take a while given the low level of husk material in the mash.

Thankfully we live in modern times and there are some simpler ways to accomplish our goal of making a tasty wit. If for some reason you couldn't find any Pilsner malt, you can always use 2-row malt as a substitute. For the raw oats, you can substitute flaked oats, which is pre-gelatinized and can be added directly to the mash. Flaked wheat can also be used as a substitute for raw wheat if needed.

Remember that these are still huskless, unmalted grains and still contain a very high level of starch and protein. They can still give you some issues when it comes to running off the wort to the kettle. The solution I use is the

same for all beers I make with a fair amount of wheat in them: rice hulls. They will provide you with extra space between the grains to allow for more efficient lautering. An addition of a half pound (0.23 kg) should be sufficient for a 5-gallon (19-L) batch. If you really want to take the easy way out, then you can simply use malted wheat. It will certainly give you less of a creamy character and will likely yield a beer that's a tad thinner in the end.

When it comes to mash time, you have the choice of whether you want to do a step mash or a single infusion. If you decide to use the traditional proportions of unmalted wheat/flaked wheat or oats/flaked oats and have the time, then a protein rest at about 122 °F (50 °C) for 15–30 minutes is a good idea. It will break down some of the protein matrix that surrounds the starch and help give the wort more total carbohydrates available for conversion to fermentable sugars. You'll end up getting a higher extract efficiency and the body of the beer will be on the lighter side as the style guidelines call for. Just don't overdo it or you may lose some of the cloudy whiteness that is a signature for the style. For single infusion and the saccharification rest of a step mash, a conversion temperature around 150–152 °F (65–67 °C) is ideal.

Extract Brewing Tips

In the case of extract brewing, I think the biggest hurdle is getting the proper mouthfeel into the beer. Pilsner malt extract and wheat malt extract will make a good base providing the right flavors and levels of fermentable sugars. To get some of that creamy texture and head retention into the beer, I would suggest steeping a small of amount of oat flakes and/or wheat flakes. 0.50–1 lbs (0.23–0.45 kg) of each per 5 gallons (19 L) of beer should do the trick. You want to be careful not to overdo it since there won't be any enzymatic action taking place on all that starch.

A better approach would be to add some base malt to it and conduct a mini mash if you want to play it safe. To do this, add approximately three parts base malt for every part raw or flaked

grains in your mini-mash. For example, if you had 1 lb. (0.45 kg) of raw wheat and oats, add 3 lbs. (1.4 kg) of Pilsner malt. The enzymes from the Pilsner malt will degrade the starches from the raw grains if you hold the temperature in the saccharification range (148–162 °F/64–72 °C) and keep the liquid to grain ratio in the same range as a typical full mash. Anything from 1.25–3 qts./lb. (2.6–6.3 L/kg) will work well for a partial mash. For example, if you mini-mashed 1 lb. (0.45 kg) of combined raw wheat and oats along with 3 lbs (1.4 kg) of Pilsner malt, you should add between 5 and 12 qts. (4.7 and 11 L) of water for the mash.

A small mini-mash will greatly improve your extract-based witbier, especially in the area of mouthfeel and achieving the right level of cloudiness.

Boiling and Spice Additions

The boil for an all-grain batch of witbier should last about 60 minutes. One or two early hop additions using European varieties such as Goldings, Hallertauer or any of their American counterparts will provide the low levels of hop flavor and bitterness (under 20 IBUs) the style calls for. Towards the end of the boil is where you get to choose whether you want to stick to tradition or add that little extra something to make your buddies rack their brains during a sampling session.

Most witbier recipes include additions of coriander and bitter orange peel. In a 5-gallon (19-L) batch, adding from 0.25–1 oz. (7.1–28 g) of each with 5–15 minutes remaining in the boil is appropriate. This will give you some wiggle room when it comes to the beer's spicy and citrusy flavors.

The spices should be fresh. If you cannot find a decent source of bitter orange peel, use the peel of any variety of orange that you enjoy.

Grains of paradise, cardamom and chamomile are a few specialty ingredients that some brewers add to provide a shroud of mystery to their witbier. If you decide to use them, remember that this isn't a Belgian strong holiday spiced beer. If you haven't brewed beers with any of these ingredients in the past, take a look at a few recipes and use

PIERRE CELIS
The Father of Modern Witbier

When I moved to the Austin area in 1999, it was a beer oasis in the middle of Texas. There were plenty of brewpubs — including Waterloo, The Copper Tank and The Bitter End. There were two homebrew shops and there was a world-class brewery — Celis.

The Celis Brewery was the namesake of Pierre Celis, who could be called The Father of Modern Witbier. Celis' brewing life is a study in changing fortunes — from the highs of reviving and popularizing an extinct beer style to the lows of losing not one, but two, breweries.

Celis came to Texas from Belgium, where he began brewing witbier in 1966, after other breweries had abandoned the style a decade earlier. Unfortunately, although things were going well for his beer brand — which eventually came to be called Hoegaarden White, his Belgian brewery (which was then called De Kluis) burned down in 1985. Celis was unable to reopen the brewery by himself because he was underinsured. So, he entered an agreement with Artois to reopen with them as a partner. Unhappy with the changes Artois made to Hoegaarden's formulation, Celis sold his stake in the brewery in 1990 and was able to secure funding to open a brewery in Texas in 1992.

His Austin brewery produced Celis White, which was a world class beer — and it earned the medals at various commercial beer competitions to prove it. To top it off, the brewery also made a second world-class beer, Celis Grand Cru. (To be fair, they also made Celis Raspberry and Pale Rider, a beer advertised as having been brewed to the specifications of Clint Eastwood. But, with two home runs in Celis' portfolio, it's silly to spend much time on the bunts.)

Celis was thinking big when he set up shop in Austin, a kind of big that few US craft brewers were back in the 1990s. He came to Austin primarily because of the water, but he also knew that Austin put him between two of the biggest cities in the US (Dallas, to the north, and Houston, to the east), near a major seaport (Houston) and near a major US highway (the brewery was located right off I-35). Celis wanted his brewery to be huge; and, for awhile, it looked like that was going to happen. Sales of Celis White were initially strong. At its peak, the brewery was cranking out 22,000 barrels of beer a year. But then, Celis struck a deal that gave Miller Brewing a controlling interest in the brewery.

Now, I'm not the kind of homebrewer who thinks that every last thing "The Big Boys" do is evil. They make a neutrally flavored fermented grain beverage and sell it through intensive marketing. It's not something that interests me, but good for them. However, Miller did bring about the demise of one of the best breweries ever. Miller insisted on cost-cutting measures, including using cheaper ingredients, and soon production at Celis dwindled to 15,000 barrels a year. (What they did was akin to buying Lamborghini, then putting inexpensive 4-cylinder engines under the hoods because that's what worked for Toyota.) Then, because the brewery wasn't selling enough beer, Miller shut down production in 2000. Contractually, Celis could have bought the brewery back, but he didn't have the funds.

By the mid-2000s in Austin, Waterloo, Copper Tank and The Bitter End were also gone and one of Austin's homebrew shops switched to selling only wine supplies. Currently, Celis White is still available, in the US and abroad, but it's brewed by Michigan Brewing Company. And sadly, Pierre Celis died on April 9th, 2011, at the age of 86.

I'm a fan of alternative history novels — novels that ask, "what if the Germans won WWII?," that sort of thing — and I sometimes wonder what the current craft brew scene would be like if Pierre hadn't signed on the dotted line. Look at the shelf space dedicated to Blue Moon, Shock Top and other wit-like concoctions and imagine if Celis White had remained a world-class beer. The brand was growing quickly in the early Austin days. (Miller wouldn't have been interested in a then-still-fairly-obscure Belgian style if it wasn't.) What if the current "witty" shelf space was dominated by Celis White, with a row of Celis Grand Cru next to it? Might the craft brew explosion of the '80s and '90s have gone supernova for Celis White with a little clever marketing, some word of mouth and bit of luck? Celis might now be the largest US-based brewing company in the country. (On the other hand, a recurring theme in alternative history novels is the unforeseen effects of a single change in history's path. Maybe in our alternate world, the Big Boys see the rising star of Celis and decide they need to go all in on the craft brew thing, crowding the supermarket shelves and blocking the growth of smaller breweries.)

With a spate of recent brewery openings, Austin, Texas is once again a beer oasis. There's even an Austin-brewed witbier available — (512) Wit, made with 2-row pale malt, unmalted barley and oats, coriander and Texas grapefruit peels. Austinites miss Celis and his White beer, but Pierre's brewing journey didn't end in Austin. He returned to Belgium and did what he did best — brewed another incredible beer (in this case, Grottenbier Bruin). — *Chris Colby*

them as a guideline.

A witbier cannot be ruined by adding too little of an herb or spice, but it sure can be by using too much of it. In this case, less is better. When brewing your witbier, smell your spices and be ready to adjust the amount you add downward if you think they smell especially pungent.

Fermentation and Beyond

At the end of the boil, your target original gravity should be in the range of 1.044–1.052. There are a wide variety of Belgian yeast strains out there that are capable of making a perfectly good witbier. There is however, an added bonus if you use one specifically cultured for this style of beer. They can provide a slight tartness to the beer during fermentation, which is one of the style's signature flavors. That means less work for you, as the finished product will not require any additional ingredients to provide that flavor prior to bottling. A couple strains that fit into this category are White Labs WLP400 (Belgian Wit Ale) and Wyeast 3944 (Belgian Witbier).

Whatever yeast you choose, just make sure that the strain is on the cleaner side of the spectrum. You don't want there to be an overabundance of spicy, fruity or phenolic character in a witbier. The estimated attenuation of the strain you use should be anywhere from 72–77%. Try not to pick one that has the capability of going above 80%, which would make the body of a beer of this strength way too thin and will produce higher levels of ethanol than are appropriate. Belgian yeast tends to like warmer fermentation temperatures, but I believe it's best to keep the wort in the 70–72 °F (21-22 °C) range. That way your beer will have an unmistakably Belgian flavor without going overboard. The target final gravity you're shooting for is from 1.008–1.012, which will yield a beer that is 4.5–5.5% alcohol by volume (ABV).

If you aren't able to get your hands on some witbier yeast, I would recommend tasting the beer at the end of fermentation to see if there is any tartness to it. If not, you can always add just a touch of lactic acid to the beer prior to

bottling. Make sure not to overdo it, as the tart edge is only meant to complement the beer's sweetness.

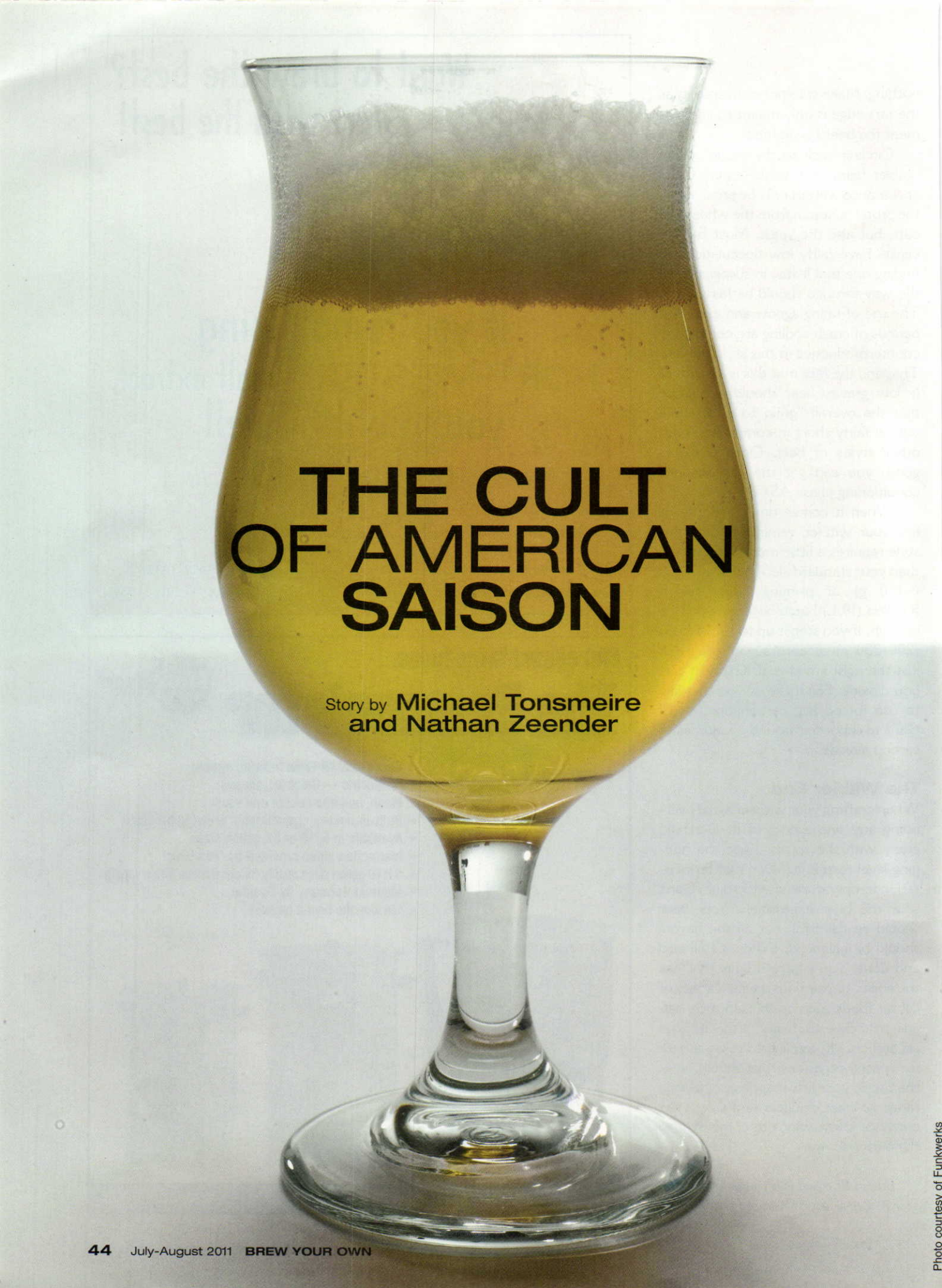
Circling back to the origin of the witbier name, the white aspect of its appearance will not only be provided by the proteins/starch from the wheat and oats, but also the yeast. Most Belgian yeasts have fairly low flocculation, so finding one that'll stay in suspension all the way through should be fairly easy. The use of fining agents and extended periods of crash cooling are completely counterproductive in this style of beer. That and the fact that this is a relatively low gravity beer should guarantee that the overall "grain to glass" time will be fairly short in comparison with other styles of beer. Once it tastes good, you can get the carbonation/conditioning phase ASAP.

When it comes time to bottle or keg your witbier, remember that this style requires a little more carbonation than your standard ale. The usual ¾ cup (~150 g) of priming sugar for a 5 gallon (19 L) batch bottling won't be enough. If you step it up to 1–1.25 cups (200–250 g) of corn sugar, you'll get just the right amount of dissolved carbon dioxide. For those of you that like to use forced keg carbonation, you'll want to shoot for around 3 volumes of carbon dioxide.

The Witbier End

When crafting your witbier, avoid overdoing any one aspect of it. Don't go crazy with the spices. Keep the hopping level restrained. Don't let fermentation temperatures rise too high. Don't sour the beer excessively. Your beer should be flavorful, but all the flavors should be balanced. When it's all said and done, you'll have a beer that has the ability to pair with a wide variety of lighter foods such as chicken, fish, salads, mild cheeses, fruit . . . the list goes on and on. If you like to make a beer for special occasions, this should be at the top of your list. It appeals to a wide range of beer drinkers and may even convince a few winos to come over to the dark side. BYO

Justin Burnsed is a frequent contributor to Brew Your Own *magazine.*



THE CULT OF AMERICAN SAISON

Story by **Michael Tonsmeire and Nathan Zeender**

Photo courtesy of Funkwerks

Photo courtesy of Michael Tonsmeire

Saison, a storied tradition now relegated to the fringes in Belgium, has found a strong revivalist movement among today's artisan brewers all across the United States. We asked Yvan De Baets, brewer of De La Senne and Belgian beer scholar par excellence, about the trend and he replied, "I feel gratitude to the U.S. brewers for the sincere interest they have in saisons and other traditional styles, from Belgium and elsewhere. This creates a movement, with serious literature, and a solid market, leading to the rescue of styles that are almost dying in their country of origin. To put it clearly: almost no one cares about saisons here in Belgium, and I'm always touched to see the enthusiasm the Americans have for those monuments of the past." Much of the current fervor can be traced directly to 2004 when Phil Markowski's informative book, "Farmhouse Ales," was published, and more pointedly, De Baets inspiring chapter on the history of saison; in fact it is hard to imagine any creative brewer reading that section without their head spinning with ideas — the book that launched a thousand saisons.

A BRAVE NEW WORLD

American breweries have brewed saisons for many years, including Brewery Ommegang's Hennepin, New Belgium's Saison and Pizza Port's SPF 45. Increasingly, however, small breweries across the country are dedicating themselves to specializing in the production of variations on the saison theme, including Upright Brewing (Portland, Oregon), Odonata Beer Co. (Sacramento, California), Funkwerks (Ft. Collins, Colorado), Stillwater Artisanal Ales (Baltimore, Maryland) and Saint Somewhere (Tarpon Springs, Florida). Jolly Pumpkin's (Ann Arbor, Michigan) visionary brewer, Ron Jeffries, was an early adopter of traditional farmhouse techniques. Dann Paquette, of Pretty Things (Somerville, Massachusetts), declares that traditional saison is a style lost to history. His Jack D'Or anglicizes the tradition producing what he coins a "Saison Americain." In this new school, the term "artisan" stresses hands-on, small production marked by specialization, with a personal, uncompromising approach.

Saisons are yeast driven, phenolic beers of high attenuation, often using various cereal grains, covering the gamut from refreshing-straw-colored-quenchers to dark-complex-vinous-sippers. The romance of

saison is that it offers the creative brewer great seasonal and localized variation, harking back to the time when these beers were an agricultural product of farm-life tied to the harvest.

Where the Wild Things Are

For a day of collaborative brewing, we tracked down Ryan Michaels, the head brewer at McKenzie Brew House, just outside of Philadelphia. Michaels, along with assistant Gerard Olson, has quietly been brewing one of America's most decorated saisons. Saison Vautour has commanded gold an astounding three of the last four years at the Great American Beer Festival. Peculiarly, each of the three wins came with a different treatment of the same base recipe: clean fermented in stainless steel, *Brettanomyces* spiked, and wine barrel fermented with a mixed-microbe culture.

For the collaboration, we settled on a beer that would bridge the Belgo-French farmhouse traditions — a saison-bière de garde-bière de miel mashup fermented and aged in oak barrels that had all been used for mixed fermentation beers. We named it Irma. The aim was to craft a baroque beer that would offer a broad palette of elements that could be pieced back together after the beers had ripened separately. A single wort was used to produce four distinct beers: a clean version in stainless steel, a funky version in a red wine barrel, a miel version in a red wine barrel with a blend of honeys added directly to the barrel to preserve their aromatics, and a version in an apple brandy barrel to accentuate the classic caramel apple character indicative of bière de garde.

Yeast Strains

Saison is a style primarily defined by its yeast, so when planning a recipe, yeast selection should be paramount. The common traits that all saison strains share are that they produce more spicy/peppery phenols than fruity esters, have a high degree of attenuation and work well at elevated temperatures. These strains do not need to be stressed to produce their distinctive characters — the brewer aerates and pitches the wort with as many cells as for any other beer.

Dupont

The Saison Dupont strain is available from both Wyeast (3724, Belgian Saison) and White Labs (WLP565, Belgian Saison I). Dupont is the saison yeast that all other strains are measured against. At temperatures from the mid-80s °F (30 °C) into the low-90s °F (32-33 °C) it produces a spicy blend of pepper, yeast and fruit without noticeable fusel alcohol production. Patience is required because the yeast can take several weeks to attenuate a beer completely even at these elevated temperatures; at lower temperatures, fermentation often stalls with considerable gravity remaining.

"We started out with White Labs WLP565. The famed Dupont strain. It took several generations to acclimate to the brewery environment. The first few batches took a couple of weeks to fully attenuate. We now reach full attenuation, typically down to almost zero, in three days. I pitch at a much higher temperature than normal, 80 °F (27 °C), and let it rise as it will to 90 °F (32 °C) or so," said Bob Sylvester of St. Somewhere.

White Labs produces another strain, Belgian Saison II (WLP566) that is rumored to be a different isolate from Brasserie Dupont. WLP566 has a similar character to WLP565 (although it tends to be fruitier), but is less finicky to work with.

French Saison

This strain, rumored to originate from Brasserie Thiriez, is available from Wyeast (3711, French Saison).

"We use the Wyeast 3711, which I love for the fact that it produces lots of different flavors in the different worts we put it in, which makes it easy for our beers to be distinct among themselves," said Alex Ganum from Upright Brewing. "Lots of people would probably say that they love how well it attenuates, although I consider it over-attenuating and we often struggle to get the yeast to just quit at some point. It makes bottle conditioning a bit of a pain as you could imagine."

This strain produces fully attenuated beer, with a mild pepper character and a bit more tropical fruit than other saison strains. It has gained many devotees in the U.S. because it is less temperamental than the Dupont strain. While the character of the finished beer can benefit from elevated fermentation temperatures into the 90s °F (32–33 °C), the strain will attenuate completely at temperatures as low as the mid-60s °F (18 °C). Despite rarely finishing above 1.004, it leaves a wonderful impression of body.

Bière de Garde

This release from Wyeast (3725, Bière de Garde) is only available at certain times of the year. Rumored to have been isolated from Fantôme, despite the name, it produces a cleaner character than most other saison strains, especially at lower temperatures. WY3725 is easy to work with and performs well in stronger beers with complex character, complementing spices especially well. It ferments well from the mid-60s °F (18 °C) into the high-80s °F (31 °C) and is highly attenuative, even in worts with specialty malts.

Brettanomyces

The wild yeast *Brettanomyces* can be used to add rustic charm to a saison. Depending on the strain, it can add flavors that include cherry, lemon peel, wet hay, leather and barnyard.

The Bruery (Orange County, CA), Brewery Ommegang (Cooperstown, NY) and Boulevard Brewing (Kansas City, MO) all make saisons with *Brett* character.

Any of the commercially available *Brett* strains can work well in a saison. *Brettanomyces bruxellensis* is especially well suited to hoppy saisons since its earthy character makes a wonderful counterpoint to bright fresh hops. *Brettanomyces claussenii* contributes a subtle funky flavor which adds complexity to a saison without obscuring the flavors produced by the primary strain. You can pitch *Brett* at any time, but the earlier you add it, and the more healthy cells you pitch, the quicker you will get a noticeable character. Due to

American Saison RECIPES

Petit Saison

(5 gallons/19 L, all-grain)

OG = 1.036 FG = 1.002
IBU = 30 SRM = 3 ABV = 4.5%

The inspiration for this beer was a play on De Baets' remarks that traditional saisons were low gravity and heavily hopped. When it was still brewed with the Rodenbach strain, De Ranke's XX Bitter was a rough approximation of a traditional saison, but with its cleaner character today you'll have to brew your own for a taste of history. This recipe makes for a refreshing summer beer with the gravity dialed down and aromatics pushed to the fore.

Ingredients

7.5 lbs. (3.4 kg) Pilsner malt
0.50 lbs. (0.23 kg) flaked wheat
6 AAU Sterling hops (60 mins)
(0.75 oz./21 g of 8% alpha acids)
4 AAU Hallertauer hops (10 mins)
(1.0 oz./28 g of 4% alpha acids)
1 oz. (28 g) Hallertauer hops (0 mins)
0.75 oz. (21 g) Sterling hops (0 mins)
1.13 oz. (32 g) Sterling hops (dry hop)
Wyeast 3711 (French Saison) or East Coast Yeast ECY08 (Saison Brasserie) yeast
Wyeast 3763 (Roeselare Blend) yeast and bacteria
5.8 oz. (164 g) table sugar (for priming)

Step by Step

Mash at 145 °F (63 °C) for 90 minutes. Boil for 90 minutes adding hops as indicated. Start fermentation at 70 °F (21 °C) with both the saison yeast and the Roeselare blend, allow to rise into the mid-80s °F (28–29 °C). Rack to secondary when primary fermentation is complete and dry hop for a week. Allow the gravity to stabilize before bottling, aim for 3.0 volumes of carbonation.

Extract Equivalent

Replace the Pilsner malt and flaked wheat with 3.0 lbs. (1.4 kg) of Pilsner dried malt extract, 0.75 lb. (0.34 kg) of wheat dried malt extract, and 0.50 lbs. (0.23 kg) of table sugar.

McKenzie's Saison Vautour clone

(5 gallons/19 L, all-grain)

OG = 1.057 FG = 1.006
IBU = 30 SRM = 4 ABV = 6.7%

Saison Vautour is named for the vultures that ominously circle the brewery on brew days. This is the recipe for McKenzie's Brew House's multi-gold-medal-winning rye saison from head brewer Ryan Michaels. It's a good example of how a very simple recipe can result in a beer of extraordinary complexity. The clean version has a wonderful rustic character from the rye and yeast, while the barrel aged version adds some tartness and funk.

Ingredients

9 lbs. (4.1 kg) Pilsner malt
2 lbs. (0.91 kg) rye malt
0.50 lbs. (0.23 kg) soft blond candi sugar
5.1 AAU Hallertau Tradition hops (60 mins)
(1.3 oz./37 g of 4% alpha acids)
1.5 AAU Hallertau Tradition hops (15 mins)
(0.35 oz./10 g of 4% alpha acids)
1.25 AAU East Kent Goldings hops (15 mins)
(0.25 oz./7.1 g of 5% alpha acids)
1.5 AAU Hallertau Tradition hops (5 mins)
1.25 AAU East Kent Goldings hops (5 mins)
White Labs WLP566 (Belgian Saison II) yeast
4.5 oz. (127 g) table sugar (for priming)

Step by Step

Mash at 145 °F (63 °C) for 60 minutes. Boil for 90 minutes adding hops as indicated. Start fermentation at 60 °F (16 °C) and allow to rise into the mid-80s °F (28–29 °C). When the gravity is stable, bottle with enough priming sugar to reach 2.5 volumes of CO_2.

To mimic the barrel aged version, rack to secondary and add 1 oz. (28 g) of medium toast French oak cubes (boiled to extract excess tannins and to sanitize), along with either a pack of Wyeast Lambic Blend (WY3278) or the dregs from two bottles of your favorite unpasteurized sour beer. Allow the gravity to stabilize before bottling, aiming for 2.5 volumes of carbonation.

Partial Mash Equivalent

Replace the Pilsner malt with 0.50 lbs. (0.23 kg) of table sugar and 4.25 lbs. (1.9 kg) of Pilsner dried malt extract. Mash the rye malt for 45 minutes at 150 °F (66 °C) before adding the extract and sugar.

Dark Winter Saison clone

(5 gallons/19 L, all-grain)

OG = 1.066 FG = 1.004
IBU = 24 SRM = 23 ABV = 8.3%

Saisons are traditionally a warm weather drink, but a few of us have a tradition of getting together each fall to brew a strong, dark, spiced saison. Each year's version has a different dried fruit and dark malt. The blend of spices along with the earthiness of the *Brettanomyces* and buckwheat honey make for an almost savory beer. *Brett C* is a good complement to the Dupont strain because it helps to dry out the beer.

Ingredients

9.5 lbs. (4.3 kg) German Pilsner malt
2 lbs. (0.91 kg) German Munich malt
0.50 lbs. (0.23 kg) flaked oats
6 oz. (0.17 kg) Carafa® Special II malt
6 oz. (0.17 kg) CaraMunich® malt
4 oz. (0.11 kg) Special B malt
0.0088 oz. (0.25 g) anise
0.035 oz. (1.0 g) star anise
0.018 oz. (0.50 g) cinnamon
1 lb. (0.45 kg) dried figs
4 oz. (113 g) buckwheat honey
7.5 AAU Simcoe hops (80 mins)
(0.58 oz./16 g of 13% alpha acids)
White Labs WLP565 (Belgian Saison I) yeast
White Labs WLP645 (*Brettanomyces clausenii*) yeast
4.2 oz. (120 g) table sugar (priming)

Step by Step

Mash at 156 °F (69 °C) for 60 minutes. Boil for 90 minutes adding hops as indicated. With 5 minutes left in the boil add the ground spices. Simmer the figs with some of the wort for 20 minutes and purée, add at flame out along with the honey. Start fermentation at 68 °F (20 °C) and allow to rise into the low-80s °F (27–28 °C). When the gravity is stable, bottle aiming for 2.4 volumes of carbonation.

Extract Equivalent

Replace the Pilsner malt with 4.75 lbs. (2.2 kg) of Pilsner dried malt extract, and the Munich with 1.25 lbs. (0.57 kg) of Munich liquid malt extract. Steep the remaining grains, omitting the oats, for 30 min at 156 °F (69 °C) before adding the malt extract.

hyper-attenuation, be wary of adding *Brett* at bottling unless your beer is already below 1.002.

Blending Strains

White Labs produces WLP568 Saison Ale Yeast Blend, which maintains most of the character of the original Dupont strain while increasing the rate of attenuation. For May-June this year, White Labs is releasing WLP670 American Farmhouse Blend, which contains *Brettanomyces* in addition to saison yeast, but we have not had a chance to try.

East Coast Yeast, a yeast lab recently opened by Al "Bugfarm" Buck, produces two saison blends: Saison Brasserie (ECY08), a blend of several saison strains which works quickly and gives a nice spicy character, but can be a bit banana heavy when young, and Farmhouse Brett (ECY03) which has the same blend of saison yeasts with the addition of a strain of *Brettanomyces* isolated from Fantôme.

"We basically sort out our yeast before pitching and the blend is kind of like 50%, 35%, 14%, 1% (yes, you CAN taste that last yeast in the beer)," said Dann Paquette of Pretty Things.

Fermentation Temperature

Many homebrewers without fermentation temperature control brew saisons in the summer. This approach can be risky because sudden temperature drops can cause the yeast to stall before fermentation is complete, and temperature spikes can result in the production of hot fusel alcohols or even kill the yeast if the temperature rises too high. If using ambient temperatures, try to find a location that has a relatively stable temperature 5–7 °F (3–4 °C) degrees below your target temperature. Placing the fermenter in a large reservoir of water (such as a bucket or cooler) can help to buffer the beer from fluctuations in temperature.

If the temperature is too cold, you can use a heated Brew Belt, place the fermenter in a water bath with an aquarium heater or place the fermenter in an insulated box with a ceramic reptile heater. The easiest way to regulate the temperature with these methods is to attach a temperature controller that has a heating mode.

Wort Production

An elementary recipe with just Pilsner malt and Saaz hops can make a great saison, but many American brewers opt for something more complicated. Saisons were originally refreshing beers brewed for summer consumption on the farm — the original lawnmower beer. However, these days it is rare to see a commercial example with less than 6% ABV. Even if you are aiming for a higher alcohol content be mindful of pushing original gravity too high; with the high degree of attenuation a 1.050 beer can end up at 6.5% ABV.

As a nod to saison's agricultural past, many breweries include both malted and unmalted grains besides malted barley in their beer. Wheat is especially popular, but rye has also gained considerable acclaim in The Bruery's Saison Rue, McKenzie's Saison Vautour and others. Oats, spelt, and buckwheat are all options worth investigating as well. These grains impart telltale grainy flavors and beta glucans that add body without sweetness. Corn or rice can be added to increase the fermentability of the wort. These grains are nice alternatives to adding sugar to the boil because their starches are turned mostly into yeast friendly maltose, and they impart a light flavor of their own.

Malted, flaked or torrified grains can be added directly to the mash. Raw grain on the other hand must be ground to grits and boiled in a generous amount of water (3 qts./lb. or 6 L/kg) before being added to the mash. The boil gelatinizes the starch, making it accessible to the amylase enzymes provided by the malted grain.

Pilsner malt is the most common base malt because of the clean, crisp malt character it provides. If using a large portion of Pilsner malt, you should boil for at least 90 minutes to volatilize as much of the DMS as possible. Vienna or Munich malt is sometimes added for their bready flavor and a golden hue.

Specialty malts are relatively rare, especially caramel/crystal malts which contribute unfermentables. When they are used, even in heartier saisons, they should be kept to a minimum. For dark grains, we favor dehusked malts like Weyermann Carafa® Special and debittered black malt. The dry finish of saisons accentuates any aggressive malt flavors, so excessive amounts of roasted barley or black patent malt can result in a harsh flavor.

A single step infusion mash is usually adequate, but if you are using undermodified base malt, a step mash with a protein rest should be employed. The saccharification rest is usually performed below 150 °F (66 °C), sometimes as low as 142 °F (61 °C) in the case of Jack D'Or, to ensure the requisite high level of attenuation. If you use a low mash temperature, you may need to rest the mash longer than the standard 60 minutes. As insurance, some brewers employ two saccharification rests, one in the low-mid 140s °F (61–63 °C) followed by another in the mid-high 150s °F (68–72 °C) to complete conversion. If you are using a large portion of unmalted grain or a low saccharification temperature, an iodine starch test should be performed.

If you are brewing a high alcohol saison, it is beneficial to get a portion of your fermentables from kettle sugars. The neutral character of table sugar is an economical choice if your only goal is to dry the beer out. More flavorful honey, unrefined sugar, candi syrup and even dried fruit are wonderful choices if you want to impart additional flavors. If you are using malt extract, for a large portion of your gravity we suggest getting a minimum of 10% of the fermentables from sugar.

Hopping

Saisons can be made with a wide variety of hopping strategies from subtle to assertive. Bittering hop additions are generally moderate because the dry finish accentuates bitterness. A small addition of hops late in the boil for aroma is common. Many American brewers are foregoing the traditional European hops in favor of brighter citrusy varieties from America and New Zealand which complement the spicy

qualities of the yeast. Dry hopping is a good choice because it contributes aromatics without increasing bitterness.

Spicing

In some peoples' minds, spicing is synonymous with saison. This just isn't the case; for the most part the spicy flavors you taste are solely from the yeast. When actual spices are used they should be subtle and build character without trampling on the flavors of the yeast. Spices that complement the peppery yeast character especially well are peppercorns (black, white, or pink), grains of paradise and long pepper. Ginger can also add a bit of heat, but be careful when using dried ginger which can easily overpower a beer.

"Spicing has loads of variables, not all spices or herbs, flowers, etc. are equal. They are unique ingredients and you must know what you are working with in order to get them to do what you want. I have done both hot and cold infusions on various herbs and spices, it comes down to what and when," said Brian Strumke of Stillwater Artisanal Ales.

Flowers such as chamomile, honeysuckle, hibiscus, jasmine, chrysanthemum, lavender, marigolds and dandelions add a delicate floral character. For a holiday saison add orange zest, cinnamon, anise or other warming spices. As with dark grains and hops, a low finishing gravity can make spices taste harsh. Experiment with hot and cold extraction teas to gauge the intensity of specific spices before adding them. Alternatively these teas can be added to taste at bottling, giving you control to dial in the flavor contribution you want.

The Mother of Invention

Saison offers itself to personalization and interpretation – give it your own signature. You don't have to stick with what has been done before; these beers are about creativity and brewing something that inspires you. BYO

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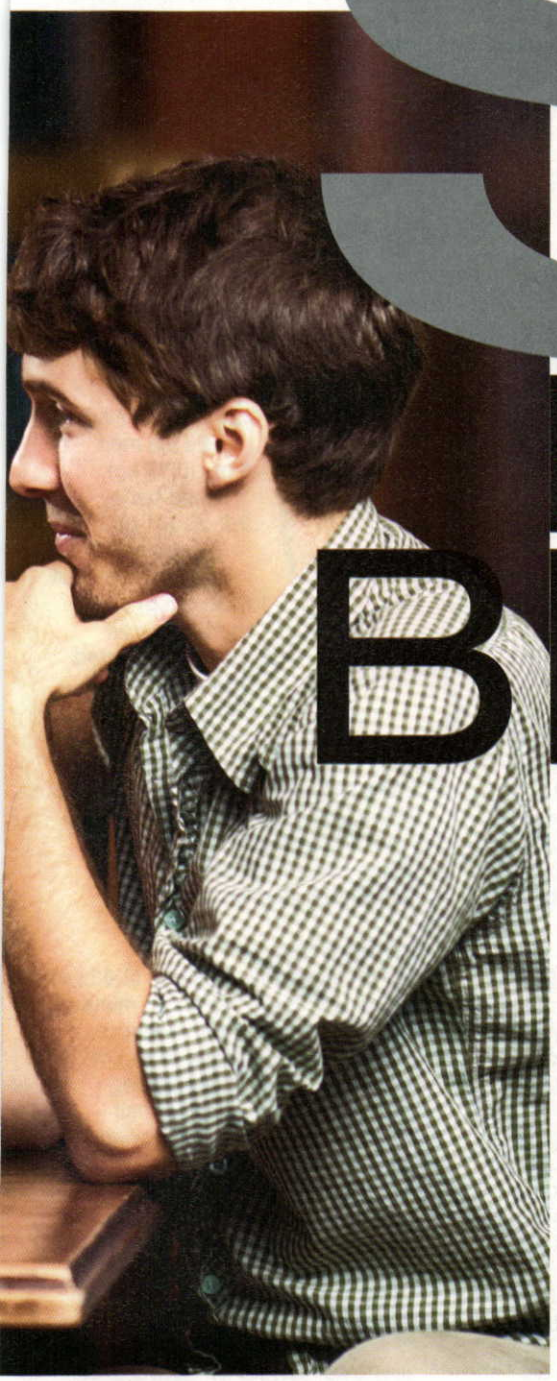
The **MOUSE** That **Roared**



SESSION BEERS

Story by **Gordon Strong**

I've always admired the British pub lifestyle where a group of friends sits around for hours, having lively discussions, maybe playing some darts and generally enjoying each other's company while hoisting a few pints. It's a different experience than the American bar scene, and it seems to have a few unwritten rules. The most important seems to be that pints are bought in rounds, and everyone must buy a round. If you are going to drink that volume, then you had better order something that not only tastes good, but won't incapacitate you. This is where the concept of session beers originates.

But what exactly is a session beer? What's a session? Those are questions without clear answers. I had heard from some Brits that a session was eight pints. Steve Hamburg of Two Bitter Men fame, told me he heard the same thing, but I've never seen anything in writing to confirm that. British beer historian Martyn Cornell has written in his blog that he thinks a session is a minimum of five to six pints, but he bases that on personal





Session Beer Recipes

Original all-grain recipes adjusted to BYO's standard 65% extract efficiency by adjusting the amount of pale malt. Original efficiencies are given. Extract based recipe conversions by BYO.

Gordon Strong's Irish Red Ale

(5 gallons/19 L, all-grain)

OG = 1.041 FG = 1.011
IBU = 16 SRM = 25 ABV = 3.8%

Ingredients

4.5 lbs. (2.0 kg) pale ale malt
2 lbs. (0.91 kg) Vienna malt
1 lb. (0.45 kg) flaked maize
0.75 lb. (0.34 kg) crystal malt (40 °L)
0.25 lb. (0.11 kg) roast barley
0.25 lb. (0.11 kg) Carapils® malt
4.1 AAU East Kent Goldings whole hops (60 mins) (0.75 oz./21 g of 5.5 % alpha acids)
0.25 oz. (7.1 g) East Kent Goldings (EKG) whole hops (10 mins)
White Labs WLP004 (Irish Ale) yeast

Step by Step

Mash at 151 °F (66 °C) using RO water treated with 1 tsp. $CaCl_2$. Use a relatively thin mash. Use no sparge technique, drain mash tun and top off boil kettle with RO water to reach 7.0 gallons (26 L).

Boil hard for 90 minutes. Ferment at 68 °F (20 °C). (Original extract efficiency 60%.)

Dan George's English Dark Mild

(5 gallons/19 L, all-grain)

OG = 1.035 FG = 1.016
IBU = 13 SRM = 32 ABV = 2.5%

Ingredients

5 lb. 14 oz. (2.6 kg) Maris Otter malt
6.0 oz. (0.17 kg) chocolate malt
1.0 lb. (0.45 kg) crystal malt (75 °L)
1.0 oz. (28 g) Carafa® II malt
2.8 AAU EKG whole hops (90 mins) (0.5 oz./14 g of 5.5% alpha acids)
1.4 AAU EKG whole hops (15 mins) (0.25 oz./7 g of 5.5% alpha acids)
White Labs WLP002 (English Ale) yeast

Step by Step

Mash at 154 °F (68 °C) using RO water treated with ½ tsp. gypsum in the mash, and ½ tsp. gypsum in the sparge water. Boil 90 minutes. Ferment at 68 °F (20 °C). (Original extract efficiency 56%.)

Dan George's English Dark Mild

(5 gallons/19 L, extract with grains)

OG = 1.035 FG = 1.016
IBU = 13 SRM = 32 ABV = 2.5%

Ingredients

9 oz. (0.25 kg) Maris Otter malt
6 oz. (0.17 kg) chocolate malt
1 lb. (0.45 kg) crystal malt (75 °L)
1 oz. (28 g) Carafa® II malt
2 lb. 14 oz. (1.3 kg) Muntons Light dried malt extract
2.8 AAU EKG whole hops (90 mins) (0.50 oz./14 g of 5.5% alpha acids)
1.4 AAU EKG whole hops (15 mins) (0.25 oz./7.1 g of 5.5% alpha acids)
White Labs WLP002 (English Ale) or Wyeast 1968 (London ESB) yeast

Step by Step

Steep crushed grains in 3.0 qts. (2.8 L) of water at 154 °F (68 °C) for 45 minutes. Combine "grain tea" with water to make at least 2.5 gallons (9.5 L) of wort. Boil for 90 minutes, adding roughly 1 lb. (0.45 kg) dried malt extract at the beginning of the boil and the rest with 15 minutes left in the boil. Chill wort and transfer to fermenter. Top up to 5 gallons (19 L), aerate and pitch yeast. Ferment at 68 °F (20 °C).

Jay Wince's Scottish 60/-

(5 gallons/19 L, all-grain)

OG = 1.034 FG = 1.012
IBU = 11 SRM = 19 ABV = 2.9%

Ingredients

6 lbs. (2.7 kg) pale ale malt
6 oz. (0.17 kg) flaked barley
3.2 oz. (91 g) Caramunich® 120 or Special B malt
1.6 oz. (45 g) pale chocolate malt
1.6 oz. (45 g) roasted barley
2.7 AAU Fuggles whole hops (75 mins) (0.6 oz./17 g of 4.5 % alpha acids)
Wyeast 1728 (Scottish Ale) or Wyeast 1318 (London Ale III) yeast

Step by Step

Mash thickly at approximately 1.5 quarts per lb. (3.1 L/kg) at 153 °F (67 °C) for 60 minutes. 75 minute boil. Ferment at 62 °F (17 °C). (Original extract efficiency 75%.)

Jay Wince's Scottish 60/-

(5 gallons/19 L, extract with grains)

OG = 1.034 FG = 1.012
IBU = 11 SRM = 19 ABV = 2.9%

Ingredients

1.25 lbs. (0.57 kg) pale ale malt
6 oz. (0.17 kg) flaked barley
3.2 oz. (91 g) Caramunich® 120 or Special B malt
1.6 oz. (45 g) pale chocolate malt
1.6 oz. (45 g) roasted barley
2.75 lbs. (1.25 kg) Briess Light dried malt extract
2.7 AAU Fuggles whole hops (75 mins) (0.6 oz./17 g of 4.5 % alpha acids)
Wyeast 1728 (Scottish Ale) or White Labs WLP028 (Edinburgh Scotish Ale) yeast

Step by Step

Steep crushed grain in 3 qts. (2.8 L) of water at 153 °F (67 °C) for 45 minutes. Combine "grain tea" with water to make at least 2.5 gallons (9.5 L) of wort. Boil for 75 minutes, adding roughly 1 lb. (0.45 kg) dried malt extract at the beginning of boil and the rest with 15 minutes left in the boil. Chill wort and transfer to fermenter. Top up to 5 gallons (19 L), aerate and pitch yeast. Ferment at 62 °F (17 °C).

Jeff Lewis' Best Bitter

(5 gallons/19 L, all-grain)

OG = 1.044 FG = 1.010
IBU = 32 SRM = 17 ABV = 4.5%

Ingredients

7.25 lbs. (3.3 kg) Maris Otter malt
12 oz. (0.34 kg) crystal malt (60 °L)
9 oz. (0.26 kg) Carapils® malt
8 oz. (0.23 kg) wheat malt
1 oz. (28 g) roasted barley
5.7 AAU EKG whole hops (60 mins) (1.2 oz./34 g of 4.75% alpha acids)

4.3 AAU EKG whole hops (20 mins) (0.9 oz./26 g of 4.75% alpha acids)
2.1 oz. (60 g) EKG whole hops (1 min)
Wyeast 1099 (Whitbread Ale) yeast

Step by Step
Dough-in with 1.33 quarts per pound of water (2.8 L/kg). Step mash using rests at 122 °F (50 °C) for 15 minutes, 154 °F (68 °C) for 60 minutes and 170 °F (77 °C) for 15 minutes. Boil for 90 minutes. Ferment at 65 °F (18 °C). (Original extract efficiency 70%.)

Jeff Lewis' Best Bitter
(5 gallons/19 L, extract with grains)
OG = 1.044 FG = 1.010
IBU = 32 SRM = 17 ABV = 4.5%

Ingredients
2 oz. (57 g) Maris Otter malt
12 oz. (0.34 kg) crystal malt (60 °L)
9 oz. (0.26 kg) Carapils® malt
8 oz. (0.23 kg) wheat malt
1 oz. (28 g) roasted barley
3 lb. 14 oz. (1.8 kg) Muntons Light dried malt extract
5.7 AAU EKG whole hops (60 mins) (1.2 oz./34 g of 4.75% alpha acids)
4.3 AAU EKG whole hops (20 mins) (0.9 oz./26 g of 4.75% alpha acids)
2.1 oz. (60 g) EKG whole hops (1 min)
Wyeast 1099 (Whitbread) yeast

Step by Step
Steep crushed grain in 3 qts. (2.8 L) of water starting at at 122 °F (50 °C) for 15 minutes, heat to 154 °F (68 °C), stirring frequently, and rest for an additional 30 minutes. Combine "grain tea" with water to make at least 2.5 gallons (9.5 L) of wort. Boil for 90 minutes, adding roughly 1.5 lb. (0.68 kg) dried malt extract at the beginning of boil and the rest with 15 minutes left in the boil. Chill wort and transfer to fermenter. Top up to 5 gallons (19 L), aerate and pitch yeast. Ferment at 65 °F (18 °C).

Frank Barickman's Hop ObSession
(5 gallons/19 L, all-grain)
OG = 1.034 FG = 1.010
IBU = 57 SRM = 4 ABV = 3.2%

Ingredients
5.5 lbs. (2.5 kg) Weyermann Pilsner malt
15 oz. (0.41 kg) Weyermann malted wheat
7.3 oz. (0.21 kg) Weyermann Munich II malt
10 AAU German Hallertauer Hersbrucker hops (60 min) (2.0 oz./57 g of 5% alpha acids)
15 AAU German Hallertauer Hersbrucker hops (15 min) (3.0 oz./85 g of 5% alpha acids)
4 oz. (113 g) German Tettnanger hops (0 min)
Wyeast 2112 (California Lager) yeast

Step by Step
Mash at 152 °F (67 °C) for 60 minutes. Raise to 165 °F (74 °C) for 10 minutes. Batch or fly sparge and collect 7 gallons (26 L) for boil. Boil for 75 minutes. At flameout, let the hops steep for 30 minutes before chilling. Collect 5.5 gallons (21 L) to the fermenter. Ferment at 65 °F (18 °C) for about 7 days. Rack into keg or secondary and cold condition for 7 days. Carbonate to 2.5 volumes. (Original extract efficiency 80%; recipe converted from 5.5 gallons to 5 gallons.)

Extract with grains option:
Replace the all-grain grain bill with 0.50 lbs. (0.23 kg) Weyermann Pilsner malt, 1 lb. (0.45 kg) Weyermann malted wheat, 0.50 lb. (0.23 kg) Weyermann Munich II malt and 2.75 lbs. (1.25 kg) Coopers Light dried malt extract.

Steep crushed grain in 3 qts. (2.8 L) of water at 152 °F (67 °C) for 45 minutes. Combine "grain tea" with water to make at least 3 gallons (11 L) of wort in your brewpot. Boil wort for 60 minutes, adding roughly 1.5 lb. (0.68 kg) dried malt extract at the beginning of boil and the rest with 15 minutes left in the boil.

Chill wort and transfer to fermenter. Top up to 5 gallons (19 L), aerate and pitch yeast. (White Labs WLP810 (San Francisco Lager) yeast could be substituted for Wyeast 2112 (California Lager) yeast.) Ferment beer at 65 °F (18 °C).

experience, not anything written. So a session beer is most likely the kind of beer you can drink all evening while socializing with friends without getting seriously inebriated.

Advice from Experienced Session Homebrewers

I'm fortunate that the SODZ homebrew club in Columbus, Ohio runs a British Beer Festival every year. So I was able to discuss session beers with some very senior judges and award-winning homebrewers who specialize in these types of beers. The recipes or comments are from Frank Barickman and Roxanne Westendorf, two Beer Judge Certification Program (BJCP) Master judges and excellent brewers; Dan George and Jeff Lewis, two National Homebrew Conference (NHC)-medalling brewers; and Jay Wince, an award-winning homebrewer who is now the brewmaster at Weaselboy Brewing Company in Zanesville, Ohio.

Session beer isn't a beer style, per se, it's more of a grouping of beers that have similar drinkability characteristics. All of the brewers I spoke with mentioned drinkability, flavor and restrained alcohol content. Barickman said in jest that it's "an easy drinking beer, something you'd actually drink without getting angry" and then stressed that it should have "drinkability, flavor, a non-watery profile, while not being boring; it should hold your interest." Westendorf said that it "can come from any country, not just the historical English beers, as long as they aren't palate-fatiguing." She said "hops, spices, oak, malt, etc., can all eventually fatigue your palate." This might argue against including Berliner Weisse as a session beer due to the high acidity. She thought that session beers also generally paired really well with a wide range of food.

Dan George said that the flavor profile should be such that "you don't recognize you're drinking a session beer" and called it "walking a knife edge" in getting a lower-gravity beer to have high flavor. Jeff Lewis, known to his friends as 60 (for 60/-, or his love of making session beers) thinks that the

Calculating Calories

It's no secret that beer can be as calorie-dense as it is delicious and satisfying. But figuring out how many calories are in a typical homebrew is a bit of a murky area. Currently, there is no inexpensive way to perform a quantitative assessment of any given batch of homebrew; the process is complicated and requires lab equipment and lots of chemistry know-how.

The process of determining calories used to involve literally burning the food or beverage to be tested and measuring how much heat was generated. After all, a calorie is simply a measure of heat. Specifically, 1 calorie is the amount of heat (or energy) that is required to raise 1 gram of water at 1 atmosphere of pressure by 1 °C, which turns out to be 4.18 Joules. In foods, the word "calorie" actually refers to a kilocalorie, or 1,000 calories (or 4,180 Joules).

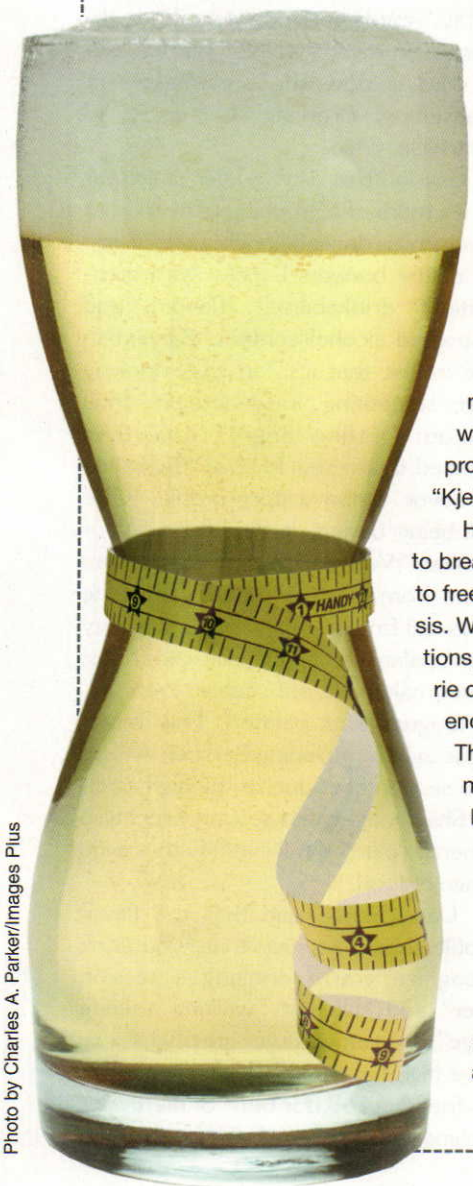


Photo by Charles A. Parker/Images Plus

The current process for testing food for caloric content is a bit more complex than simply burning it. Now, labs will break down the food to determine the composition in terms of fats, proteins, carbohydrates, etc., and then use established conversion multiplier formulas to arrive at a nutritional analysis. If you want to read up on this process, Google the term "Kjeldahl analysis."

However, there's no need to break out the liquid nitrogen to freeze your beer for analysis. With a few simple calculations, you can arrive at a calorie count that is close enough for hobby purposes. The following formulas make lots of assumptions, but the simplicity of it is a fair trade for a quick, ballpark answer.

Calories from beer come from two main sources — ethyl alcohol and residual sugars. So you need to account for both in the calorie calculation (this is where the assumptions mentioned earlier come in, in the form of constants). If you know your original gravity and final gravity, you can approximate the calories per 12 ounces of your beer, and then use that information to estimate the carbohydrate content.

Let's assume an example homebrewed beer with an original gravity (OG) of 1.050 and a final gravity (FG) of 1.010. (Note: as always, be sure to follow the rules of order of operations for algebraic equations, to insure accurate results.)

First, you calculate calories from alcohol with the following equation:

$Cal_{OH} = (FG \times 1881.22) \times ((OG - FG) / (1.775 - OG))$

That would be (1.010 x 1881.22) X ((1.050 – 1.010) / (1.775 - 1.050)), which gives us 1900 X (0.04 / 0.725), and that simplifies to 104.8 calories from the alcohol in the beer.

Then calculate calories from sugars with the following equation:

$Cal_{sugar} =$
$(FG \times 3550) \times (0.1808 \times OG + ((0.8192 \times FG) - 1.0004))$

That would be (1.010 X 3550) X (0.1808 X 1.050 + ((0.8192 X 1.010) - 1.0004)) which gives us 3585 X (0.190 + (-0.173)) and that simplifies to 60.9 calories from sugars.

Now just add the two calorie counts together to get 165.7 calories per 12 ounces of beer.

You can also get an approximation of the carbohydrate content by dividing the calories from sugars by 4 to get grams of carbohydrates per 12 ounces. In our example, that would be 60.9 / 4, or about 15 grams of carbs per serving.

As I mentioned, these calculations are based on certain assumptions and only provide an estimate of the number of calories in your homebrew. However, this estimate should be sufficiently close for homebrewers who are counting calories in their diet.

Most homebrewing software will do these calculations for you as part of the recipe formulation process. But you may want to run through the exercise yourself. There are also a few online calculators that will do these calculations using essentially the same equations outlined above. I actually wrote a simple application for Mac OS X, called Al-Cal-Culator, that performs these calculations as well. It is available at http://sourceforge.net/projects/al-cal-culator/

— Forrest Whitesides

best session beers are "well attenuated, with a drier finish; not cloying so you can easily have more than one and be ready for more." I would certainly agree that avoiding a sweet finish (like you might have in a London Brown Ale) aids in drinkability, which is why that style might not make the best session beer even though it is low alcohol. Jay Wince has an interesting perspective, as one who must now sell beers to the public. He thought a session beer was "any beer you can drink more than three of," which is fairly similar to Martyn Cornell's definition. A typical US bar drinker might have two or three pints of average brewpub beer before calling it quits, so this is a reasonable guideline. Wince thought the beer should be "4.5% ABV max, generally less, but with a nice, full flavor." He thought that many perceive session beers as being a distinctly UK creation, that in practice they can come from anywhere. Certainly Americans think it can be anything. He mentioned American Blonde Ale as a craft beer style that often has session characteristics, but that German wheat beers and Kölsch can have similar characteristics, if brewed on the light side of their range.

Both Barickman and Westendorf mentioned Belgian styles that have session-like characteristics. Frank provided an interesting recipe that doesn't neatly fit any BJCP style. He describes it as a lower-gravity Kölsch, highly hopped with noble hops, and having some of the feel of a Belgian single. He said he's tired of "imperial-everything" and asked, "Why can't we have 'session-everything' as well?" Dan George offered his dark mild recipe, which has won two NHC medals, and joked that he would likely call it "just a brown ale" if he wanted people to drink it. I think the British public has a similar aversion to calling things "mild" if you can go by the brands that are offered for sale.

Lewis thought that dry stout was a great beer that fit the category, although said many people would incorrectly think it was too strong. He would also like to see more American styles made this way, saying that the "more is better" trend is getting tired.

> "I like making double-size batches so I can have a control and an experimental batch; try different yeasts, add interesting sugars, dry hop one, you name it."

He offered a best bitter recipe, but said that it could be easily scaled down to 1.036–1.038 to make a nice Ordinary Bitter. He credits Randy Mosher's *Radical Brewing* for inspiration. Jay Wince provided a Scottish ale recipe, and also said it could be easily scaled to any gravity by keeping the grist percentages the same while maintaining the BU:GU ratio.

For my contribution, I picked an Irish red ale that won several competitions. I could have picked a pale mild, a brown porter, a dry stout, or a Newcastle-style brown ale, but wanted to pick a style that was different than the others being offered. If you are interested in a brown porter, look at something like the commercial Polygamy Porter from Utah, that packs big flavor into a 4% ABV package. Many average strength beers can easily be adjusted downward in gravity to make something more appropriate for drinking in quantity. Keeping the carbonation on the lower range in the English style should enhance drinkability, although most Belgians should have higher carbonation to be accurate.

Brewing Challenges

Brewing session beers offers some interesting challenges, but also gives you some opportunities.

Since the volume of grain is smaller, you have a smaller grain bed than is typical. If you think this might present a problem with forming an adequate filter for lautering or if maintaining temperatures is more difficult, you can always mash in a smaller container, try no-sparge brewing, or make a double-sized batch. Mashing in a smaller container is self-explanatory, but no-sparge brewing takes a little explanation. In no-sparge brewing, you increase the amount of grain in your recipe by 33-40%, but then don't sparge. You drain the mash tun and top off the boil kettle with water to make up your starting volume. Your efficiency suffers, but your malt flavors will be richer. It's sort of like only doing the first half of batch sparging. Frequently, thin mashes are used with no-sparge brewing, so less water is required to top up the wort to reach the full pre-boil volume.

I like making double-size batches so I can have a control and an experimental batch; try different yeasts, add interesting sugars, dry hop one, you name it.

In a low-gravity beer, it can sometimes be difficult to prevent it from tasting watery. To counteract this perception, try taking steps to reinforce the flavor and mouthfeel dimensions of the beer. You might use a higher percentage of specialty grains than in a standard-strength beer. Crystal-type malts can add sweetness, flavor and some body. Using continental Munich and Vienna malts for part of the grist can reinforce malty flavors. Mashing a little higher or adding dextrin-rich grains or malts (e.g., Carapils®, flaked wheat or barley) can give your beer a fuller mouthfeel.

When I travel to the UK, I'm always impressed with the flavor of their session beers. They seem to have

more fruity flavors than many American versions. Choosing yeast strains or manipulating fermentation temperatures and conditions to favor ester development can add another layer of interest to your beer (assuming it fits the style).

Increasing the hop flavor can also provide an interest point. You can add a flavor addition at 10–15 minutes left in the boil, or use one of my favorite tricks, first-wort hopping. If you use fresh hops during the initial runoff into the boil kettle, I find that this gives a smooth bitterness and a very strong but clean hop flavor. The IBUs are as much as a full boil, but they often taste like a lower amount since the bitterness is so clean. Using all late hops and skipping boiling hops can also provide a punch of hop flavor and aroma while avoiding harshness.

Increasing the interest of the flavor profile will keep the drinker's interest without having to clobber him over the head with alcohol.

Grain to Glass Time

Another benefit of brewing session beers is that they can ferment and condition quickly. If getting some beer ready for an event is a priority, brewing a session beer can be just the thing. With some attention to detail, you can be drinking your beer in as little as one week after your brew day.

If an ale with an OG less than 1.040 is pitched at an adequate rate, and the wort is thoroughly aerated, fermentation may only take two or three days, depending on the yeast strain. If the beer is transferred promptly after fermentation has definitey stopped (take specific gravity readings to be sure), and the beer is conditioned (see below), it can be force carbonated and served after a day or two of letting the CO_2 "sink in."

Rushing the beer from the fermenter to the keg can, however, leave the yeast insufficient time to cleanup any residual diacetyl. This is especially true when using many English ale strains. Once fermentation has completely stopped, sample the beer to determine if you can detect diacetyl. If you can, leave the beer in the fermenter (on the yeast) for another day and then resample.

One Final Round

You should know that you're successful if you have a beer that is easy drinking, not filling and not palate fatiguing. It should be a sociable pint that goes as well with food as it does with conversation. The beer should have enough flavor to hold your interest, but not be so aggressive as to demand your attention. Keeping the beer well attenuated, while not having it too heavy, cloying, acidic, or bitter, will enhance drinkability. Remember to make no compromises on flavor, and that you should always want to take another drink. BYO

Gordon Strong is the author of "Brewing Better Beer" (2011, Brewers Publications).

Diacetyl

The elephant in the room

by Terry Foster

Diacetyl has a pretty bad rap as a constituent of beer. Its butterscotch flavor is generally regarded as a fault. It is true that many people find its taste objectionable, and that it can be detected in relatively small concentrations, but I think it only fair to point out that some of the objections against diacetyl reflect indoctrination rather than judgement. This is because most of the research involving testing of diacetyl's effects was done using high-production pale yellow lagers as a base. As a matter of fact, beers with high non-malt adjunct levels tend to have high diacetyl levels. One study showed that increasing adjunct levels from 20% to 40% doubled the diacetyl concentration in the beer. Further, in such beers, which are not meant to have much in the way of flavor, that butterscotch flavor does stand out and spoil the brewer's designs for the beer's palate.

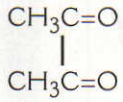
A result of this is that beer aficionados often look specifically for diacetyl when they taste a brew rather than looking at its overall palate. Not surprisingly, some of them find diacetyl even when it isn't present. Some tasters also forget that diacetyl flavor is not necessarily objectionable to all drinkers, and that that dreaded butterscotch flavor can actually add to — and help to round off — the palate of more complex beers. I remember my first taste of Samuel Smith's Bitter when I lived in Yorkshire in England back in the 1970s. It had a flavor quite distinct from most other bitter ales, one which I enjoyed and later found out was due to the presence of diacetyl, which was not removed during fermentation in Yorkshire Stone Square vessels. Perhaps you don't believe me? Well let me refer you to the December 2010 issue of *BYO* in the "Tips from the Pros." John Lyda, Brewmaster and VP at Highland Brewing Company in Asheville, North Carolina discussed Cold Mountain Winter Ale and said, "We also intentionally leave in some diacetyl to help with the overall roundness of the beer."

Well, now that my little rant is over, let's get down to more practical things. Some people do not like diacetyl in beer, and it does have a very low taste threshold. A quick check of the literature reveals this with two very well-respected brewing texts quoting a) 0.1 –0.14 µg/mL and b) 0.5 µg/mL, both for lager beers. Translating to more sensible numbers, the higher figure represents 0.5 mg/L or 0.5 ppm.

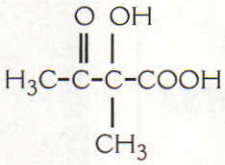
Whatever unit you use, it is a small concentration, so ensuring that your beer does not contain too much of it can be a little tricky. But, what is it and how does it get into your beer?

A little light chemistry

Diacetyl, perhaps more properly called 2, 3-butanedione, is a vicinal diketone, which means it has two carbonyl groups situated on adjacent carbon atoms:



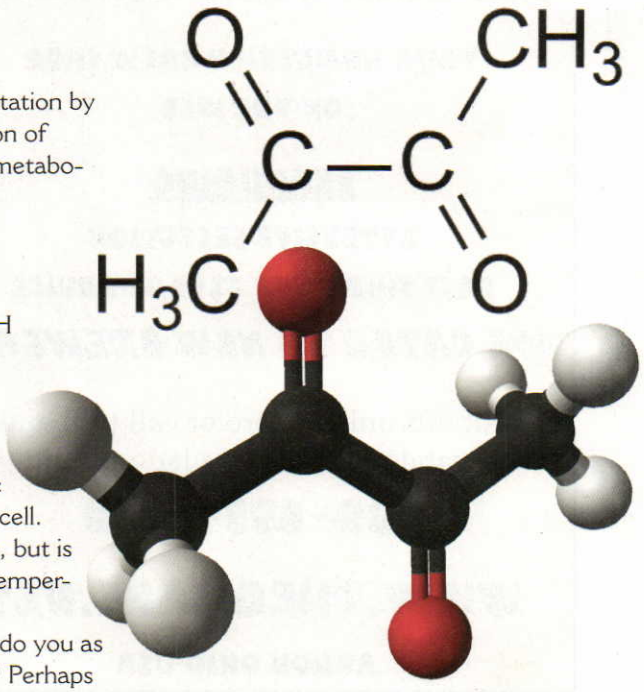
It is produced during fermentation by decarboxylation and oxidation of alpha-acetolactate (a yeast metabolite):



This is a chemical reaction (as opposed to an enzymatic one) and occurs outside the cell. It's a relatively slow reaction, but is accelerated both by higher temperatures and by lower pH.

All very interesting, but do you as a brewer need to know this? Perhaps

> "Beer aficionados often look specifically for diacetyl when they taste a brew rather than looking at its overall palate."



not, but it indicates two things, firstly that diacetyl can be removed by a reduction reaction (yielding 2,3-butanediol, which is neutral in beer flavor terms). Secondly, it may not be enough just to remove the diacetyl if its precursor, α-acetolactate is still present in significant concentration as it may later be converted to diacetyl. In short, you need to reduce both of these fermentation metabolites. Of course, the simplest thing to do would be to prevent the formation of α-acetolactate in the first place, wouldn't it? Well unfortunately that does not appear to be an option, for as yeast goes about its merry way converting carbohydrates to things that we like, such as alcohol and carbon dioxide, it insists on producing these two compounds that we don't want!

Away with it!

So how do we remove diacetyl and α-acetolactate? Well, we don't — the yeast does. Our friendly fungus, bless its little cotton socks, having put these nasties there in the first place can remove them later on. As fermentation comes towards its end, the yeast can absorb diacetyl into the cell and there reduce it enzymatically to 2,3-butanediol. If the green beer is held under the right conditions both diacetyl and its precursor can be removed by the yeast. Those conditions are simple enough, for the beer needs to be held at a reasonably high temperature in the presence of active yeast. Reasonably high temperature means around 65–70 °F (18–21 °C), which is enough to ensure full conversion of α-acetolactate to diacetyl, and with enough yeast present to reduce the diacetyl. You can't expect much in the way of diacetyl level reduction during secondary fermentation, because you have racked the beer off of most of the yeast. For practical purposes this "diacetyl rest" is best done in the primary fermenting vessel.

It should be obvious from this where the problem with diacetyl in lager arises. Primary fermentation at, say, 40–45 °F (4.5–7.2 °C), followed directly by lagering will probably remove little of the α-acetolactate and diacetyl formed earlier. This is likely to result in diacetyl levels well above the taste threshold when the beer is drunk. And that is why most (if not all) commercial lager brewers take the green beer through a diacetyl rest by taking it up to a warmer temperature after the primary stage.

It should also be obvious that there is less likely to be a diacetyl problem in ale brewing because of the higher temperatures used in the primary stage — providing you allow the beer to "sit" on the yeast once the vigorous stage of primary fermentation has ceased. But if you rack the beer right after this, there may not be enough active yeast present in the secondary to remove all the diacetyl. With most yeast strains this is unlikely to occur, but it can happen if your strain is highly flocculent. And of course this is a good

argument for never rushing things — give the beer a little time in the primary and secondary stages. If you use a good strain and a sufficient quantity of active starter your ale may have reached finishing gravity after only two or three days. Don't be fooled by that into thinking that you can then rack it directly into your keg using isinglass or gelatin finings to ensure clarity. Unless of course you are one of those drinkers who loves the taste of diacetyl! If the latter is the case, think about using a yeast noted for diacetyl production, such as the Ringwood strain.

Recap

So let's go over the procedure to ensure a low level of diacetyl in detail. I am assuming that you are not trying to control diacetyl to a specific concentration as they do at Highland Brewing, which is very difficult without sophisticated analytical techniques, or without a very good knowledge of what to expect from the yeast strain you are using. I should also point out that Jamil Zainasheff discussed this on p. 22 in his "Style Profile" column on German Pilsner in the December 2010 issue of *BYO*. I have no problem in going over this again, as control of diacetyl levels is of concern to many people and the procedure is not always well understood.

Lager brewing is the area of most concern. Carry out the primary at your chosen temperature, say 40–50 °F (4–10 °C), then bring the beer temperature up to 65 °F (18 °C). Hold it there for two or three days then cool gradually to the desired lagering temperature. Ideally you want to start the diacetyl rest slightly before reaching finishing gravity so that there is still active yeast suspended in the beer. In practice this is difficult to determine, and you need to look for a slowing in vigorous fermentation to start the rest. Look for when the yeast head has collapsed back into the beer and relatively few gas bubbles are coming to the surface, but before the beer shows visible signs of clearing. Ale brewing is much simpler. All you need to do is to maintain the beer at primary fermentation temperature (65–70 °F, 18–21 °C) for two to three days after the vigorous stage has ceased (this should take three to five days with a good, vigorous yeast starter). Do not be in a hurry to rack the beer to the secondary, although diacetyl levels can still be lowered in the secondary, depending upon how much of the yeast is carried over.

But wait, there's more!

The above deals with diacetyl produced by yeast, but that may not be the only cause of its presence in beer. For it can be produced by certain bacteria, notably *Pediococcus*, and to a much lesser extent *Lactobacilli*. This can take place in the finished beer, after fermentation and after most or all of the yeast has been removed. *Pediococcus* is capable of tak-

> "There is nothing you can do to prevent diacetyl formation if the bacteria are present."

ing diacetyl levels up to 3ppm, well above the taste threshold for this chemical. There is nothing you can do to prevent diacetyl formation if the bacteria are present.
Like many beer-spoilage bacteria, the reaction would be expected to occur only slowly. That is because there are usually only very low levels of *Pediococcus* bacteria in the beer after fermentation and it takes some time for them to grow to high enough levels to do any damage. However, I know one example where it happened quite rapidly. My fellow brewers and I were taking a cask of pale ale from Brü Rm@BAR (in New Haven, Connecticut) to a local festival, and carefully racked off the beer from its serving tank (that is after filtration) into the cask. We checked it out as we did so, and found it clean with no signs of any contamination. The next day it was set up at the festival and connected to a hand pump for serving. We tasted it again, only to find it was loaded with diacetyl!

What had happened was obvious after the fact. We had been in somewhat of a hurry and had not checked out the hand pump, which had been sitting around on a back shelf for some time. Clearly it had developed a significant amount of *Pediococcus*, enough to raise the diacetyl level of the beer almost on contact. What was worse was that we had no way of cleaning the pump, and no time to do it before the festival opened. Luckily, it turned out that after drawing off more of the beer it became clear of diacetyl and we were saved — at the expense of throwing away a few pints of beer and of enduring some unexpected stress. But it was a lesson to us, and shows that even self-proclaimed experts can make elementary mistakes!

You cannot normally cure a beer infected in this way; prevention of infection is the only answer. A brewer is first and foremost a cleaner, and if you scrupulously adhere to hygiene in the brewery, you should avoid this problem. Note that the most likely place for such an infection to occur is in serving lines used in dispensing the beer from a keg. Do not leave picnic or other taps full of beer connected to the keg. Remove and clean them frequently and thoroughly and you should have no problem with this particular source of diacetyl. BYO

Terry Foster is a frequent contributor to Brew Your Own *and writes "Techniques" in every issue.*

Immersion Chiller

Variables affecting the rate of cooling

by Chris Bible

Wort cooling is a critical step in the homebrewing process. The primary reason for cooling the wort is to bring the wort temperature down to an optimal fermentation temperature as quickly as possible in order to minimize the time during which the wort is susceptible to contamination by bacteria or wild yeast. An additional benefit is that rapid cooling minimizes the chance of forming compounds that could later form dimethyl sulfide, or DMS.

There are several ways that a homebrewer can rapidly cool boiling wort. The use of an immersion wort chiller is one common method. An immersion wort chiller typically consists of 20–50 feet (6.1–15 m) of coiled, ⅜–½-inch (0.95–1.3 cm) copper tubing with appropriate fittings on either end to allow cooling water to flow into and out of the coil. The coil is typically placed into the boiling wort several minutes prior to the completion of the boil in order to sterilize it. Upon completion of the boil, the heat source is extinguished and the cooling water is allowed to flow through the coil. The heat from the wort is removed by transferring the heat from the wort to the cooling water.

Typical immersion chillers can remove heat from the wort at a rate such that the wort is brought down from boiling temperature to yeast-pitching temperature (65–70 °F/ 18–21 °C) within 5–15 minutes. The rate at which an immersion chiller removes heat from the wort is dependent upon several things, including the surface area of the immersion chiller, the temperature of the cooling water and wort, the rate of flow through the immersion chiller, the degree of movement of the wort near the immersed coil and the "overall heat transfer coefficient" of the chiller.

Increasing the surface area of the immersed chiller increases wort cooling rates. Having more cold surface area cools the wort more quickly by allowing more hot wort to contact cold surface area per unit time. More surface area equals faster cooling.

The larger the difference between the cooling water temperature and the wort temperature, the faster the wort will be cooled. The rate at which cooling water flows through the coil is related to this in that the faster the cooling water flows through the coil, the lower the average temperature of the cooling water within the coil will be. At higher cooling water flow rates, the water has less time to heat up as it travels trough the coil, so it doesn't get as hot compared to if it were moving more slowly through the coil. A colder coil and hotter wort (in other words, a larger temperature difference) equals faster cooling.

The amount of agitation of the wort around the coil is also very important to the observed heat transfer rates. If the immersion coil is simply allowed to sit in the boiling kettle with no agitation of the hot wort, it will take much longer to cool the wort. The reason for this is that the wort nearest the coil will be cooled quickly, but will only be moved away from the coil by convective forces within the system. Convective movement is a relatively slow process. This means that, without agitation, wort in very close proximity to the coil will have a relatively cool temperature in comparison to the remainder of the wort. If the temperature of the wort nearest to the coil is relatively close to the temperature of the coil, very little heat transfer will occur. Of course, the homebrewer must not agitate the wort too much when it is at its hottest. Too much agitation could potentially contribute to hot side aeration and oxidation of the wort. An easy, gentle movement of wort is all that is required. Good agitation equals faster cooling.

The "overall heat transfer coefficient" of the chiller is a number that

> "An immersion wort chiller typically consists of 20–50 feet (6.1–15 m) of coiled, ⅜–½-inch (0.95–1.3 cm) copper tubing . . ."

Photo by Les Jörgensen

quantifies the rate at which heat will be transferred from the wort and into the cooling water for a specified chiller geometry, wort temperature and cooling water temperature. This number is an empirically determined number that varies from system to system. Perry's Chemical Engineer's Handbook states that for a system with forced convection and with hot-side/cold-side medium consisting of watery solution/water respectively, the overall heat transfer coefficient of the system will be between 195 – 245 BTU/hr·ft^2·°F. All of the above discussion can be summed up using some relatively simple equations. The equation that describes the rate at which heat is removed from the wort by an immersion chiller is:

$Q_1=UA\Delta T$

Where:
Q_1 = heat removal rate, BTU/hr
U = Overall heat transfer coefficient, BTU/hr·ft^2·°F
A = Surface area of immersed coil, ft^2
ΔT = Average temperature difference between wort and cooling water during heat transfer process.

The equation that describes the total amount of heat that must be removed form the wort in order to bring its temperature down to optimal fermentation temperatures is:

$Q_2=mCp\Delta T$

Where:
Q_2 = total heat removal, BTU
m = mass of wort, lbs.
Cp = Heat capacity (or specific heat) of wort, usually close to 1.0 BTU/lb-°F
ΔT = Temperature change of wort

Here is an example to illustrate how these equations can be used to predict the amount of time it will take to chill your wort. The assumptions behind the model are:

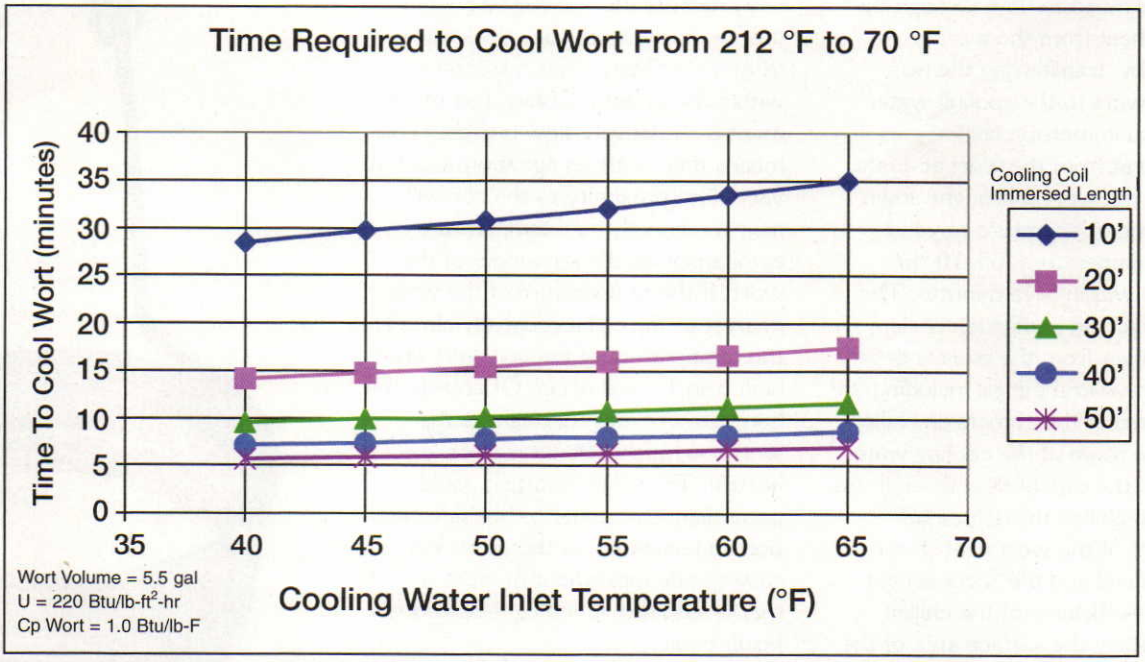
1. Immersion chiller is comprised of a 50-foot cooling coil that is ⅜-inch outside diameter and has 46 feet of coil immersed in the wort
2. Amount of wort to be cooled: 5.5 gallons (21 L)
3. Specific Gravity of Wort: 1.070
4. Initial Temperature of Wort: 212 °F (100 °C)
5. Final Temperature of Wort: 70 °F (21 °C)
6. Inlet Temperature of Cooling Water: 65 °F (18 °C)
7. Initial Outlet Temp. of Cooling Water: 140 °F (60 °C)
8. Final Outlet Temp.of Cooling Water: 68 °F (20 °C)
9. U = 220 BTU/lb·ft^2·°F (the average of the range as stated in Perry's Handbook)

To determine the total amount of heat that must be removed use $Q_2=mCp\Delta T$:
Q_2 = (5.5 gal)(8.34 lb./gal for water)(1.070 S.G. of wort)(1.0 Btu/lb·°F)(212 °F-70 °F)
Q_2 = 6,969 BTU

To determine how long it will take to cool this wort down to 70 °F use $Q_1=UA\Delta T$:
Q_1 = (220 BTU/lb·ft^2·°F)(4.52 ft^2)(37 °F)
Q_1 = 36,793 BTU/hr

Next divide Q_2 by Q_1 to get:
Q_2/Q_1 = 6,969 BTU heat removal required/36,793 BTU/hr heat removal rate = 0.19 hr ≈ 11 minutes

The graph below shows the results of this model, giving



Effect of Cooling Water Inlet Temperature on Time Required to Cool Wort for Various Immersed Lengths of Immersion Chillers

cooling rates by water temperature and chiller length. Remember for this example, the ΔT value used in the $Q_l=UA\Delta T$ equation is the average temperature difference between the coil and the wort during the entire time that the cooling process is taking place. Initially the wort will be close to 212 °F (100 °C), the inlet temperature of the cooling water will be 65 °F (18 °C), and the outlet temperature of the cooling water will be approximately 140 °F (60 °C). Near the end of the cooling process, the wort temperature will be close to 70 °F (21 °C), the inlet cooling water temperature will still be 65 °F (18 °C), and the outlet cooling water temperature will be approximately 68 °F (20 °C).

Using turbulence to increase cooling rate

The phenomena of a hotter fluid rising within the bulk of a cooler fluid is called free convection. If the amount of fluid movement within the hotter/cooler fluid system is increased by an external force, this movement is referred to as forced convection. An example of forced convection is when a bartender shakes or stirs an ice/drink mixture in order to quickly chill the drink. Forced convection can also be used with an immersion coil to increase the rate of cooling of the wort.

Forced convection causes turbulence within the fluid/heat exchanger system and creates a more intense amount of contact between the fluid and heat exchanger. This increased turbulence enhances the heat transfer coefficient within the system and causes the heat transfer to happen more quickly. This can be illustrated by examining Newton's cooling law and the equations for some dimensionless number groups.

Newton's cooling law states that the rate of heat transfer between an object and the surrounding fluid is proportional to the surface area of the object exposed to the fluid, and to the temperature difference between the object and the fluid. Newton's cooling law is given by:

$$Q = hA(T_{surface} - T_{fluid})$$

Where:
Q = rate of heat transfer, BTU/hr
h = heat transfer coefficient, BTU/hr·ft^2·°F
A = surface area, ft^2
$T_{surface}$ = temperature of the surface, °F
T_{fluid} = temperature of the fluid, °F

From this equation, we see that by increasing any of the terms, we can increase the rate of heat transfer.

Forced convection increases heat transfer by increasing the value of the heat transfer coefficient (h) within the system. The specific manner in which this happens within our immersion-coil/wort system can be described using a spe-

cific empirical definition of the Nusselt number.

The Nusselt number is a dimensionless number group that expresses the ratios between the convective heat transfer coefficient and the conductive heat transfer coefficient. For a cylinder in a cross-flow situation (a close approximation to an immersion coil being moved back and forth or up and down within the wort-filled pot), the Nusselt number, Nu_D, is given as:

$$Nu_D = \frac{hD}{k} = 0.3 + \frac{0.62Re_D^{1/2}Pr^{1/3}}{[1 + (0.4/Pr)^{2/3}]^{1/4}} \left[1 + \left(\frac{Re_D}{282000}\right)^{5/8}\right]^{4/5}$$

Where:
h = heat transfer coefficient
D = characteristic diameter
k = Thermal conductivity
Re_D = Reynolds number, GD/μ
G = fluid mass velocity
D = diameter
μ = fluid viscosity

Pr = Prandtl number, v/α
v = kinematic viscosity
α = thermal diffusivity

This is quite a scary looking equation, but the important thing to note about the Nusselt number equation is that the Reynolds number terms (Re_D) appear in the numerator of the equation, and that the variable "fluid mass velocity" (G) appears in the numerator of the Reynolds number. This means that as the fluid mass velocity increases, the Reynolds number value increases, and therefore the Nusselt number value increases. Since the Nusselt number is given by:

$Nu_D = hD/k$

with D being a constant and k being effectively a constant, this means that the value of the heat transfer coefficient, h, is also increasing as a function of the fluid mass velocity across the coil.

The practical take-away from all of this is that turbulence within the heat transfer system increases the rate of heat transfer and therefore increases the rate of cooling of the wort. Succinctly, more turbulence equals faster cooling.

Cooling your wort as quickly as possible is an important step in the brewing process. A basic understanding of the equations presented here will give you a better understanding of the factors that affect wort cooling. BYO

Chris Bible is BYO*'s "Advanced Brewing" columnist.*

Insulated Keg Fermenter

Get more flocculation temperature control

by Christian Lavender

There are many useful ways to convert a half-barrel keg, and a rubber-coated keg is even more intriguing. There are different ways to take advantage of its insulating power. You could build a mash tun, electric keggle system or a fancy bar stool. But for my keg, I decided that insulation seemed like a great choice for regulating temperatures during fermentation, so I built a fermenter out of a rubber keg.

I had seen many different keg insulating materials in the past for standard stainless steel kegs like the Keg Coat and Keg Jacket that could be zipped on and off as needed. This keg's rubber skin was permanent, bonded directly to the stainless steel shell and could not be removed. I ran a few tests to find that the rubber keg held stable temperatures for a much longer period of time than a keg with a temporary insulating material.

Knowing that fermentation temperatures are a major factor influencing the degree of fermentation, I thought the rubber keg would be perfect. Yeast produces energy, which in turn creates heat. So my thought was that the fermentation activity inside the keg would naturally create additional heat up to a few degrees bringing the fermentation to the target temperature needed and then hold steady.

I scoured the Internet for ideas on how to build an efficient system for siphoning and cleaning. I found the dead-sexy Sabco Brew-Magic Fermenter with a large 4-inch Tri-Clamp port for easy cleaning and access. This keg fermenter has all the bells and whistles, which is why it costs upwards of $600. I had to keep searching. Finally, I came upon an American Sanke Keg Fermenter Kit with Thermowell for under $80.

The kit used the keg's existing Sanke valve port with a tri-clover clamp assembly which was TIG welded with a racking tube, blow off port and thermowell. The only drawback was that the valve opening was small and hard to get into the keg for cleaning. I was able to boil some water in my Hot Liquor Tank (HLT) and transfer the boil over to the fermenter to soak. Then I hit it with Powdered Brewery Wash (PBW) and a carboy scrub brush. Using a small pump, some PBW and a little PVC pipe, I was able to clean with ease.

Before we go any further, however, a word about obtaining a legal keg: the kegs left over from a party or restaurant belong to the brewery that filled them, and the deposit on the keg does not cover the cost of replacing it, which drives up the cost of beer. Instead of keeping a keg, contact local breweries and ask to purchase used kegs, or purchase a reconditioned keg from a vendor (such as Sabco).

> "Knowing that fermentation temperatures are a major factor influencing the degree of fermentation, I thought the rubber keg would be perfect."

Parts and Supplies List

- 15.5-gallon (59-L) rubber-insulated keg
- Fermenter cap with compression nut
- Racking cane with sanitation cap
- Blow-off tube with vinyl tubing to attach it to the cap
- Tri-clover clamp
- Cap O-Ring
- Racking cane O-Rings
- LOVE temperature control switch TS-13010
- Temperature sensor (Thermister)
- Flathead screwdriver
- Nail
- Measuring tape
- Skill Saw
- Plywood (14-inches x 14-inches)
- Ratchet tie-down
- (3) 1-¼ in. caster rubber wheels
- (12) wood screws

A rubber-coated keg can hold in heat longer, making it a great cool-weather fermenter.

1. POP THE TOP

Using a keg coupler or pump, de-gas the keg and let out all the pressurized air that may be inside the keg. (Brewer's Note: Using a screwdriver to push down the steel ball valve to depressurize the keg can result in a face full of old beer and is not recommended. Note #2: Not depressurizing the keg and attempting to remove the spear can result in serious injury when the spear launches from the keg like a missile!) Remove the ring clip by placing the tip of a small nail into the groove on the outside of the ring clip (retainer ring) and press down until the clip pops out. Grab the ring with a pair of pliers so you don't cut your fingers on any sharp edges of the clip. Tapping the keg spear using a flathead screwdriver, gently tap the barbs counterclockwise with a hammer. The Sanke spear should twist as you tap. Finally, remove the keg spear by grabbing the spear and lifting it out of the keg. Save the spear. You may be able to incorporate the stainless steel tube into your brewery either as a siphon or as another piece of plumbing on another project.

2. ASSEMBLE THE KIT

Lay out the parts included with the kit. Place the large silicone O-ring over the thermowell and racking cane and press it into the groove on the fermenter cap. Hold the O-ring in position as you thread the racking cane and thermowell into the rubber keg. Set it in place. Make sure the O-ring doesn't slide out of position and then use the clamp to lock the cap onto the fermenter. Loosen the compression nut and slide the racking cane in as far as it will go. Using the included piece of ½-inch tubing, you can either attach the stainless steel blow off tube or you may choose to just install a 3-piece type airlock. I was anticipating a vigorous fermentation, so I chose the blow-off tube.

3. CLEAN AND SANITIZE

Before you get started with your first fermentation, make sure to clean all of the parts. Cleaning the Sanke keg fermenter is best done using PBW, Oxyclean or an equivalent cleaner and hot water. The easiest way to do this is to mix a few gallons of cleaner in your HLT and fire on the burner. Be sure the opening is not obstructed and bring the solution to a boil. Shut off the flame and transfer the solution into your fermenter via a pump and allow the fermenter to cool down. Once it is cool, you can roll the keg on the ground and/or use a carboy brush to reach the inside of the top. The steam will have loosened the kräusen ring and the PBW solution should take care of the rest. Rinse your fermenter well and turn it upside down to drain.

4. INSTALL THE TEMPERATURE SENSOR

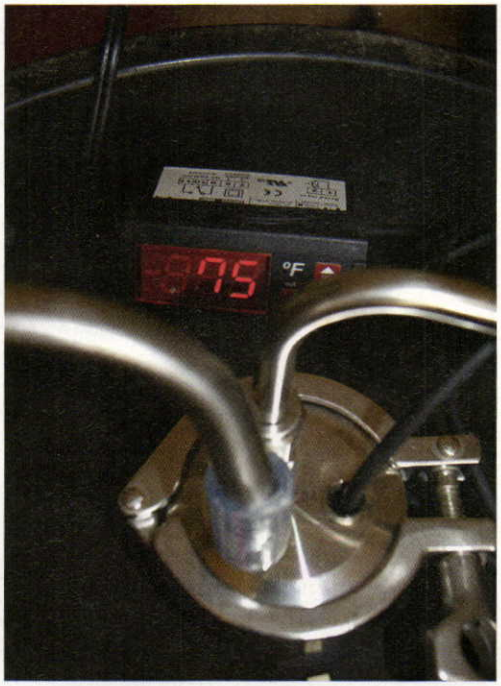
I used the LOVE Temperature Control Switch TS-13010 for temperature monitoring on this fermenter. The switch came with a temperature sensor that easily wired into the back of the unit using the included wiring instructions. I now had a functional temperature monitor and it was time to test it out. I filled the keg fermenter up with enough hot water to reach the middle of the thermowell and inserted the Thermistor down the tube of the thermowell. I watched as the digital temperature display increased and then held constant. This was a good sign that the system was functioning properly.

5. STABILITY AND MOBILITY

Once the fermenter kit was installed I needed a way move the keg around easily and with good stability. The last thing I needed was for the fermenter to spill over and face plant while I was wheeling it across the floor. I grabbed a few small rubber caster wheels, wood screws and some plywood. I placed the keg on the plywood and made a trace of its circumference, measured its diameter and cut a square of plywood equal to that measurement. I measured an equilateral triangle in the center of the plywood and mounted the casters at each point of the triangle giving me equal weight distribution across the three wheels. I used a ratchet tie-down belt in order to secure the keg to the keg dolly. Cheap and dirty, but it worked.

6. TEST DRIVE

Time to get some beer bubbling. I brewed up 10 gallons (38 L) of Tasty APA for a trial run in the new fermenter. After running the wort out of the boil kettle, through the pump and oxygenation system, trub filter and plate chiller, the beer made its way to the keg. I pitched the yeast and gave everything one last quick spray with sanitizer and then set the fermenter cap assembly in place. After 24 hours I checked back on the progress and I had an extremely active fermentation going on which was noticeable by the massive amount of activity coming from the blow off tube. The keg was not under pressure, but I would advise never to stand directly over the fermenter assembly. BYO



Christian Lavender is a homebrewer in Austin, Texas and founder of Kegerators.com and HomeBrewing.com.

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I'm a proud father. I'm a proud homebrewer. I'm a better father than I am a homebrewer — I hope.

I have a three-year-old daughter and a nine-month-old son. I hadn't homebrewed in more than three years because, well, I've been distracted. So it was with some excitement and anticipation that I set out on a recent Saturday to brew up a batch of IPA and involve my daughter in the process. She's handy in the kitchen.

It took a bit of arm-twisting to get my wife to go along with my plan to brew with a three-year-old, but my powers of persuasion (which basically consisted of asking, "What could possibly go wrong?") are renowned.

And so we began. First, we filled a pot with 3 gallons (11 L) of water. Easy. Fun. Especially when you can fit inside the pot.

Next, we measured out the grains for the muslin bag. In the process, the child learned a new word, "muslin," some basic math skills and was introduced to the science of weights and measures. Plus, mmmmmmm mmm, she tasted the crunchy barley. I said excitedly, "They taste like Grape Nuts, don't they?" She stared, blankly.

We watched the bloated grain bag sink slowly into the pot, darkening the water as it begins its transformative journey to wort. "It's like tea!" my observant one squealed.

Soon the wort was bubbling away on the stove, filling the house with that delightful Raisin Bran aroma. So far so good. She was engaged, interested and helpful.

Then it was time to add the first round of hops. She learned about geography as we tore open the packets of Cascade, Centennial and Amarillo. "Find the Yakima Valley on our map of the United States" I told her. And, "breathe deep, honey, that's Dada's favorite smell in the whole wide world." "Can I taste them?" she asked while carefully stirring the wort. Ignoring the concerned look from Mama, I said, "Yeah, sure, why not?"

Now it was time for a bath. An ice bath! What three year-old doesn't love a bath? "No, my little braumeister," I explained, "you can't get in the tub with all that ice."

Once my high-tech cooling system was deployed, it was time to pitch our yeast.

"Daddy, what's yeast?" she asked.

"Ah, it's a, um, ah . . . a microorganism. A tiny creature, it's kind of, sort of, like a fungus," I attempted. "You know, mushrooms are a fungus. It is in the air, but we can't see it because it's so small but, um, it, ah, eats the sugar in this wort and, um, it poops out alcohol. Get it? No? Well, my hop cone, there are yeast scientists, yeast-ologists I think they're called, who don't even know what yeast is but trust me it's important." Yeast lesson completed.

Next, I asked her to hand me an airlock. She loves the airlock. Of course she does. Airlocks are cool. She filled it with water and we sealed the goodness into the carboy to let the beer ferment.

As I kissed her goodnight she had one final request, a fair one considering her contribution to the process, "Dada," she whispered, "can I taste the beer when it's done fomenting?"

"It's fermenting, my wee home brew judge, and of course you may taste it...once you turn sixteen."

On bottling day, my little Carol Stoudt-in-training managed to fill more than a few bottles and spill more than a few bottles worth. She wielded a capper better than many a seasoned homebrewer I've seen, and she went to bed sticky and smelling of beer. (See earlier comment about my parenting credentials.)

Note: No children were harmed in the making of this column. However, one marriage was tested. BYO

> "'Daddy, what's yeast?' she asked. 'Ah, it's a, um, ah . . . a microorganism. A tiny creature, it's kind of, sort of, like a fungus,' I attempted."

Photo courtesy of Richard Bolster

Richard Bolster taught his three-year-old the technique of using a capper during a recent father-daughter brew day.

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