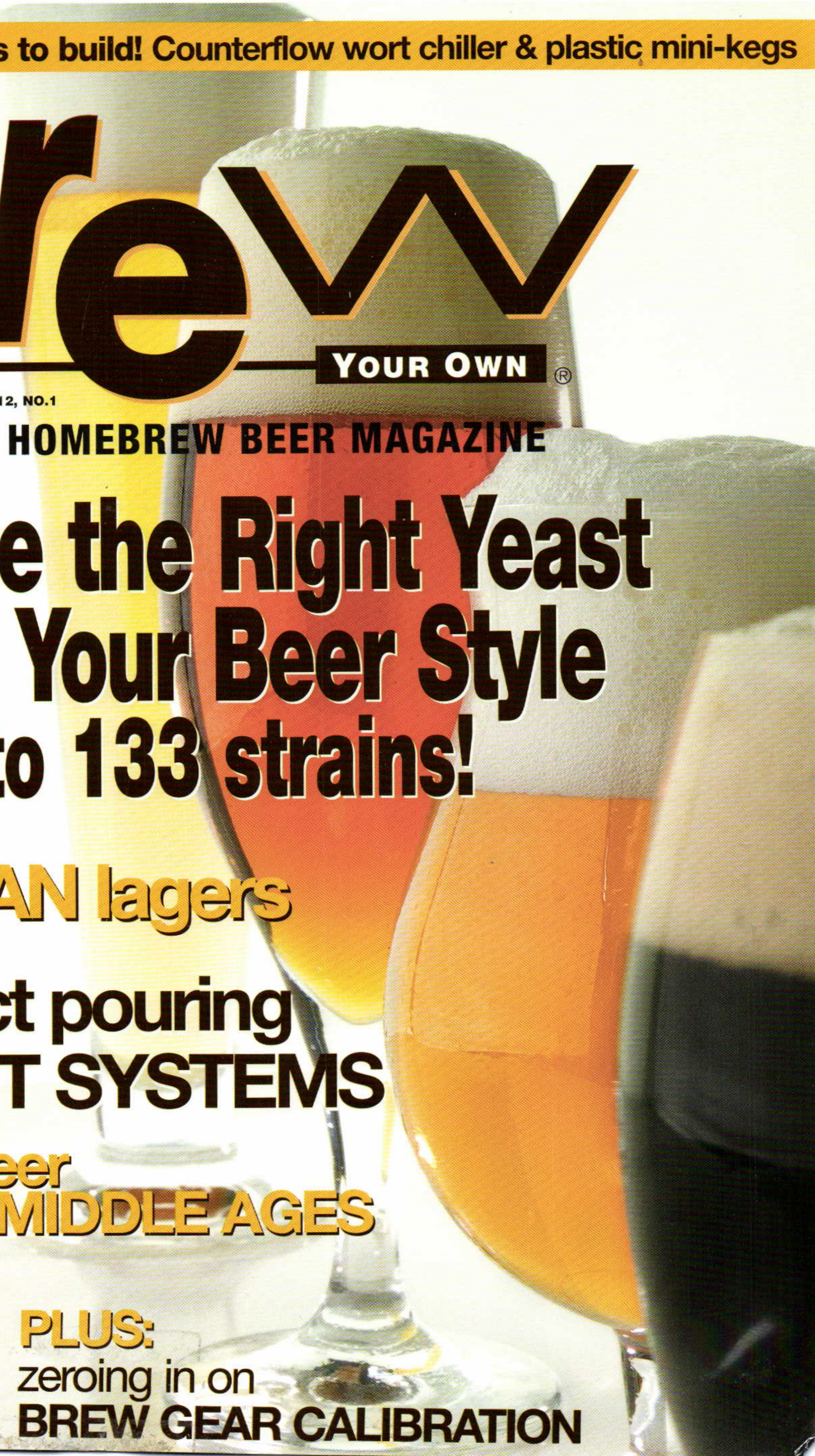
2 GREAT projects to build! Counterflow wort chiller & plastic mini-kegs

Brew YOUR OWN®

JANUARY-FEBRUARY 2006, VOL.12, NO.1

THE HOW-TO HOMEBREW BEER MAGAZINE



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JANUARY-FEBRUARY 2006
Volume 12 Number 1

Brew Your Own

THE HOW-TO HOMEBREW BEER MAGAZINE

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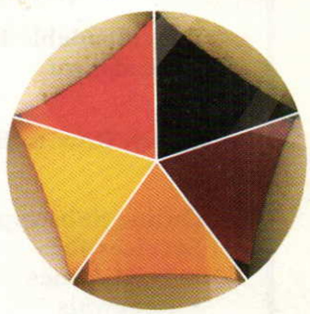
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Where to find it

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THE HOW-TO HOMEBREW BEER MAGAZINE

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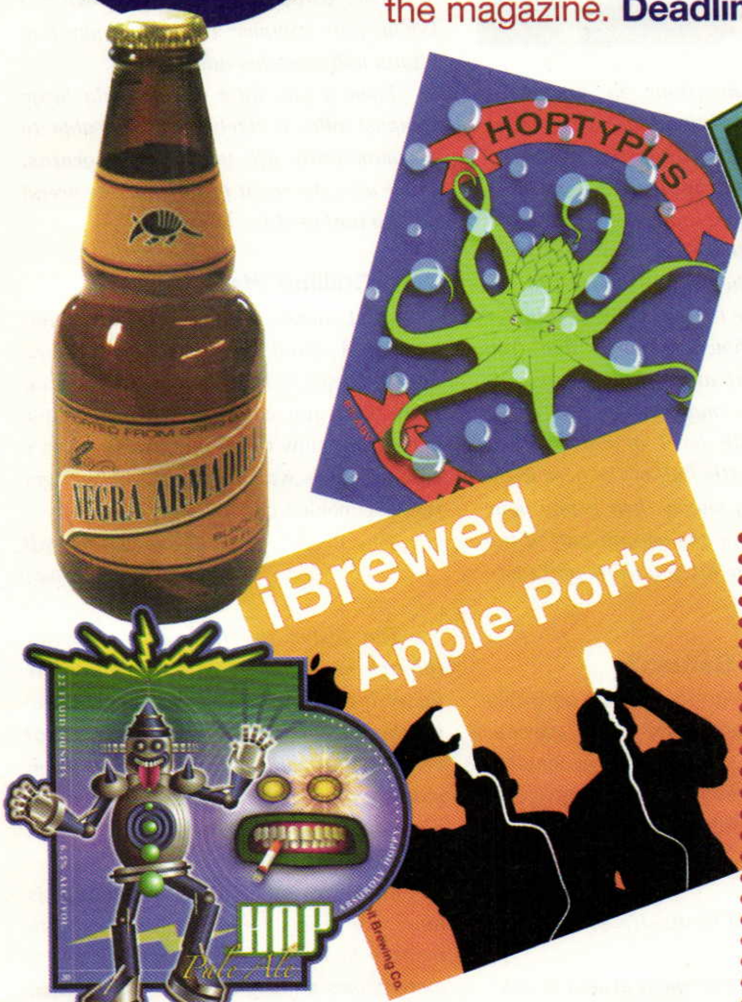
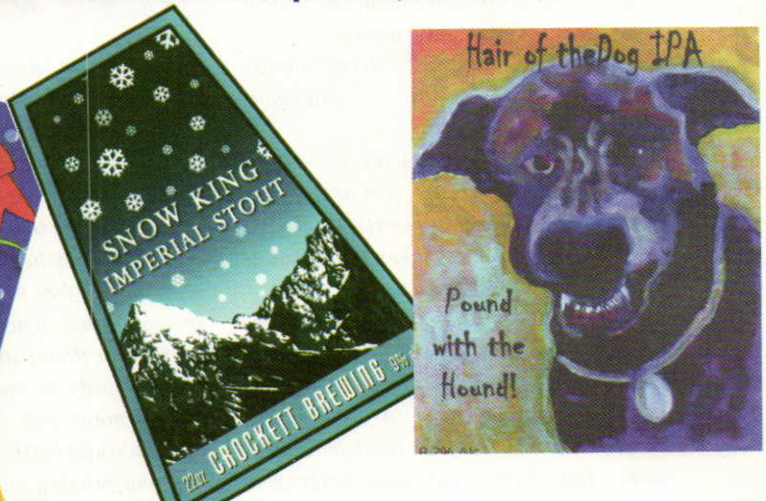
Brew Your Own's 11th Annual Homebrew LABEL Contest

WIN GREAT HOMEBREW PRIZES!

Send us your best homebrew labels and you could win some great brewing prizes from **BYO** advertisers! Enter as often as you like, but you can only win one prize. Winners will see their artwork featured in the July-August issue of the magazine. **Deadline to enter is April 14, 2006.**





Rules: Entrants can send labels or labels already stuck to bottles. The bottles can be full of beer. No digital or electronic files will be accepted. All other rules are made up by the editors of *BYO* as we go along. Labels are judged in one category, open to graphic artists and amateurs alike, so ultimate bragging rights are on the line. When submitting your labels, tell us a bit about the artwork and its inspiration. Is it hand-drawn? Created on a computer? Send us your best labels, tell us how you made them, and good luck!

Brew Your Own — Label Contest Entry Form

THE HOW-TO HOMEBREW BEER MAGAZINE

Name ____________________

Address ____________________

City ____________________

State/Province __________ Zipcode/Postal __________

E-mail ____________________

Daytime Phone ____________________

All original artwork? Y or N (circle one)

Send your entry to:
BYO Label Contest
5053 Main St., Suite A
Manchester Center, VT 05255

DEADLINE: April 14, 2006

Black Pipe Bottler?

I enjoy your magazine very much, but I wanted to make a comment on the article "Make a CP Bottler" by Reg Pope (November, 2005). In all 5 photos, 2 tee fittings are shown. The article states using bronze tees, but the photos show what appears to be black pipe fittings. I would warn your readers not to use black pipe as it is for gas lines and treated with chemicals to resist the gas chemicals. If used in this project, it could prove to be toxic. I can't imagine Reg making this mistake, since he says he has built and used it — but the pictures seem to show black pipe tee's. Maybe the photos were added by someone who attempted to put together the project to match the article and who doesn't actually use it?

Jerry Bonnici
via email

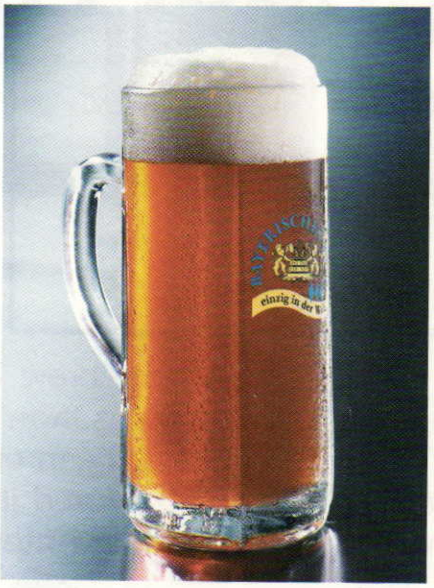
The fittings in the pictures — taken by Reg Pope — are brass, just as it states in the parts list for the project. (Maybe it's just the lighting that makes them look a bit dark.)

Black pipe is usually made from iron or steel and would indeed be a poor choice for a variety of reasons. However, it would be fairly hard to accidentally confuse the two at your local hardware store. But, we'll print your letter just to let readers know that not all hardware store fittings can be used for beer equipment.

Franconian Fan

I'm a huge fan of Franconian beer, having been born there myself and experienced the delights of small village breweries there. I would love to try brewing Kellerbier ("Kellerbier," by Horst Dornbusch, November 2005) but am not quite at the stage for using Corny kegs. So I'm stuck with bottles only. Is Kellerbier to remain unprimed even when using bottles? Or might I simply reduce the priming sugar by about half (3/8 cup for corn sugar; 5/8 cup for dry malt extract) to have Kellerbier in the bottle? I'd really like to try this recipe out.

Paul Hofmann
Milwaukee, Wisconsin



As Horst mentions in his story, Kellerbier is traditionally served from unpressurized casks and is not carbonated. If you decide to bottle your homebrew, your serving method will be non-traditional, so there's no real answer to how it should *be bottle-conditioned. As such, you're free to bottle your Kellerbier interpretation however you'd like. You could go without any priming sugar, or you can add a small amount to get a barely noticeable level of carbonation. (or, you could bottle half of the beer without any priming sugar, then prime your bottling bucket for the second half of the batch.) Go with what you think will taste best to you.*

Grains in the Garden?

I am an all-grain brewer and also grow my own hops and veggy garden. Would there be any useful nutrients in the grains and trub after brew day for my gardens, or would I just be creating a giant fly farm?

Mike Petrarca
So. Chicago Heights, Illinois

Yes, you can use spent grains in your garden. When you prepare the soil in spring, you can add a little spent grain in with whatever else you are mixing into the soil (for example, manure). However, you don't want to overdo it as too much can cause pH related problems in your soil. A better approach to tilling spent grains directly into your garden is to compost them first.

Composting involves more than making a big pile of grains in your backyard. (This will just stink up the neighborhood for a couple days. Don't ask us how we know.) To compost the grains, you will need to layer the grains in with straw, hay, leaves, wood chips and/or vegetable waste from your garden and kitchen.

To work right, a compost pile needs to be turned occasionally and a correct level of moisture maintained. A good book on composting can give you all the details (and help you decide if you want to try "hot composting" or "cold composting.") When your compost is ready, your hop plants will love this added boost.

Even if you have a relatively large compost pile, it likely won't be able to accommodate all your spent grains. Other uses for spent grains include bread baking and feed for livestock.

Wort Chilling Water

I just started using a wort chiller and wondered about how much water flow should I use? If I turn my cold water on high, the water coming out of the chiller is cold. If I slow down the flow the water coming out is warm. Which way will get the wort cooled down faster?

Steve Vanderwall
Vanderbilt, Michigan

The faster the flow of cold water through your immersion wort chiller, the faster it will cool your wort. (This is due to the larger temperature differential between the cold water — which, when moving quickly through the chiller, doesn't have much time to heat up — and your hot wort.)

However, the speed of chilling is inversely proportional to efficiency with respect to how much water is used. If water flows quickly through your chiller, it doesn't absorb much heat from the wort and so more water is required. Also, the faster the flow of water, the more pressure is built up in the chiller and you can fairly easily pop off clamped tubing if you turn on the water too high.

Most homebrewers try to strike a balance between a quick chilling time and the amount of waste water they generate. If you can get your wort chilled within a half hour, you are doing fine.

If you're concerned about your water usage, you can collect the initial hot water runoff in an empty bucket or picnic cooler and use it for cleaning your equipment at the end of your brewday. Some thrifty brewers even collect the hot water and put it in their washer to do a load of clothes. Cooler water from later in the chilling can be collected and used to water your lawn or garden.

For a chiller that makes more efficient use of water, see Reg Pope's article, "Counterflow Wort Chiller," on page 38 of this issue.

Bottling Time?

I have read your first brew article (from the *Brew Your Own* Beginner's Guide) and it was great! I brewed an ale using a beer kit with fresh dry yeast yesterday. The yeast took off like crazy, peaked about 8 hours later, then quit less than 20 hours after introduction of the yeast. Should I go ahead and bottle?

Richard Lee
via email

It's best to wait at least three days after fermentation appears to have finished to bottle most ales. This will give the yeast some time to settle and the beer to clear up a bit. (Different strains drop out at different speeds — i.e. have different flocculation properties — so let the beer rest undisturbed longer if it still appears very murky.)

We would, however, like to point out one thing: a fermentation that peaks after 8 hours and is finished after 20 is a very quick ferment. Did you check the temperature of your wort before pitching your yeast? Some beer kits instruct beginning brewers to transfer their hot wort into cold water in their brewing bucket and then to top up to 5 gallons (19 L).

The problem with this procedure is your diluted wort may still be very hot, depending on the amount of concentrated wort you boiled and the temperature of your dilution water. It's been our experience that many beginning brewers start their fermentation way too hot (from 85–100 °F/29–38 °C) by following directions like these and not checking their wort temperature before pitching their yeast. (Yeast will live — and, in fact, thrive — at these temperatures, but they will not make good beer.)

A much better procedure for beginning brewers is to chill their brewpot in a sink full of cold water before transferring their wort to their fermenter. (We recommend cooling the wort until the side of the brewpot feels neither hot nor cold — around average human body temperature 98.6 °F (37 °C) — then diluting the wort with your cool dilution water.)

The Opposite Problem

I followed directions given to us with a kit for pale ale. We added the yeast and now it's been 16 hours and there is no sign yeast is doing its thing. (Is the yeast dead?) Can new yeast be added to save this batch of beer? Or does it have to be thrown away and start over with new ingredients? Hate to waste the liquid if it can be saved.

Willie Bobo
via email

Optimally, your beer should start fermenting before 16 hours have passed, although some homebrew ferments don't get started until 24 hours and still end up OK. Whenever a fermentation doesn't start, adding more yeast is always an option. (Aerating the wort again may also help.) Many homebrewers keep an extra packet or two of dried ale yeast in their refrigerator in case one of their fermentations does not start.

Two Pot Plan

I have been a homebrewer for four years and I am considering making the transition from extract and partial mash brewing to all-grain brewing. Most of the books and articles I have read about all grain brewing recommend that you boil the entire volume of beer. My question is whether it would be feasible to split the entire batch into two smaller brew pots on the kitchen stove?

Ben Ahrens
via email

Yes, this requires a bit of extra work, but is a viable option.

2005 Brew Your Own Story Index

RECIPE INDEX

Page

BYO RECIPE STANDARDIZATION

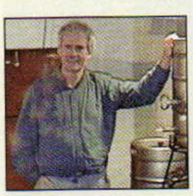
Extract efficiency: 65%
(i.e. — 1 pound of 2-row malt, which has a potential extract value of 1.037 in one gallon of water, would yield a wort of 1.024.)

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.

Contributors



BILL PIERCE'S reaction to his first taste of homebrew as a college student in the 1970s: "I believe your horse has diabetes," he said. Nearly 20 years later, in 1994, he brewed his own first batch — an extract brown ale from a kit — and, in his own words, "was hooked." After completing the Craft Brewer's Certification Program at the Siebel Institute of Technology in Chicago, he had a brief stint as a brewpub brewer. "Professional craft brewing was a real eye-opener," he says of the experience. "It's a true labor of love for those who do it." Now the BJCP-certified judge helps moderate the Brews and Views internet forum sponsored by the online Home Brew Digest. Bill writes the Advanced Brewing department in each issue of *BYO*. His latest column on balancing your draft system starts on page 55.

GRAHAM SANDERS is a homebrewer and craftbrewer from North Queensland, Australia. Graham is also a co-founder of the Australian Craft Brewers Website www.oz.craftbrewer.org. Here he has published several brewing articles and build-it-yourself projects. Graham, in all his modesty, says "In typical Australian fashion I can say that I know enough about brewing to keep me out of trouble, make a decent beer and not poison my friends." Graham has a bachelors degree in agricultural science and has been homebrewing for 15 years and craftbrewing for 13 years. He is also the state delegate to the Australian Amateur Brewers Association and hosts a podcast radio program. In this issue, he contributes the "Fantastic Plastic Kegs" project that begins on page 53.

homebrew systems that will MAKE YOU DROOL

Doug Hungerford • Southington, Connecticut

I have been a homebrewer for just a year now and I am a relatively new subscriber to *BYO*. Reading through my first six issues I find that I enjoy the articles that homebrewers write that share brewing ideas and equipment they have modified or built. So, in similar fashion, I thought I could share a project that I completed last spring.

Last fall when I started homebrewing I quickly found that kegging the ales

was much easier not to mention quicker than bottling, so I promptly invested in a double CO_2 corny keg system. This worked out quite well when my wife and I hosted parties where my homebrew was served.

The only problem that I had with the keg system was that it looked very "college dorm like" with its industrial mechanical looks. The cheap cobra dispenser head did not do justice to the care that was used in brewing the beer. What I needed was a clean looking setup that would allow me to serve the ales with the same attention to detail that was used during the brew.

What I came up with is a portable, Old World-style "tap stand." I wanted the tap stand to emulate the look and feel of an Old World pub without compromising its portability. The system that I built around is working quite well and has been used inside our home as well as out doors during picnics. The details of the build and its use are as follows:

• The cabinet was designed to fit flush against the center island in my kitchen, when it is in-place it appears that it is part of the island. The wood that I used is just oak veneered plywood trimmed in hardwood. I used a dark stain to give it the old styling that I was looking for and finished it off with three coats of polyurethane. The brass hardware is styled to copy an old time ice box. I designed the interior dimensions so that one corny keg, a 5-pound CO_2 bottle and a 5-gallon (19-L) pail could fit. I finished the back panel so that the entire tap stand would look good from all sides when it is closed up.

• The brass tower was purchased from my local brew supply house, Maltose Express in Monroe, Connecticut, and the tap handle was purchased on eBay. The unit does not contain refrigeration so I use the tap stand in one of three ways. For parties during cooler weather it is only necessary to chill the keg to 38–42 degrees and the ale has stayed cold throughout the party. When it gets warmer I dispense through 25 feet of 1/2-inch coiled copper tubing that I submerge into a 5-gallon (19-L) pail of ice and water. I have also placed the keg into a 5-gallon (19-L) pail and packed it with ice when the sun is beating directly onto the tap stand. I also found that when using the 25 feet of coiled copper tubing, I did not have to reduce the dispensing pressure and the carbonation held strong.

homebrew CALENDAR

February 3

12th Annual Boston Homebrew Competition
Boston, Massachusetts

The Boston Wort Processors are proud to announce the 12th Annual Boston Homebrew Competition. This year's competition will be held at the Sam Adams Brewery in Boston. All 28 BJCP (2004) beer, mead and cider styles will be judged, with all beer category winners qualifying to enter the 9th annual Masters Championship of Amateur Brewing (MCAB IX) in 2007. The fee is $6 per entry. Please send or drop off all entries before February 3. The awards ceremony will be held on February 18. For more information contact Alastair Hewitt via phone at (617) 475-1612. Or you can visit the Website at www.bhc.wort.org.

February 6

Best Florida Beer Homebrew Competition
Tampa, Florida

Weeklong events for the "Best Florida Beer Homebrew Competition" will include the following: Beer & Food Pairing, the Brewers Ball, Stogie n' Stouts, a Pub Crawl throughout Ybor City and the competition's Awards Ball. The fee for entries is $6.00 per entry. Please be sure to have all entries mailed or dropped off by February 6. For more information contact Dave Morgan via phone at (727) 734-6968 or www.dunedinbrewersguild.com.

February 11

War of the Worts XI
Collegeville, Pennsylvania

This competition is open to all beer, mead and cider categories included in the 2004 BJCP guidelines. This year, the competition will also feature the Mead Makers Massive Mayhem (MMMM). This event is open to meadmakers who will compete within a separate arena for a separate best of show award. Entries are $6 for the first entry and $5 per subsequent entry. The entry deadline is February 11 and the awards ceremony will be held on February 18. For more information contact Vince Galet via phone at (215) 855-0100 or visit the Website www.keystonehops.org.

homebrew CLUB

Wort Hog Brewers • Gauteng, South Africa

"fifty Classic Beers, 25 Classy Brewers, One Passion" . . . A Testament To Home Brewing On The African Continent!

The 2005 Summer Beer Festival was the Wort Hog Brewer's most successful homebrew event ever. 500 guests came to enjoy what was probably the greatest range of homebrewed beers ever exhibited on the African continent. There were classic Irish stouts, weizens, porters, English bitters, fruit beers, Belgian ales, Alts, Kolsch and even a chilli beer. When the media showed up to savor the event and its beers, the Wort Hog Brewers' message was clear; you can brew great beer at home!

The WHBs started life under the guidance of a bio-kineticist named Moritz Kallmeyer. Moritz ran his own gym by day, but spent his evenings and weekends in Pretoria learning everything he could about brewing beer at home. Through a desire to share his knowledge, Moritz became the central source of know-how and ingredients that sparked the many kit brewers to become a passionate band of grain brewers. From a fledgling bunch of customers in 1992 grew a club that now nears its first decade of formal existence, with six meetings a year attended by up to 70 people.

In addition to hosting live meetings with expert lectures and peer-beer tastings, the WHBs also have a strong online presence (www.worthogbrewers.co.za). A quick visit to the site will introduce you to their IRC Chat Channel (they hold online tastings once a month), pictures of previous events, a technical library, a suppliers database, a list of WHB members' Websites, past club newsletters and an online recipe formulator.

In between their formal and online meetings, the WHBs run brewing demonstrations at members' homes, hold two monthly regional study evenings for smaller groups of brewers and try to participate in every AHA event. The

WHBs participated again this year in a Big Brew event and, for the second year in a row, hosted more sites in South Africa than all other non-USA countries combined! Brewers were even asked to include some African sorghum grain to their beers to give more of an African flavor to the event. *Cheers!*

ingredient PROFILE

WORKHORSE YEAST STRAINS

There are a few yeast strains out there that are widely used for the simple fact that they ferment and nothing else. By that, we mean that they are used by a number of brewers for no other reason than they are proven "clean" fermenters. From our chart on page 32, you'll see there are over 130 yeast strains on the market, and from the descriptors you'll see that most contribute distinguishing characteristics to the final beer. The workhorses do not! They just ferment, leaving very little in the way of a fingerprint aroma or flavor. The workhorse fingerprint (hoofprint?) is therefore the fact that they "accentuate" the natural flavors of the malts, hops and adjuncts used in the brew. In fact, because they are this clean, these yeast strains are so versatile that many brewers (even professionals) opt to use them in every style beer that they make. The three most recognizable workhorse strains available to homebrewers are Wyeast 1056, White Labs WLP001 and Safale US-56. All are American (or California) ale strains that can easily ferment at typical room temperatures between 68 and 74 °F (20–23 °C).

we want you

Do you have a system or some unique brewing gadgets that will make our readers drool? Email a description and some photos to **edit@byo.com** and you too may have a claim to fame in your brewing circle!

If we publish your article, recipe, photos, club news or tip in Homebrew Nation, you'll get a cool t-shirt (courtesy of White Labs) and a *BYO* Euro sticker.

reader RECIPE

Steve Ruch
Vancouver, Washington

Several years ago my wife fixed us a dinner of chicken flavored with lemon and rosemary. Over supper we discussed a local beer brewed with lemon. We got to wondering what lemon with rosemary would taste like in one of my own beers. I put together the following recipe and found out it tastes GRRRREAT (with apologies to Tony the Tiger)! My wife's middle name is Aurora hence the name.

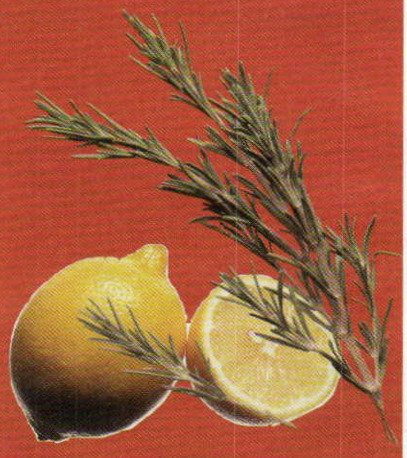
AURORA ALE
(3 gallons/11.4 L all-grain)

Ingredients

6 lbs. (2.7 kg) 2-row malt
8 ozs. (224 g) white malt
20 IBU Hallertau for 60 minutes
1/4 tsp. Irish moss for 45 minutes
1 tsp. rosemary to steep for 15 minutes
1 lemon's-worth of juice for zest steep for 15 minutes
1 pkg. White Labs California Ale Yeast (WLP001) or WYEAST American Ale Yeast (1056)
1/3 cup corn sugar to prime

Step-by-step

Mash all grains at 150-152 °F (~66 °C) for 60 minutes. Add the rosemary and lemon juice with 15 left to the boil. Let your wort cool and pitch yeast. Primary fermentation should take 4-7 days. Rack to secondary and let mature for 7-10 days. Extract brewers can substitute the lightest extract they can find for the malts suggested.



homebrew DICTIONARY

HOMEBREW UNIVERSITY

U is for . . .

U.K. gallon: A synonym for imperial gallon, the English measurement equal to ~1.2 U.S. Gallons. Similarly, the fractional volumes of U.K. pints and quarts are also the equivalent volume greater than the U.S. measurement.

ullage: A term that refers to calculating the headspace of a cask, keg or barrel.

uni-tanks: a type of fermenter that is used for both primary fermentation and conditioning.

unload: the process of emptying the steeped malts from the steeping vessel.

undermodified malt: Malt containing barley or other grains that have been kilned or dried out in a way that prevented all the enzymes from transforming into proteins.

underoxygenated: A term used to describe worts that have not been sufficiently aerated for fermentation. Yeast need an adequate amount of oxygen to effectively convert sugar to alcohol (and CO_2).

V is for . . .

VGA: an American hop variety providing medium bitterness.

Vienna lager: A style that derives from Austria that is amber in color. In modern day, Mexico has made this style popular through beers like Dos Equis Amber. For more information on this style see page 24.

viscosity: As an adjective, this descriptor refers to body and mouthfeel, but it literally refers to the resistance of liquid (beer) to flow — i.e. its thickness.

volatile acids: Acids in beer and other beverages that are decreased through evaporation, chemical treatment and fermentation.

vorlauf: German word referring to the process of recirculating wort through the grain bed.

replicator

by **Steve Bader**

DICK'S BREWING COMPANY

Dear Replicator,

I got really spoiled last summer when I stayed at my brother's house in Seattle and had easy access to a specialty beer store called Bottleworks. I could spend hours just looking at all the different world class beers properly chilled, but what I miss most, now that I live in Tacoma, is being able to always count on picking up a bottle or two of Bottleworks IPA brewed by Dick's in Centralia, Washington. The one place that carries it in town always sells out really quickly. I would love to brew a clone. Can you help?

Paul Zmolek
Tacoma, Washington

Bottleworks is one of the Seattle area's premier "beer by the bottle" shops, selling all kinds of bottled beer from the Northwest, and around the world. Bottleworks and Dick's Brewing Company worked out a deal for Dick's to contract brew the Bottleworks IPA for them to sell as their own private label IPA.

Bottleworks loved Dick's original IPA, and wanted a huge beer with the IPA-like flavor profile, and thus Bottleworks IPA was born! Dick's has been brewing Bottleworks IPA since 2001.

Head brewer Ezra Cox loves to talk about beer, and was excited to give me the details of this incredible beer. Ezra says Bottleworks IPA is all about the hops, with a nice balance from a bit of residual sugar from the crystal malts used.

Ezra calls Bottleworks IPA an "Industrial IPA" or "Imperial IPA," with both terms meaning you take the regular IPA style, and increase everything that goes into the beer! More hop bitterness, more hop aroma, more malt flavor, and more alcohol. You get the idea. What's not to love here for a beer drinker?

Since this is a big beer, Dick's takes its time producing Bottleworks IPA. It takes a total of 6 weeks to ferment, clear in the bright tank, mellow, and then Dick's bottle conditions the beer for another two weeks.

Ezra said that he used a full 5 ounces of Columbus as the bittering hop. Well, that calculates out to over 300 IBU! Can it be true? For this recipe I toned it down a bit to just over 2 ounces, but that still calculates to over 100 IBU! Typically you cannot taste any difference in IBU levels when it gets above around 100, and many brewers say that you cannot extract more than about 100 IBU's into a beer. This sounds like a grand hop experiment to me!

For more information on this brew you can visit the Dick's Brewing Company Website at www.dicksbeer.com or call the brewery at (360) 736-1603.

Dick's Brewing Company Bottleworks IPA

(5 Gallons/19 L, extract with grain)

OG = 1.080 FG = 1.018
IBUs = over 100! SRM = 11.3
ABV = 8.0%

Ingredients

11.75 lbs. (5.3 kg) Briess light unhopped malt extract syrup
8.0 oz. (224 g) crystal malt (120 °L)
1.0 oz. (28 g) chocolate malt
1 tsp Irish moss (60 min.)
33.7 AAU Columbus hops (60 min) (2.25 oz./63 g of 15% alpha acid)
15.0 AAU Columbus hops (20 min) (1.0 oz./28 g of 15.0% alpha acid)
15.0 AAU Columbus hops (5 min.) (1.0 oz./28 g of 15% alpha acid)
White Labs WLP001 (California Ale) or Wyeast 1056 (American Ale) yeast
0.75 cup (180 mL) of corn sugar (for priming)

Step by Step

Steep the crushed malts in 3 gallons (11.4 L) of water at 155 °F (68 °C) for 30 minutes. Remove grains from wort, add the malt syrup and bring to a boil.

Add the Columbus bittering hops and Irish moss, then boil for 60 minutes. Add the second addition of Columbus hops for the last 20 minutes of the boil. Add the remaining Columbus hops at the end of the boil and let them steep for five minutes. Now add the wort to 2 gallons (7.6 L) of cool water in a sanitary fermenter, and top off with cool water to 5.5 gallons (~21 L).

Cool the wort to 75 °F (24 °C), aerate the beer heavily and pitch your yeast. Allow the beer to cool over the next few hours to 68 °F (20 °C), and hold at this temperature until the beer has finished fermenting. Dick's conditions this beer for approximately a total of six weeks, then bottle or keg your beer and enjoy!

Notes: To get the full amount of bitterness in an extract IPA, you will need to do a full-wort boil. Also, although hop bitterness is thought not exceed 100 IBUs, hop flavor and aroma may increase with additional hops. Consider adding the full 5 oz. (142 g) per 5 gallons (19 L) of bittering hops if you're a real hophead.

All-grain option:

This is a single step infusion mash. Replace the malt syrup with 16 lbs. (7.25 kg) of 2-row pale malt. Mash the three grains together at 155 °F (68 °C) for 60 minutes. Collect approximately 7 gallons wort (26.6 L) to boil for 90 minutes. The remainder of the recipe is the same as the extract recipe.

Intro to Hydrometers

The versatile tool to measure gravity in beer

by Garrett Heaney

What is a hydrometer?

A hydrometer is a tool that measures the specific gravity of a liquid. Specific gravity is an important measurement at all levels of brewing: before fermentation is induced, during fermentation and following fermentation. When you measure specific gravity, the most important factor you are trying to determine is how much sugar your wort or beer contains. The sugar concentration of wort prior to fermentation is an important number. Known as the "starting gravity," it gives you a basis for predicting the amount of alcohol that can be produced during fermentation, if the yeast were able to ferment all the sugar in the wort (this predicted amount is called potential alcohol). Extract brewers measure the specific gravity after the wort is mixed and has cooled while all-grain brewers also measure during sparging (the process of rinsing spent grains to retrieve sugar content for your mash) to determine when to stop (approximately 1.008–1.010 SG).

Brewers then conduct hydrometer tests throughout fermentation to monitor the yeast's progress in converting these sugars into alcohol, which in turn decreases the specific gravity and Brix of the fermenting wort. Towards the end of fermentation is an important time for the hydrometer as well. When the specific gravity you are aiming for (called the target gravity) is achieved, your hydrometer will tell you that it is time to rack your beer off from the yeast sediment (trub) and into a secondary fermenter.

How does a hydrometer work?

Physically, a hydrometer is a cylindrical glass tube with a weighted, sphere-shaped bottom. This weighted base allows the instrument to float upright when placed in a testing jar of liquid (wort or beer for our purposes). Inside the tube is a graduated scale of specific gravity readings (typically ranging from 0.990–1.120). The degree the hydrometer sinks into the solution represents the measure of specific gravity. Some hydrometers, especially those used for brewing, measure using the Brix scale, a measurement that implies actual sugar content. To convert between Brix and specific gravity, 1 °Brix is approximately equivalent to 1.004 specific gravity. When the hydrometer is floated in a liquid, the specific gravity reading can be read at the point where the tube breaks the surface of the liquid (called the meniscus). For pure water, the reading should be 1.000 SG and for liquids with higher sugar content (such as wort), the specific gravity readings increase with the concentration of sugar (and suspended solids in the liquid). It is also important to note that hydrometers are calibrated to measure specific gravity at certain temperatures (60 °F or 16 °C is the norm for the hydrometers most homebrewers use). It is important, therefore, to measure at the correct temperatures or adjust your readings to account for the temperature differential. In general, the rule of the thumb is to add 0.001 to your specific gravity reading for each 10 °F (6 °C) increase in temperature (and subtract the same 0.001 for each 10 °F (6 °C) below the calibrated temperature).

How do I use a hydrometer?

As mentioned earlier, your hydrometer will need to be floated into your wort or beer, so the first thing you'll need to do is make sure you have a testing jar (which looks like an enlarged test tube and stands on its own). Most hydrometers come with this container which holds between a half cup and 2 cups of liquid. When you float your hydrometer in the testing jar, give it a spin with your fingers (like you would a top) in order to eliminate air bubbles from the instrument's sides and rid the beer of as much CO_2 gas as possible. Air bubbles and residual CO_2 gas would both affect the buoyancy of the hydrometer and throw off the accuracy of your reading. After you release the hydrometer, you need to wait a moment to allow everything to still, then take your reading at the meniscus — as mentioned above, the meniscus is the point where the hydrometer actually breaks the surface of the liquid, forming a funnel shaped lip. Take the reading from the lowest point of the meniscus rather than the top. Knowing specific gravity will help you put the guesswork aside. *Cheers!*

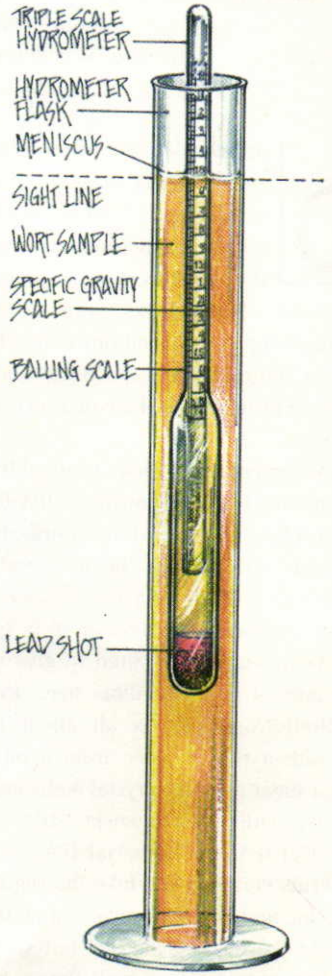


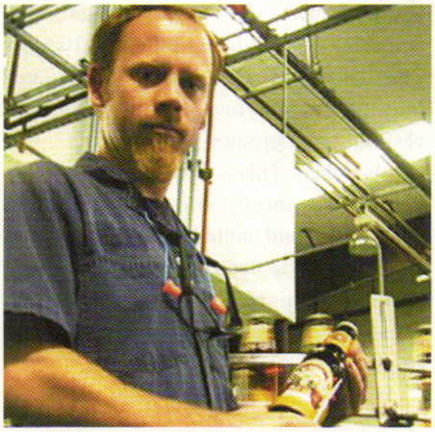
illustration by don martin

Fixing for Finings

Professional advice for clearing up your beer

by Thomas J. Miller

Beer clarity is important to many brewers, both at the homebrewery and the commercial level. To achieve this, without the use of filters that can strip your beer of valuable yeast flavor contributions, brewers have another, less abrasive option — finings. There is a wide array of fining agents available to the homebrewer and an equally wide range of fining procedures to employ. Take the advice of these two pros to help you make mighty fined brews!



Matthew Brynildson attended the Siebel Institute of Brewing Technology and joined the Goose Island Beer Company in 1996 as Head Brewer of their Chicago, Fulton Street production facility. In 2000 Matt moved to Central Coastal California to Join the SLO Brewing Company as Brewmaster. In July of 2001, Firestone Walker Brewing Company acquired the Paso Robles production brewery and asked Matt to stay on as Brewmaster and General Manager.

Kettle finings are coagulating agents added to hot wort, typically toward the end of boil, to aid in the precipitation of cold break. They are also referred to in the industry as copper finings because they are typically utilized in the kettle: often called the copper in the UK.

There are several types of finings. One is Irish moss, a red seaweed or algae that is rich in carrageenan. Irish moss contains polysaccharides that carry a negative charge that readily binds with positively charged proteins in the wort. This binding activity results in precipitation of these proteins after the wort is cooled. These finings are utilized predominantly in the ale brewing world and are not as common in the lager world. They are considered a process aid and are not technically an ingredient since it precipitates out of solution or is filtered out of finished beer.

We utilize kettle finings to aid in producing clear (cooled) wort and ultimately clearer finished beers. Utilizing kettle finings results in beer that is much easier to filter, or if you don't filter, beer that naturally drops much cleaner.

Kettle finings also improve the physical stability of beer by removing haze potential proteins. These proteins, if left in the beer, will eventually combine with tannins and form haze. In other words, the removal of potential haze-forming proteins results in a beer that is not only less hazy when finished or filtered, but stays bright for a longer period of time after it is packaged.

These finings are excellent at binding with these proteins and work to remove them from solution through precipitation. The resulting complex tends to settle out and is removed with the yeast at the end of fermentation.

We use Whirl-Floc in our beers. Whirl-Floc is the trade name for a product produced by Kerry Bio-Science. We utilize a granular form of the product that is very easy to handle and is contains high grade carrageenan. A tabular form is made for the small scale brewer.

There are other Irish moss products that are readily available. They are typically dusty and a little more difficult to handle than the granular or tab forms. They are derived from similar starting material and act in the same manner. Any time you are looking for good clarity, kettle finings are, in my opinion, a good option to exercise. If we are brewing a wheat beer or something that we want haze or turbidity in the finished product, we omit kettle finings from the process.

When we do use them, we add kettle finings 10 min before the end of boil by adding the material into the kettle. Boiling them for 10 minutes seems to be a perfect amount of time. You can draw a sample of finish boiled wort from the kettle and cool it down for visual inspection. You should be doing this anyway to measure your starting gravity. Allow the sample to sit and observe the clarity of the wort and the nature of the precipitate. You are looking for brilliantly clear wort with a relatively compacted precipitate.

I also know a number of small scale brewers that have very good results with gelatin finings for finished beer clarification. There are other aids like PVPP and silica-gels (generally referred to as beer stabilizers) that can be used to remove haze-forming compounds as well.

With all of this in mind, I live by the brewing rule that less is usually more. I tend to utilize as few inputs as possible to gain my desired end result. Each fining product has a specific mode of action. For example: If I wanted to deal with protein haze issues I would start with kettle finings. They are negatively charged and bind with positively charged protein helping to remove protein haze by binding with them in the kettle.

To get yeast out of suspension, I would choose a fining agent for that purpose. Isinglass is positively charged and binds to negatively charged yeast cells aiding in yeast precipitation in the conditioning vessel. These two fining steps will result in very clear finished beer.

Chris Buckley is the Brewmaster at Red Oak Brewing Company in Greensboro, North Carolina.

There are many additives that will speed up the clarification of beer. Due to my background as a Bavarian brewer and maltster, I will concentrate on the traditional method — additive free — the way Red Oak lager beers are produced. This method lends itself well to homebrewers who are also not in a hurry to produce the beer.

To me, time is the key to success with this method. What do I mean by this? You will need to dedicate four to six weeks of lagering at 30–32 °F (~0 °C). Cold conditioning of beer clarifies and increases the colloidal stability of it. You cannot skip this step if you want a clear beer in the traditional method.

The amount of trub material in the wort affects the rate of clarification. Boil vigorously as this helps to coagulate proteins. Remove the hot break prior to fermentation by means of a whirlpool (this is the modern method).

Transferring the fermenting beer off the cold break and into a secondary vessel to complete fermentation yields a beer of better clarity and flavor. Careful transfers that avoid agitation are important. One of the most common mistakes made by homebrewers is agitating during racking, which can cause oxidation.

Beer with a pH of 4.2 to 4.4 will clarify more rapidly. Adjust the pH during mashing and wort boil with sour malt or food grade phosphoric acid to achieve a pH of 5.3 to 5.6 in the pitching wort (unless of course, the pH is naturally in the proper range).

As for fining agents: Adsorption is the process most used in the fining of beer. Finings have an electrostatic attraction to haze forming particles, thereby making the particles heavier to promote sedimentation and/or larger to aid in the removal by filtration. The most common additives to promote clarification are:

Irish moss: Use ½ tsp. per 5 gal. This is a dried algae added to the boil 10 minutes before cast out, which helps coagulate hop tannins and protein in the boil resulting in a greater hot break.

Isinglass. This is the dried swim bladder of fish, mostly sturgeon, soaked in cold water and added to the fermented beer to quickly drop out yeast and other suspended particles from the beer. Amounts to be used in beer vary from one product to another.

Malt Spec-ulation

Phacts on phenolics, nutty nut brown and an alarm ring

I loathe the cloves

How do you reduce the amount of phenolics in a beer? My recent beers have had a slight distaste of cloves, which I'm not too fond of. Is the presence of phenolics due to the yeast strain or what? One final question — if you are reusing the yeast for another beer, should you take it from the first or second fermenter?

Richard Heidemann
Alleroed, Denmark

You are correct that a yeast strain is the most common cause of phenolic aromas in beer. The classic clovey, phenolic producing yeasts are those used for German-style hefeweizens. These yeasts convert ferrulic acid from malt into the unmistakable 4-vinyl guaiacol, which smells just like cloves. As it turns out, wheat malt contains more ferrulic acid than barley malt and if you actually wanted to try to produce more clove flavor using the same yeast strain, using more wheat malt is one way to do that. This is just the opposite of your goals.

Weizen yeast is not the only type to produce detectable concentrations of this compound. Many of the Belgian strains produce enough phenols to leave a not-so-subtle fingerprint in the finished beer and some British ale yeast produce barely enough to be detectable. The other types of yeast that are known for the production of phenols are wild yeast strains. In general, a wild strain is any strain growing in your fermenter other than the one intended. The phenolic aroma from wild strains is usually not the pleasant clove found in weizen beer but is more of a strong medicinal aroma similar to those wonderful phenol sprays like chloraseptic that dull the pain of a sore throat.

Medicinal aromas can also come from the reaction of chlorine with phenols produced during fermentation. The dreaded chlorophenol off flavor arises when chlorine, usually from bleach sanitizers or heavily chlorinated water, and

Today, if the phenolic aroma comes from the yeast it is probably a purposeful trait for the strain.

fermenting beer commingle. One precaution to take if you suspect this to be the problem is to eliminate chlorine from coming into contact with beer. That can be done simply by making the decision to not use bleach as a sanitizer or being sure to rinse thoroughly after use. Also, be sure to use brewing water that is chlorine-free. One method used to remove chlorine from water is to add potassium metabisulfite (found in Campden tablets).

These days there are plenty of good brewing yeasts on the market and if you are pitching yeast from a well-known supplier, I doubt the yeast is contaminated with wild yeast. In the late 1980s and early 90s that was not uncommon, especially in some dried yeast, and phenolic aromas were often blamed on the yeast supplier. Today, if the phenolic aroma comes from the yeast it is probably a purposeful trait for the strain. So, switching strains may help alleviate your problem. We always harvest and re-use our yeast (like other commercial brewers) and the accepted rule is that yeast should be cropped as soon as possible when its viability and vitality are at their peak. Some ale brewers continue to crop yeast from the tops of an open fermenter and this is done towards the end of peak fermentation before the cap begins to fall into the beer . . . although in the case of some top fermenting strains the thick kraüsen never really falls.

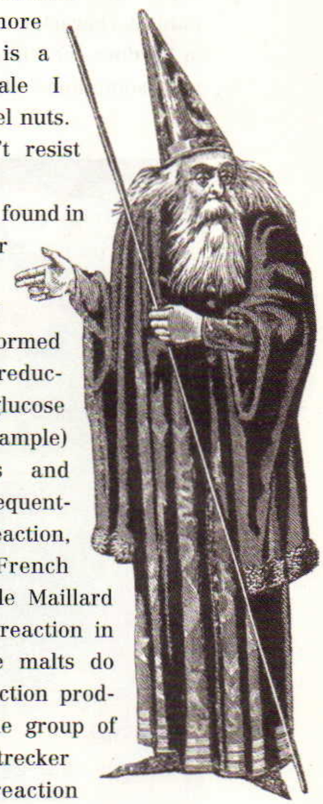
Most brewers these days harvest yeast from the bottom of conical fermenters and one must wait until the yeast is on the bottom and can be taken. Our ale flocculates pretty well and we can harvest yeast about 3–4 days after primary fermentation is complete. The longer you wait to harvest and reuse your yeast, the greater the chance of having sluggish, not-so-healthy yeast in your next batch. I would suggest not reusing yeast that has been sitting on the bottom of a carboy for any longer than two weeks.

Going nuts for nut brown

I brew a pretty good nut brown but I would like to increase the distinct nutty flavor. I'm not sure what ingredients or combination of ingredients produce this flavor. Could you help me out?

Rebel Tjomsland
via email

I guess it really depends on the type of nut brown ale you are brewing. I mean if it is a pea-nut brown ale I would reach for more peanuts and if it is a hazel-nut brown ale I would add more hazel nuts. Sorry, but I couldn't resist the obvious!



The nutty flavors found in brown ales and other dark beers come from malt. And nutty flavors in malt are formed during kilning when reducing sugars react (glucose and maltose, for example) with amino acids and polypeptides in the frequently cited Maillard reaction, named after the French chemist Louis Camille Maillard who discovered the reaction in 1912. Although pale malts do contain Maillard reaction products (MRPs), it is the group of MRPs that undergo Strecker degradation, a reaction where intermediates in the Maillard reaction combine with amino acids and condense into nitrogen-containing cyclic molecules. These molecules have biscuity, nutty and toasty aromas. Adolph Strecker (1822–1871), by the way, was a German chemist born in Darmstadt who developed a method to synthesize amino acids and identified the so-called Strecker degradation in the laboratory before the Maillard reaction was discovered.

The products of the Maillard reaction and Strecker degradation range from toasty to burnt — in the middle is nutty. Maltsters can adjust kiln temperature and moisture content during kilning and roast malts with varying degrees of modification to influence the flavors of roasted malts and ultimately beer flavor. One of my favorite brews is a brown ale that my brewery makes once every year or so that contains brown malt. The signature flavor from the brown malt is a dry, roasty nuttiness that I really like.

Other malts that give the type of flavor you seek include Munich malts, especially darker types, biscuit malt, aromatic malt, amber malt and other high-kilned malts. One of the best ways to select malt for a brew is to taste it or, as many brewers say, "chew" the malt. Munching on malt is a great way to evaluate its character as it gives a good idea of hardness or friability (ease of milling), can sometimes indicate evenness of modification and gives a straight-up sensory profile of that one malt. Sometimes when I am searching for a flavor I can't adequately describe with words I find what I am after when chewing on malt samples.

Ring around the bottle

I have always heard that if your beer has a ring at the top of the bottles that this is almost a guarantee that your beer has some sort of contamination. Is the ring on top of a carboy the same thing? I threw away the first batch where this happened, but went ahead and kegged the last batch where this happened and it was really good. It doesn't seem contaminated, or am I just drinking it fast enough that I don't give it time to really go bad? I know there are some beers where outside contamination is a good thing, but how can you tell? Is there any way to tell if your batch is contaminated or should you go through the trouble to bottle or keg and find out for yourself?

Tim Behm
Austin, Texas

First off, all beer fermentations have a "bath-tub" ring at the top of the beer at the end of primary fermentation. German brewers call this "braun hefe" or brown yeast and it is a combination of trub, hop resins and yeast that combine on top of the brew during fermentation. Some braun hefe ends up stuck to the wall of the fermenter and some of it ends up in the bottom of the fermenter and looks like little bits of chocolate. If the ring you are describing fits my description of braun hefe you have nothing to worry about. I'll say that again. A big, thick, crusty, brown, nasty looking ring of schmoo stuck to the side of the fermenter near the top of the beer is totally normal and it is also common for some of this crunchy stuff to end up in the bottom of the fermenter with yeast. Do not worry about it!

Also, I must say that the number of beers in the world that actually benefit from "contamination" is virtually nil as viewed through my accepted definition of contaminate. A beer that contains a contaminant has something in it that is normally unwanted and is "contaminated." Although many Belgian beers have yeast and bacteria from the locale where they are brewed, I would argue that these unusual microorganisms are typical for these unusual styles — a good lambic is not contaminated because the brewer knowingly invited these invisible visitors into the wort.

Lambics, unlike "normal" beers, do contain *Pediococcus* and go through a ropy phase where polysaccharide "ropes" develop in the beer, but that stage passes and the finished beer is not ropy. Ropiness can be found in bottled beer contaminated with *Pediococcus* but is rare these days because of improvements in cleaning and sanitation as well as better knowledge of the causes of such problems. I have never actually seen ropy beer . . . thank goodness! I think the anecdotal ring you mention in your question would include ropy beer. Another surface contaminant of beer is acetic acid bacteria, but those critters require oxygen and would therefore be highly unusual in bottled beer (although they are in cask ales).

Some things that can be on the surface of beer that are not normal include little white mold colonies, the previously mentioned ropiness associated with *Pediococcus* and the thin pellicle seen in beer contaminated with either acetic acid bacteria or *Brettanomyces*. These days there are many brews inoculated with *Brettanomyces* and these fermentations usually exhibit a pellicle on top of the beer. In beers pitched with typical ale and lager yeast strains the appearance of oddities on top of the beer following fermentation is definitely not acceptable. Keep in mind, especially with many ale strains, that some yeast may stay on top of the beer after fermentation and even after most of the yeast has settled to the bottom of the fermenter.

My advice is not to worry too much about such matters. If you practice good sanitation methods, buy good yeast and ferment in a closed fermenter things are most likely going to be just fine because the environment I have described is difficult to become contaminated. Homebrewers, for the most part, do not have labs so early detection is not an option. Most packaging commercial breweries have labs and routinely use a variety of microbiological methods to monitor beer for unwanted microbial critters.

Some folks believe that a microscope is a great tool because you can actually see contaminants. The problem is, contaminants are a very small percentage of the population of life in beer. Most fermentations contain around 20 million yeast cells per milliliter and as few as 100,000 bacteria per milliliter can begin to pose a problem. That's 1 bacterium for every 200 yeast cells and bacteria are about 1/10th the size of a yeast cell. Fewer than 100 bacteria per bottle can cause trouble in packaged beer — pretty hard to spot by examining a sample of beer under the scope.

The best way for homebrewers to have confidence in their beers is to use good techniques, look out for slow or sluggish fermentation, monitor the progress of fermentation, smell the gas bubbles coming out of the airlock, monitor the appearance of the fermentation and taste the beer before bottling. If everything seems normal from a time perspective, looks normal, smells normal and tastes normal . . . chances are it is normal.

A spec of difference?

I know how to read a malt specification sheet, but — like most homebrewers — I don't on a regular basis. If I need Pilsner malt, I just buy some at my local homebrew shop and treat it as I treated my last sack of Pilsner malt. But I'm wondering, how much do malt specs vary? In particular, does the potential extract vary a lot from batch to batch (or year to year) of the same malt? And does it vary enough to influence my original gravities? Are there some malt specifications that sometimes "drift into the red" and would require me to alter my mashing program? I understand that the monetary considerations of commercial brewers make them very interested in all the particulars. But, from a practical standpoint, does a 5–10 gallon homebrewer who is just looking to make good beer need to worry about anything that is reported on malt specification sheets?

Brian French
Hayward, California

Malt specifications, i.e. specs, have some information that is very useful to give brewers a feel for what they are using in their brews and commercial brewers take these specs very seriously because they are in the business of creating the same beer day-to-day. Color, degree of modification, protein content, extract, enzyme content, beta-glucan content and moisture are all part of standard malt specs and are required pieces of data to evaluate malt. Since most maltsters make malt to suit the needs of their customers, most malt is made in accordance with the biggest customers in mind because if out-of-spec malt is delivered to a medium to large-sized brewery that falls out of spec then the shipment is likely to be rejected and sent back to the maltster. A good business is run to minimize shipments by customers. Maltsters as a whole do a good job converting barley, also purchased based on stringent specifications, into malt that brewers want to purchase. In some years, the barley crop is bad because of weather and malt quality is affected, but for the most part brewers enjoy a ready supply of good malt.

When I buy malt I know the general specs for what I am buying. This means I know the color, the protein range, the degree of modification and the approximate enzymatic activity. The extract content of the malt, expressed as hot water extract or the laboratory yield, is actually a number I personally do not fuss over much because most malts of a similar type almost always fall into a very narrow range. It has been my experience that some of the challenges I have had with malt, be it flavor or wort separation issues, do not show up on malt specs and a "problem" lot can look totally normal when judged using a spec sheet.

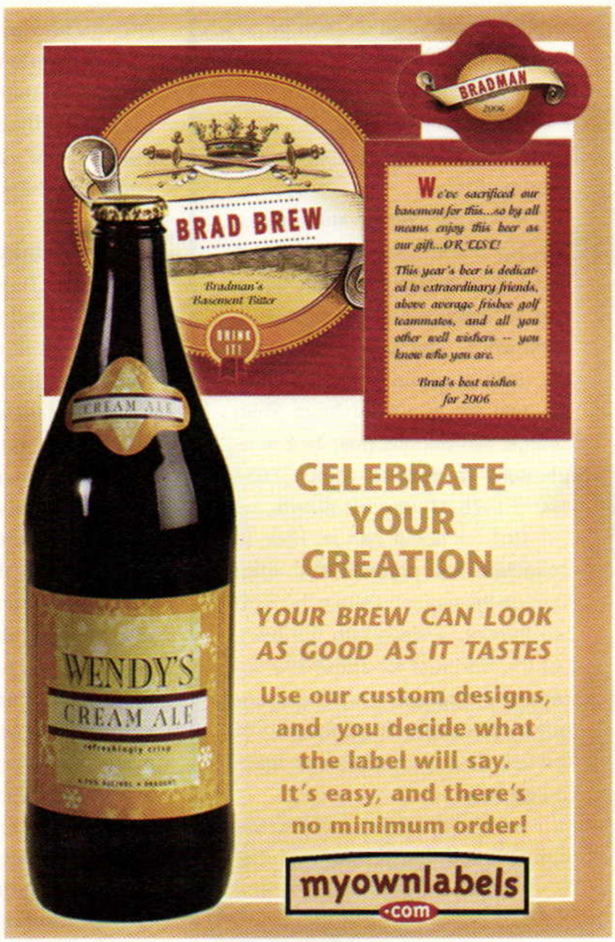
Pale malt is typically purchased in railcar quantities or by the truckload and the malt specs typically go directly from the malthouse lab to the brewery needing the information. Homebrew ingredients are handled by distributors who often repackage malt in smaller bags than the standard 50 pound and 25 kilogram bags used in North America and Europe, respectively. It's easy to lose track of lot numbers when this happens, but not impossible to track. Then the malt goes out and is sold by retailers (homebrew shops, usually) and sometimes the malt is blended into ingredient kits or sold in bulk where lots are mixed. If the lot number and specs left the malthouse with the malt, chances are they have been separated from each other long before you buy your malt.

This is no dig to any of the players in this chain of custody, it's just a realistic look at the facts. Even if you did have a bag of malt from a maltser with a lot number printed (which by the way I have never seen) and decide to call the maltster to ask for specs, you're against the wall. The person on the other end of the phone is tasked with supporting a plant producing literally thousands of tons of malt daily and a call from a homebrewer about 50 pounds of malt purchased from a retailer 2 or 3 links separated from the malthouse is probably not going to be placed on the must-do list for the day.

Again, the good news is that if you know the product you are buying, who produced it and what the product specs are, you will be fine because companies who produce 2-row, 50 °Lovibond crystal malt, for example, are going to do their best to produce a consistent product to satisfy their customer's needs. Malt is not the only thing consumers buy that has a spec sheet. Open your cabinet in the kitchen and every single commodity-type product has a spec sheet — sugar, flour, coffee, rice, etc. I watch a lot of cooking shows and have never heard any one talk about adjusting recipes based upon a specification!

Malt specs do indeed exist and they contain valuable information. Commercial brewers are required to know this information in some detail but at the homebrew level, malt analysis is less available. I hope my laid back advice is not disappointing! I will take this opportunity to quote Mr. Charlie Papazian — "relax, don't worry and have homebrew!"

BYO Technical Editor Ashton Lewis has been answering homebrew questions as his alter ego Mr. Wizard for the last ten years. Do you have a question for him? Send inquiries to *Brew Your Own*, 5053 Main Street, Suite A, Manchester Center, VT 05255 or send your e-mail to wiz@byo.com. If you submit your question by e-mail, please include your full name and hometown. In every issue, the Wizard will select a few questions for publication. Unfortunately, he can't respond personally. Sorry!



Gruitbier

An herb brew from the Middle Ages

by Horst D. Dornbusch

RECIPE

Gruit Ale
(5 gallons or 19 L, all-grain)
OG = 1.064 FG = 1.014
SRM = 45 ABV = 6.6%

Ingredients

8.5 lbs. (3.8 kg) pale ale two-row malt 3–4 °L
1.0 lb. (0.45 kg) Briess flaked barley (1.5 °L)
2.5 lbs. (1.14 kg) dark Briess Munich malt (20 °L)
0.5 lbs (0.23 kg) Briess roasted barley (300 °L)
1.0 lb. (approx. 0.45 kg) Weyermann dark wheat malt (6—8°L)
½ oz. (56 g) dried lavender
2 oz. (56 g) dried woodruff
½ oz. (14 g) dried juniper berries
½ oz. (14 g) dried rosemary
1 package ale yeast (English or German wheat beer)
½ cup dry malt extract or corn sugar (for priming)

Step by Step

Place the herb mixture into a pot. Boil about two quarts (or two liters) of water. Pour over the herbs and let steep for about one hour. Meanwhile, single-infusion mash the grain at about 152 °F (67 °C). Let rest for about an hour. Then sparge, allowing the grain bed temperature to rise to about 165–170 °F (~75 °C), but not above.

Boil for about half an hour to coagulate the proteins into trub. Turn off the heat and strain the herb tea through a sieve into the wort. Let the wort rest for about 30 minutes to precipitate the trub. If your gravity is slightly off at the end of the boil, do not worry: You are making gruitbier!

Heat-exchange the wort to the fermentation temperature of the

recipe continued on page 21

Here is a beer style you may never have heard of, but which, in its time — some 500 to 1,000 years ago — was clearly the most common beer style in the world. The beer style is gruitbier or gruit beer. Gruit (pronounced "groot") is old German for herbs. In modern German, the noun "Gruit" has evolved into "Kraut," which is of course part of the word sauerkraut (literally "sour herb"), the name of the well-known German relish of pickled white cabbage.

Gruit (or herbs) — either as a single type or as a mix — is what most medieval brewers used to flavor their beers, both on the European continent and on the British Isles. But gruitbier began die out in the 16th century, when hops replaced gruit as a universal beer-flavoring ingredient. Gruitbier is now experiencing revival, however, among North American craft brewers, especially in brewpubs. At the Great American Beer Festival, these beers usually compete in the "Herb and Spice Beer" category, which had 49 entries in 2004 and 57 in 2005.

Gruit versus hops

In the Dark Ages, under the feudal system of landownership, people could do with the soil and nature's bounty only what they had been granted permission to do. All facets of life were strictly regulated based on a clear division of rights and obligations between lords, vassals and serfs. This meant that all land that was not specifically bestowed upon a vassal remained the preserve of the crown. And crown land, which was mostly uncultivated, was also where brewers tended to find the best gruit. Though many monastery, burgher breweries and private households were given the right to brew, not everyone was given the privilege to pick gruit on public lands. Thus, the quality of a brewer's beer in those days depended on access to gruit. Especially on the European continent, the crown reserved that privilege initially only for its own estates. Later, the gruit right was delegated even more so to local authorities — mostly secular lords and the church — who doled it out, often corruptly for a fee, to the unwashed masses. The term gruit, therefore, eventually came to mean not only the herbs brewers used in their beers but also the taxes they had to pay to their overlords for the picking privilege . . . that is, until beer flavored with cultivated hops began to replace beer flavored with wild and taxed gruit.

Apparently, hops were first used in beer by Benedictine brew monks in the Abbey of Weihenstephan in Bavaria, outside Munich. The evidence for this is a document dating from 736, only a dozen years after the founding of Weihenstephan by the Franconian missionary Corbinian. The document is the oldest known mention of hops anywhere. It refers to the cultivation of the hops vine in the monastery gardens. Though there is no reference to beer in the document, it is extremely doubtful that these industrious brew monks cultivated the vine just for its esthetic appeal. We know from other records, dating from 859, that the Bohemians (present-day Czechs), too, were among the early pioneers of hops used as a flavoring component for beer.

From central Europe, the use of hops in beer spread slowly but steadily northward and westward, replacing gruitbier in its wake. The next chronological milestone in the spread of hops in beer is a French law, proclaimed by King Louis IX in 1268, in which the King stipulated that, in his realm, henceforth only malt and hops may be used for beer-making. By the 1300s, we know, hops had also moved

Gruitbier by the numbers

OG	1.064 (16 °P)
FG	1.014 (3.5 °P)
SRM	40–60
IBU	none
ABV	6.6%

to the Netherlands, where it had become a regular ingredient in beer-making. And in 1516, the Bavarian beer purity law (the Reinheitsgebot) made hops one of only three allowable ingredients in beer (next to malted barley and water). All this suggests that, at least by the late Middle Ages, hops had become a common brewing ingredient replacing gruit on most of the continent.

In Britain, on the other hand, hops were much slower to gain acceptance in the brew houses. In fact, its introduction seemed to raise nothing but controversy. It was during the early 1400s, that the hop vine seems to have made its first appearance as a cultivated plant in England — even though hops had grown wild there at least since 5,000 B.C.

The early 15th century was the height of the Hundred Years War between France and England, which actually lasted for 116 years between 1337 and 1453. During this protracted cross-channel strife, trade blossomed particularly between England and Flanders (in present-day Belgium) just to the north of the region most affected by the war. Raw wool and finished cloth from such beer towns as Bruges and Ghent were among the most important trading commodities. Many Dutch-speaking farmers from Flanders even migrated to England, where they settled mostly on the fertile soil of Kent.

These Flemish immigrants were almost certainly the first to introduce British brewers to hops, which they cultivated in Kent as they had done back home. And today, of course, Kent is still the home of what is perhaps the most famous of English ale hops, called East Kent Goldings. As we know from a manuscript from 1440, the new — hopped — ale became known as "beer" to distinguish it from the traditional un-hopped "ales." By the time of the Glorious Revolution under William III of Orange that gave Britain a more stable constitutional monarchy, in 1688, British ale had emerged with a dominant hoppy nose, and the term "ale" had taken on a meaning that is closer to our own. By then, ale denoted a strong, hopped, top-fermented brew made from the first runnings of the mash, while the term "beer" was reserved for a brew from the second runnings. Also, a "small beer" was an even weaker brew from the third runnings. Thus, by the beginning of the 17th century, the once-dominant unflavored or gruit-flavored beers had all but disappeared from British brew houses, too.

With this kind of lineage, there is no right or wrong way to make this beer. In a sense, you could make (almost) any old beer and flavor it with any old amount of any old herb or combination of herbs, and you would have a gruitbier. Thus, when replicating a gruitbier at home or in a craft brewery, there are only a few rules to observe. The rest is just our interpretation of the brew from the foggiest of evidence. Here are the basic rules:

Herbs

The medievals used just about any herb to flavor their brew. Sometimes they even used herbs that were harmful to your health. Perhaps the most common herbs for spicing beer in those early days were yarrow, bog myrtle (also known as sweet gale), juniper, rosemary, lavender, and woodruff. Depending on the flavor you want in your gruitbier, you can choose a single herb or a mixture of herbs. As always when using ancient descriptions, measurements can be a problem. What really is "a handful?" I use about five ounces (or 140 grams) of herbs for five gallons (19 liters) of beer. I made mine with 2 ounces (56 g) of woodruff, and ½ ounce (14 g) each of rosemary, lavender and juniper berries. Place these in a pot and pour about two quarts of boiling water over them, then steep them for about an hour and strain the herb tea through a sieve. Discard the herbs.

Bog myrtle or sweet gale, (*Myrica gale*), was a very common beer flavoring in England. Beers brewed with it in place of hops use to be called gale ale. Bog myrtle is a small, deciduous shrub with resinous-tasting leaves.

Juniper, (*Juniperus communis*) is a coniferous shrub that grows well throughout the northern hemisphere. The blue-black juniper berries are available dried in the spice section of your grocery store. Their taste is probably best known from gin, which is a clear spirit flavored with juniper berries. The traditional ale of Finland, sahti, is spiced with

recipe continued from page 20

selected yeast. Rack the brew after about three weeks, prime and package. The brew is ready to drink after about a week of conditioning.

Gruit Ale
(5 gallons or 19 L, extract plus grain)
OG = 1.064 FG = 1.014
SRM = 45 ABV = 6.6%

Ingredients

6 lbs. (2.7 kg) pale ale liquid malt extratct
1.0 lb. (0.45 kg) Briess flaked barley (1.5 °L)
2.5 lbs. (1.14 kg) dark Briess Munich malt (20 °L)
0.5 lbs (approx. 0.23 kg) Briess roasted barley (300 °L)
1.0 lb. (approx. 0.45 kg) Weyermann dark wheat malt (6–8 °L)
½ oz. (56 g) dried lavender
2 oz. (56 g) dried woodruff
½ oz. (14 g) dried juniper berries
½ oz. (14 g) dried rosemary
1 package ale yeast (English or German wheat beer)
½ cup dry malt extract or corn sugar (for priming)

Step by Step

Prepare the herb mixture as described for the all-grain version. Mill the specialty malts and steep in four bags for about an hour in about two gallons (eight liters) of water at about 160 °F (71 °C).

Remove the bags and stir in the extract. Add another 2 gallons (7.6 liters) of additional water. Boil for about 20 minutes. Then strain the herb tea into the wort and measure the gravity. Because it is not certain how great a contribution to extract you achieved from the steeped grain, take a gravity reading and add enough water to get close to the target OG.

Then heat-exchange the wort to the fermentation temperature of the selected yeast (most likely close to room temperature). Rack the brew after about three weeks, prime and package. Age at least a week and enjoy!

both juniper berries and twigs. Unless you want the juniper flavor to be dominant, add no more than ½ to 1 ounce (14–28 g) to your brew.

Lavender (*Lavandula angustifolia*) is a widely available herb in the mint family *Labiate*. It is a perennial with gray

Although lavender has a sweet aroma, it is used in brewing for its bittering qualities and flavor.

leaves and purple flowers that bloom in summer. At harvest the leaves and flowers are cut about 6 inches (15 cm) below the buds as soon as they bloom. Although lavender has a sweet aroma, it is used in brewing for its bittering qualities and flavor. You should add lavender late in the boil or if you're feeling experimental, dry hopping with the flowers is an alternative.

Rosemary (*Rosmarinus officinalis*) is easy to find in the herb and spice section of your supermarket. It is an evergreen shrub with one-inch long leaves that impart a camphor-like, aromatic pungency to the brew. Tastes are subjective, but I would not use more than ½ to 1 ounce (14–28 g) of rosemary in my gruitbier.

Woodruff (*Asperula odorata*) appears to have been more common in the Germanic beer culture on the continent than in the Anglo-Saxon beer culture on the British Isles. Sweet woodruff grows in shady patches at the edge of forests. It has star-like whorls of narrow, bright-green leaves on 8 to 10-inch high stalks. I happen to be very fond of woodruff, so I like to use about 2 ounces (28 g) of it as part of my herb mixture for gruitbier. To me, the sharpness of woodruff is mildly reminiscent of hops. Today, the marriage of woodruff and beer is still alive in Germany, where a jigger of woodruff-flavored sugar syrup is often used to balance the lactic acidity of a spritzy Berliner Weisse. Woodruff leaves are also used to flavor a German May punch made from a mixture of young Moselle wine and Champagne, with fresh strawberries immersed in it.

Yarrow (*Achillea millefolium*) has bitter, astringent-tasting leaves and flowers. To my taste, yarrow can easily overpower a brew, so do not use more than two ounces of it.

While some of these herbs are available in supermarkets, others may be hard to find. For the rarer herbs, there are mail-order vendors on the Internet. If all else fails, you might have to plan your gruitbier way ahead by ordering seeds on the web and plant them in small flower pots in your kitchen. Woodruff and yarrow, incidentally, are easy to grow, if you have a garden.

Because most of these medieval herbal hops-substitutes add a slight bitter-sweetness to the brew, a quick and easy way to imitate the flavor of gruit is to make a regular, un-hopped, dark brew and add about a cup of Vermouth right after the start of fermentation. Taste the brew before bottling. If desired, you can add more Vermouth before conditioning and packaging the brew.

Grain

Because all the beer of the common folk in the Dark Ages was brown or darker, compose the grain to a color roughly between a porter and a stout, around 40 to 60 SRM. Precision is not crucial when making a gruitbier. The darkness of these early beers was the direct result of unpredictable malting techniques. The malted grist was kiln-dried over open fires, which caused the grain to become somewhat dark, smoky and roasted.

Also, the kernels were almost certainly unevenly malted and some may have remained unmalted altogether. Therefore, contrary to all modern brewing practices, an authentic gruitbier probably ought to be made with the worst rather than the best brewing grain. To imitate this condition in modern homebrew practice, compose the grain bill with about 55% of any pale ale malt for enzymes.

Then, to replicate the unevenness of the malting process, mix about 10% flaked barley (such as Briess at approx. 1.5 °L) plus 5% roasted barley (such as Briess at approx. 300 °L) into the grist. The latter also adds a needed acrid burnt component. Finally, to supply the brew with body, use about 25% dark Munich malt (such as Briess at about 20 °L).

For a little bit of creaminess, I also add about 10% dark wheat malt (several maltsters offer these around roughly 6 to 8 °L). Because medieval beers tended to be stronger than most modern session brews, I would shoot for an original gravity of about 1.064 (16 °P).

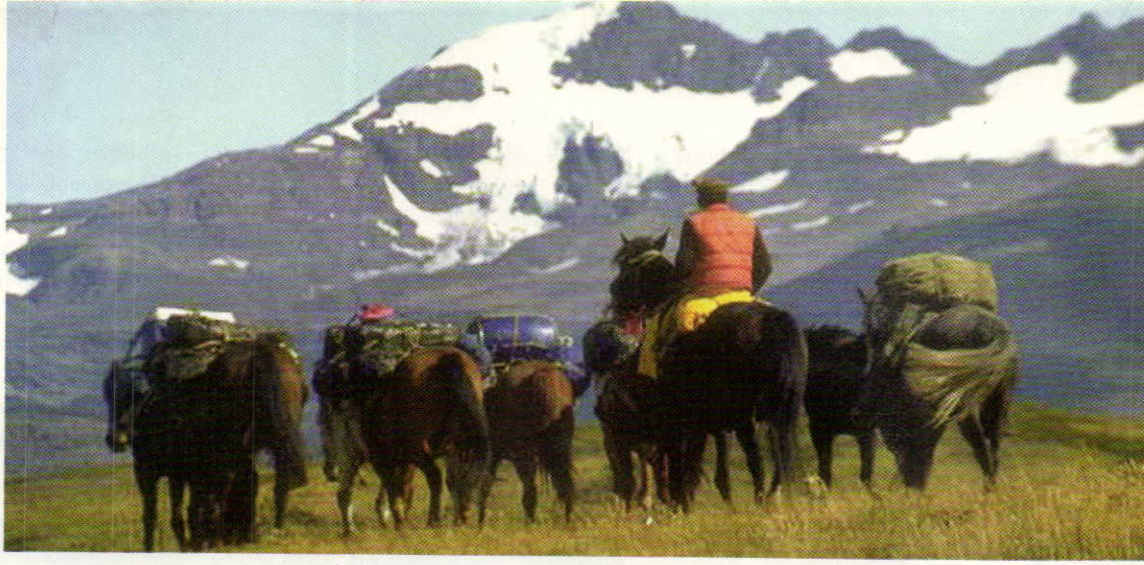
Although we have not included an extract-only recipe, my advice for the pure extract brewer is to use any kind of dark ale liquid malt extract as a substitue for the grain (an extract blended for porter is probably the best choice) — but check the can's label to make sure the extract does not contain corn syrup. Corn is a New World crop that would not be authentic in a beer that evolved long before the New World was discovered!

Yeast

You can use essentially any ale yeast for gruitbier. I like to use hefeweizen yeast, because it adds a slightly phenolic and spicy bubblegum note to the brew — I think this adds some depth to the brew's herbiness. For a full run down of all the yeast strains available to homebrewers, take a look at our Homebrew Yeast Strains chart on page 32. Note that gruitbier does not need to be all that effervescent, so half a cup of priming agent is plenty. After about three weeks, prime and package. The brew is ready to drink after about a week of conditioning.

Horst Dornbusch is an award-winning beer writer and brewer. He owns Cerevisia Communications, a PR agency for the international beverage industry.

HYBRID



Tex-mex is hybrid style of cuisine, blending interior Mexican and Southwestern US (especially Texan) influences. Most Tex-mex dishes — including enchiladas, tacos, burritos (and chimichangas), nachos and fajitas — combine hard or soft tortillas and salsa with spiced meat and cheese. In central Texas, where I live, you can't swing a duck (*pato*) without hitting a Tex-mex restaurant.

The beer menu at these places usually features a whole raft of Mexican beers — Bohemia, Carta Blanca, Dos Equis Special Lager, Modelo Especial, Pacifico, Sol, Tecate and, of course, the ubiquitous Corona.

By **Chris Colby**

These beers are all fizzy yellow lagers in the same basic Pilsner style that is sold all over the world. When I order beer at a Tex-mex place, I usually opt for a beer that is itself a hybrid — Negra Modelo, a Mexican Vienna lager.

"Negra Modelo" means dark Modelo, with "Modelo" being the name of the brewery that produces it (Cerveceria Modelo, Mexico City, Mexico). In Grupo Modelo's promotional literature, Negra Modelo is alternately referred to as a Vienna-style lager or a Munich-style lager. The Beer Judge Certification Program (BJCP) pegs it as a Vienna lager, though, and so do most beer authors. Brewed since 1926, Negra Modelo was for many years one of the few existing Vienna-style lagers in the world. European breweries abandoned the style for Pilsner-style beers or — if an amber beer was to be brewed — for Octoberfests.

Another Mexican beer — Dos Equis Amber — is also described as a Vienna-style lager by its brewery (Cerveceria Cuauhtémoc Moctezuma, Monterrey, Mexico). Bohemia, made by the same brewery, is sometimes described as a Vienna lager, but more closely resembles a Pilsner (although it's deep gold color is a little darker than most).

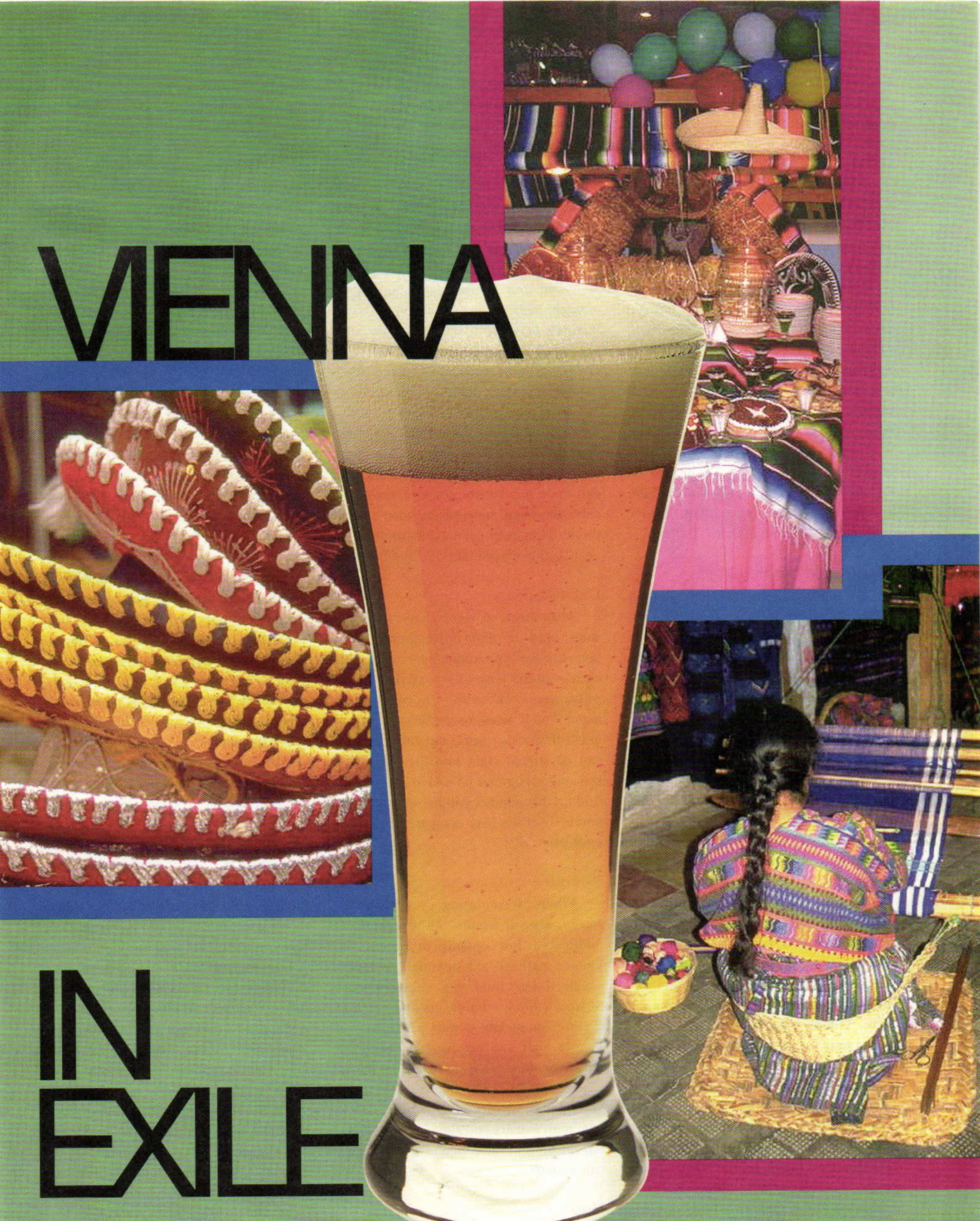
A few American breweries have added Vienna lagers to their lineups. The August Schell Brewery (of New Ulm, Minnesota) offers a Vienna lager called FireBrick in their year-round lineup and Leinenkugel's Red Lager is also sometimes described as a Vienna lager. Leinie Red is brewed by the Leinenkugel Brewery of Chippewa Falls, Wisconsin — a subsidiary of SABMiller.

Brewing a Mexican Vienna lager — or an all-malt American craftbrew style Vienna lager — is fairly simple, but there are a few things to keep in mind.

Vienna Malt

The key ingredient in a Vienna-style lager is Vienna malt. This should make up the majority — if not the entirety — of your grain bill. Vienna malt is a 2-row base malt that is darker than most pale malts, but lighter than Munich malt. Pilsner malts, and generic 2-row pale malts, usually fall around 1.5–

VIENNA IN EXILE



2 degrees Lovibond (°L). English pale ale malts usually rate around 3 °L. Vienna malt is typically rated around 3–6 °L, while light Munich malts rate from 8–12 °L and dark Munich falls around 20 °L. Homebrewers tend to think of Vienna as a extra-light version of Munich malt.

A beer made from all Vienna malt has a malty character, with a slight biscuity or nutty aspect, but that description really doesn't do it justice. Just as Munich malt has a distinctive character that you can recognize once you've brewed with it, so does Vienna. Vienna and Munich have a similar malty/grainy flavor, but you can tell them apart without much trouble if you've brewed with them a couple times. Weyermann, Durst and Briess make Vienna malts that are available to homebrewers. Weyermann also makes a Vienna malt extract, called Vienna Red, that is made with Vienna malt, Pilsner malt and melanoidin malt.

Pilsner and Munich Malts

A Vienna lager may also contain Pilsner or light Munich malt. Adding Pilsner malt lightens the color and softens the Vienna malt profile while adding Munich darkens the beer and adds melanoidin-rich, Munich malt notes. Both may be added together, to "round out" the malt profile. As a rough guideline, I would say Pilsner malt could occupy up to about two thirds of the grain bill. The Vienna malt will still stand out against this background. A light Munich malt could maybe comprise up to around a third; more and it will overpower the Vienna malt flavor.

Some Vienna lagers are made from a mixture of Pilsner and Munich, with no Vienna in the mix. (Schell's beer is made from Pilsner, Munich, CaraPils and caramel malt.) Although you can get the right color and a very similar flavor, I think Vienna lagers should contain Vienna malt — your mileage may vary.

Caramel and Color Malts

A small amount of crystal malt or caramel malts — including crystal malts from 30–60 °L as well as CaraVienne and CaraMunich® malts in the same color range — can be added to increase color depth and give a little sweetness to back up the malt character. Don't overdo it, though — keep specialty grains under 0.75 lbs. (0.34 kg) per 5 gallons (19 L). At most, the specialty malts should accentuate the malty Vienna notes. They shouldn't compete with (or overshadow) the Vienna malt.

Some homebrewers can't seem to formulate a light lager recipe without including CaraPils malt in the grist ("for body"). And, you can add up to 0.5 lb.. (0.23 kg) of CaraPils if you want. However, your Vienna lager should have enough body if you've added a bit of medium crystal/caramel malt and keep your mash temperatures constant.

If you'd like, you can add a very small amount of a dark malt — such as chocolate malt or Carafa® malt — to add a touch of color and change the hue of the beer from reddish to coppery. You don't want to add enough dark malt that you can taste any roasty notes or make the color too deep, however. A good rule of thumb is to keep color malts under 0.75 oz. (21 g) per 5 gallons (19 L) of beer.

Corn Adjunct

Most Mexican Vienna lagers contain some corn in their formulation. As a homebrewer, you could add up to 20% corn — in the form of grits, flaked maize or brewers corn syrup — to your Vienna lager. You'll need to perform a cereal mash if you use grits, but flaked maize can be stirred right into the mash and brewers syrup can be added in the boil. Adding this adjunct will lighten the color and body of the beer compared to an all-malt beer.

Recipe Formulation

When formulating your Vienna recipe, keep it simple. Although I have outlined a few options to accent the Vienna malt, all are optional. And personally, I don't think Vienna lagers benefit from adding a bit of this and pinch of that for complexity — start with a base of Vienna malt and maybe add one or at most two other grains to tweak the flavor.

Extract brewers should either use a Vienna malt extract as their base, or use pale malt extract and steep (actually partial mash) as much Vienna malt as they can manage.

Hops

Any hop without a strong varietal character will work as a bittering hop in a Vienna lager. Any hops, such as German noble hops, that traditionally appear in Octoberfests are a good choice. Domestic hops such as Willamette, Mt. Hood or even Clusters should be OK, especially for Mexican Vienna lagers, which are typically hopped less than American craftbrew versions. The slightly "spicy" Tettnanger is one of my favorite hops for this style.

As with everything else in a Vienna lager, the hops should support the Vienna malt, not compete with (or overshadow) it. A dose of bittering hops that yields 20–25 IBUs is what you should be shooting for. Too little bitterness and the beer will be too sweet; too much and you will obscure the Vienna malt character. If you simply must, you could add up to 0.25 oz. (7 g) of flavor hops for the last 15 minutes of the boil, but a single addition of hops for bittering is best.

Yeast

Any lager yeast will work for a Vienna lager, but those that are typically used in malty styles will do best. Octoberfest yeast strains are an obvious choice, but strains designed for bocks and Bohemian Pilsners will work well, too. I personally like White Labs WLP920 (Old Bavarian Lager) yeast because it's a little more aromatic than other lager yeasts.

In order to run a good fermentation, make a yeast starter big enough to get the fermentation started within 12 hours and adequately attenuate the beer, but not so big that it will dry the beer out excessively. A 3 qt. (~3 L) yeast starter at a starting gravity of around 1.030, well-aerated, is optimal for 5 gallons (19 L) of beer.

If you can't maintain lager temperatures, you can still make a Vienna lager. A little-known fact about lager yeasts is that they can be used at ale temperatures. Your beer will be more estery than a standard lager, but will still taste like lager beer. Many times homebrewers who wish to replicate a lager beer at ale temperatures are told to use a clean ale strain (or a "steam" beer strain) of yeast. However, a clean ale does not really taste like a lager. A "dirty" lager, however, will still taste lager-like — it will just have more yeast-derived aroma.

If you do use a lager yeast at ale temperatures, you must make a starter and aerate your wort well. Low pitching rates

RECIPES

On the Beautiful Blue Rio Grande (Mexican Vienna Lager)

(5 gallons/19 L, extract with grains)
OG = 1.048 FG = 1.011
IBU = 24 SRM = 11 ABV = 4.7%

Ingredients

0.75 lbs. (0.34 kg) Coopers Light dried malt extract
0.75 lbs. (0.34 kg) corn sugar
4.0 lbs. (1.8 kg) Weyermann Vienna Red liquid malt extract (late addition)
2.0 lbs. (0.91 kg) Briess Vienna malt
6.33 AAU Hallertau hops (60 mins) (1.6 oz./45 g of 4% alpha acids)
1 tsp. Irish moss (15 mins)
1/4 tsp yeast nutrients
Wyeast 2124 (Bohemian Lager), Wyeast 2206 (Bavarian Lager) or White Labs WLP820 (Octoberfest/Märzen) yeast (3 qt./~3 L starter)
1 cup corn sugar (for priming)

Step by Step

Heat 0.75 gallons (2.8 L) of water to 165 °F (74 °C) in your brewpot. Heat 1.75 gallons (6.6 L) of water to 170 °F (77 °C) in a separate pot. Place crushed Vienna malt in a nylon steeping bag and steep grain in brewpot at 154 °F (68 °C) for 45 minutes. Remove grain bag and place in colander over brewpot. Rinse grains slowly with about 48 fl. oz (1.4 L) of 170 °F (77 °C) water from the other pot. Add remaining hot water to liquid in brewpot, to make about 2.5 gallons (9.5 L) of wort, and bring to a boil. When boiling, stir in dried malt extract, corn sugar and hops and boil for 60 minutes. At 15 minutes left in boil, add Irish moss and yeast nutrients. At end of boil, stir in liquid malt extract and let sit for 15 minutes before cooling. Cool wort in sink or with immersion chiller until temperature is about 65 °F (18 °C). Rack wort to fermenter, top up to 5 gallons (19 L) aerate and pitch yeast. Cool down to 58 °F (14 °C) overnight. Ferment at 58 °F (14 °C). Lager for 2 months at 40 °F (4.4 °C) or below.

Double Crossed (Mexican Vienna Lager)

(5 gallons/19 L, all-grain)
OG = 1.044 FG = 1.009
IBU = 21 SRM = 10 ABV = 4.5%

Ingredients

5.0 lbs. (2.3 kg) Breiss Vienna malt
2 lb. 14 oz. (1.3 kg) Briess Pilsen malt
2.0 lbs. (0.91 kg) flaked maize
0.33 lbs. (0.15 kg) crystal malt (60 °L)
5.5 AAU Mt. Hood hops (60 mins) (1.1 oz./31 g of 5% alpha acids)
1 tsp. Irish moss (15 mins)
1/4 tsp yeast nutrients (15 mins)
Wyeast 2042 (Danish Lager), White Labs WLP850 (Copenhagen Lager) or White Labs WLP940 (Mexican Lager) yeast (3 qt./~3 L starter)
1 cup corn sugar (for priming)

Step by Step

In your kettle, heat 3 gallons (11 L) of water to 142 °F (61 °C), stir in grains and rest for 15 minutes at 131 °F (55 °C). Heat mash to 148 °F (64 °C) for a 30-minute rest then heat to 160 °F (71 °C) for a 15-minute rest. Heat to 170 °F (77 °C) and transfer to lauter tun. Collect about 5.5 gallons (21 L) of wort, add 1 gallon (3.8 L) of water and boil for 90 minutes, adding hops, Irish moss and yeast nutrients at times indicated in ingredient list. Cool wort to 56 °F (13 °C), transfer to fermenter and aerate. Pitch yeast from (cooled) yeast starter. Ferment at 56 °F (13 °C). Lager for 2 months at 40 °F (4.4 °C) or below.

Red Ball Express (Vienna Lager)

(5 gallons/19 L, all-grain)
OG = 1.052 FG = 1.013
IBU = 25 SRM = 11 ABV = 5.0%

Ingredients

10 lbs. 12 oz. (4.9 kg) Vienna malt
9 oz. (0.26 kg) CaraMunich II® malt (45 °L)
6.66 AAU Tettnanger hops (60 mins) (2.2 oz./63 g of 3% alpha acids)
1 tsp. Irish moss (15 mins)
1/8 tsp gypsum (75 mins)
White Labs WLP920 (Old Bavarian Lager) yeast (3 qt./~3 L starter)
1 cup corn sugar (for priming)

Step by Step

In your kettle, mash in at 131 °F (55 °C). Pull a 1-gallon (3.8 L) decoction and heat it to 162 °F (72 °C), stirring constantly. (The decoction should be from the thickest part of the mash.) Rest decoction at 162 °F (72 °C) for 5 minutes, add a pinch of calcium ($CaCl_2$) and bring decoction to a boil, stirring constantly. Boil decoction for 15 minutes, still stirring constantly. Transfer decoction back to main mash and heat mixture to 154 °F (68 °C) for a 45-minute rest. Stir well to even out mash temperatures. Heat mash to 168 °F (76 °C) then transfer to lauter tun. Recirculate mash for 20 minutes, then run off wort and sparge with 170 °F (77 °C) water. (Do not let temperature of grain bed fall below 165 °F (74 °C); if it does, heat sparge water to 180 °F (82 °C).) Collect about 5.75 gallons (22 L) of wort, add water to make 6.5 gallons (25 L) of wort. Boil for 90 minutes, to reduce wort to 5 gallons (19 L). Add 1/8 tsp. gypsum with 75 minutes left in boil. Add hops with 60 minutes left in boil and Irish moss with 15 minutes left in boil. Cool wort to 55 °F (13 °C), let cold break settle, transfer to fermenter and aerate (preferably with a 45 second shot of oxygen). Pitch yeast (from cooled starter) and ferment at 55 °F (13 °C). Lager for 2 months at 40 °F (4.4 °C) or below.

and low aeration levels contribute to ester production as well as temperature, so you need those other two variables taken care of. I would actually make a larger starter than normal for an ale-temperature lager fermentation — 4–5 qts. (~3.75–4.75 L) per 5 gallons (19 L). And, of course, get the temperature as low as you can steadily hold it.

Water

You can brew a good Vienna lager with almost any kind of water. Moderately hard, moderately carbonate-rich water is best, but unless your water is very soft or very hard, you're probably fine. For very soft water, add a half teaspoon of gypsum (calcium sulfate) and one teaspoon of chalk (calcium carbonate) per 5 gallons (19 L). For very hard water, "cut it" with some distilled water.

Mash

As with almost all modern malts, a single infusion mash is sufficient to completely convert all the starches in Vienna malt. And, you can make a Vienna lager from a single mash. However, you will probably yield better results with a step mash. You can rest in the beta glucan range (121-131 °F) for about 15 minutes, then perform one or two rests in the starch conversion range. For more body — as in an American craft brew style Vienna lager — a rest around 154 °F (68 °C) will work well. For a little less body — as would be appropriate for a Mexican Vienna lager — a rest at 148–150 °F (64–66 °C) followed by a rest at 158–162 °C (70–72 °C), will yield a somewhat more fermentable wort. For an even drier beer, a rest around 140 °F (60 °C) could be added, but this could make the beer too thin. (Long rests — up to a couple hours — in this range are employed when making light American lagers.)

You could also do a step decoction mash, if you'd like. A single decoction from a beta glucan rest to around 154 °F (68 °F) is what I've done when I've made my Vienna lagers. Whether a decoction mash provides any flavor benefits is a matter of debate — I just do it because it I tried it once and liked the results.

For stovetop extract brewers, partial mashing a small amount of Vienna malt and using an extract late procedure is the best approach. A partial mash can be performed exactly the same way specialty grains are steeped as long as you keep the temperature and amount of water in appropriate bounds. The hops can be boiled in the wort from the partial mash (and perhaps some light dried malt extract) and the remainder of the extract — liquid Vienna malt extract — can be stirred in at the end of the boil.

Boil

All-grain brewers should boil their their wort for 90 minutes, adding the hops with an hour left in the boil. This boil length will ensure a good hot break and better beer clarity. A pinch of calcium at the beginning of the boil may help drive the post-boil pH down, especially if your water is soft.

Extract brewers should boil part of their malt extract for 60 minutes, adding the remaining for the final 15 minutes of the boil. (Alternately, you can add it at the end of the boil and let it steep for 15 minutes before cooling).

Cooling

For best results, homebrewers should cool their wort all the way down to fermentation temperature. For brewers with tap water above 45 °F (7.2 °C) or so, this will require a little extra work. But, there are a few options to explore. All begin by using an immersion chiller and chilling the wort as much as possible with tap water.

After the initial cooling, you can use the immersion chiller as a pre-chiller leading to a counter-flow wort chiller. The pre-chiller is immersed in an ice bath leading to the water input of the counter-flow chiller. By measuring the temperature of the wort exiting the chiller and restricting its flow if needed, you should be able to hit your target temperature. When using a counter-flow chiller, you may want to collect the wort in a sanitized bucket first, then rack it to your primary fermenter once the cold break settles out. If you have a cylindrical-conical fermenter, just dump the cold break at your earliest possible convenience.

A second option is to circulate ice water through your immersion chiller once your tap water is no longer effective for cooling. A simple way to do this is make an ice bath in a 5-gallon (19 L) pot or picnic cooler. Connect two relatively short lengths of hose or tubing to your immersion chiller. Use a drill pump to push cold water through the immersion chiller and direct the outflow back to the ice bath. Since the wort has already been cooled with tap water, the ice will not melt immediately and can knock the temperature of your wort down to your target quickly. Once the wort is cool, let the cold break settle in your kettle before racking (relatively) clear wort to your fermenter.

A third option is to put the immersion chiller in an ice bath and siphon your wort through the immersion chiller. You will need to have cleaned the inside of your immersion chiller well before doing this. It will become sterile when submerged in wort for the initial chilling with tap water.

The final option is to cool the wort as much as possible with tap water, then siphon it to your fermenter (or a settling bucket). Cool the fermenter in a "swamp cooler" — a picnic cooler filled with ice water — until you hit your target temperature. This method works, but can be fairly time consuming.

Pitching and Fermentation

Before pitching your yeast, you will need to cool it down to near fermentation temperature. At room temperature, your yeast starter will be about 20–25 °F (11–14 °C) above the temperature of your wort. Pitching the warm yeast into cool wort can shock the yeast and should be avoided. The simplest way to cool down your yeast starter is to place it in a refrigerator earlier in your brewday, perhaps at the end of the mash. A "temperature strip" stuck to the outside of your starter container will allow you to ascertain the temperature of your yeast.

During fermentation, keep the temperature constant until the fermentation is almost over. I like to ferment my Vienna lagers at the high end of their temperature range (or even slightly over) to get as much character from the yeast as possible, but you can ferment at the lower end of the range if you like cleaner lagers.

Next, let the temperature rise to 60 °F (16 °C) if your yeast strain requires a diacetyl rest. After the diacetyl rest, rack the beer to secondary as quickly as possible to get the beer off the sedimented yeast. Unlike with most ales, which can sit on yeast for awhile with no ill effects, lagers will pick up off flavors from flocculated yeast fairly quickly. Cornelius kegs make a nice secondary fermenter or conditioning tank for lagers as you can blow off yeast sediment as it sediments during lagering.

If you ferment at (or slightly over) the high end of your yeast's range, the fermentation will go quickly (for a lager), a shorter diacetyl rest will be necessary (if at all) and you can quickly rack the beer off the yeast and into secondary and start lagering the beer. With an adequately sized starter, primary fermentation may take as little as a week.

Lagering

Vienna lagers don't need to be lagered (cold conditioned) for a long time. Less than a month is common for commercial Mexican Vienna lagers. Bigger lagers such as Octoberfests and bocks may benefit from up to 3 months of lagering, but a Vienna lager will likely be ready in about 2 months, if not sooner. If you fine the beer with Polyclar AT in secondary, just before racking it to your serving keg (or bottling bucket), you may shave a week or so off this time.

Similar Styles

If you replaced the words "Vienna malt" in this article with "Munich malt," you would have a pretty good description of how to make a Märzen — a style that, like Vienna lager, can be thought of as a "little Octoberfest." Throw in some dark Munich malt and just enough chocolate (or Carafa®) malt to get a hint of roast and you're on your way towards a dark Munich-style lager.

Vienna lagers are a great everyday beer. They're also a great "everyone" beer — appealing both to beer fans and folks who think of beer as fizzy, yellow water. The recipe for Vienna lagers is simple — as simple as Vienna malt and one hop addition — and your success in brewing one will come from your skill as a brewer, not from a complicated recipe.

Chris Colby thinks chimichangas (deep fried burritos) are the best culinary idea of all time.

These days, when it comes to beer ingredients, homebrewers face an embarrassment of riches. Homebrew shops carry base and specialty malts from all over the world and numerous varieties of hops, including varieties not heard of just a couple years ago. And when it comes to yeast, homebrewers have an astounding variety to choose from.

Over 100 yeast strains are available to homebrewers for brewing ales, lagers, wheat beers, Belgian beers and even "wild" beers fermented with wild yeast and bacteria. Want to brew a British ale? You have about 40 yeast strains to choose from. How about a German lager? For that, you have over 20 choices. A Bavarian wheat beer with the aroma of bananas and cloves? There are 8 strains. What about a funky Belgian beer? A dry Irish stout? A huge, full-bodied Scottish ale? A clean American-style hop monster? A Kölsch or alt? A mouth-puckering sour beer? Your local homebrew shop has the yeast you need to brew all these styles and more.

To keep you up to date on what's available, *Brew Your Own* presents our list of every yeast strain available to homebrewers on pages 32 through 34. And, we've thrown in two articles on how dried and liquid yeast are produced. (See pages 31 and 35.)

For each strain in the table, the level of flocculation is given. Strains are rated either high, medium or low depending on how quickly they drop out of solution following fermentation. Under proper brewing conditions, highly flocculant strains make beer that falls clear very soon after fermentation is over. With a less flocculant strain, you would have to wait longer for the beer to clear (or cool it down to coax the yeast drop out of solution).

The level of apparent attenuation for each strain is also given. Apparent attenuation is a measure of what proportion of the wort's malt sugars the yeast consume. It is calculated by subtracting the final gravity from the starting gravity and dividing this result by the starting gravity. For example, if you made an OG 1.048 ale and it finished at a gravity of 1.012, the apparent attenuation would be 75% [(48-12)/48 = 0.75].

To achieve the levels of attenuation quoted here, you need to pitch an adequate amount of yeast, aerate your wort well and ferment the yeast within its proper temperature range.

The optimal temperature range for each strain is also listed. Below the stated temperature range, your fermentation may be sluggish, the yeast's desired characteristics may be muted or absent or the yeast may not ferment at all. All yeast strains will grow happily above their optimal beer-making range, but they may produce a beer that is too fruity or contains higher alcohols (also called fusel oils).

Examining these numbers, and the brief description of each yeast's characteristics (all given by the manufacturers) will help you pick the right yeast for your brew.

DRY YEAST

by **chris colby**

Less costly, and with a longer shelf life than liquid yeast, dried yeast is finding favor with some homebrewers. New production methods mean dried yeast is better than ever.

photo courtesy of Coopers Brewery Ltd.

Dried Yeast, Past and Present

In the beginning, there was dried yeast . . . and it wasn't very good.

In the early days of modern homebrewing, homebrewing for most brewers meant buying a can of malt extract with a packet of dried yeast in the lid. The yeast was sprinkled on top of the wort and left to do its thing. Since the yeast wasn't dated, there was no way of knowing how old it was and sometimes fermentations didn't start — and when they did start, the results weren't always good.

Once liquid yeast came along, most homebrewers switched. There were many new strains to try and — rightly or wrongly — dried yeast gained the reputation of having levels of contamination high enough to cause problems, or at least concern.

Recently, though, things have changed. The technology for making dried beer yeast has improved, new dried beer yeast strains are available and many homebrewers are giving dried yeast a try and having good results. (Most homebrewers also realize that part of the blame for bad results in the "good 'ol days" lay with stale extract and ill-considered brewing techniques.)

Commercial brewers are also experimenting with dried yeast. Hoptown Brewing in Pleasanton, California even won a gold medal at the Great American Beer Festival (GABF) for their IPA brewed with dried yeast (the Fermentis US-56 strain of ale yeast).

Compared to liquid yeast, dried yeast has its advantages and disadvantages. The advantages are that it costs less, stores longer and you can simply rehydrate the yeast when you brew — no need to make a yeast starter. And, if you want to up your pitching rate, you can just buy a second sachet of yeast.

The disadvantages of dried yeast are that there are far fewer strains available and, unlike with liquid yeasts, dried yeasts can carry a small load of contaminating microorganisms, which concerns some homebrewers.

Making Dried Yeast

I spoke with Bruce Patterson of the Lesaffre Group (producers of Fermentis dried yeast) about how dried yeast is manufactured.

Fermentis yeast strains are stored in a laboratory either at -80 °C (-112 °F) in glycerol or at 4 °C (39 °F) on slants. Each strain is genetically identified before it is sent to the factory for a production run. The yeast is transferred to a liquid media made from molasses (with a sucrose content of 45–55%) with added nutrients to supply nitrogen, phosphorous, vitamins and minerals. The culture is stepped up several times in the lab before being sent to the factory.

At the yeast plant, the culture enters a rapid cell production phase and the yeast are fed continuously with molasses, nutrients and oxygen. The yeast are grown in very large fermenters, much larger than at liquid yeast plants. (How big exactly is a trade secret.)

Next, the rate of cell division is slowed and, in preparation for drying, nutrients and unspecified agents are added to the yeast to help it survive the process. The yeast cells are then harvested, separated from their media and dried to a cream with between 15 and 20% solids. The cream is pressed into a cake and extruded through a mold to produce yeast "noodles." The noodles are then dried in an air lift dryer.

In an air lift, the yeast sit on a grate and hot air is forced up through the yeast "noodles." The yeast are churned sort of like corn kernels in a hot air popper. (An older way of drying the yeast is to put the yeast in trays and have it ride on a conveyer belt through a long oven.) The yeast are slowly dried until they contain 94% solids. The dried yeast is then vacuum packed into sachets, which have a shelf life of two years when stored under 10 °C (50 °F). The viability of the dried yeast is 86%, but each dried yeast packet contains about 10 billion living cells per gram. Thus an 11 g pouch would contain about 110 billion cells. (These are the numbers for Fermentis yeast. The numbers for Danstar Nottingham and Windsor yeasts are comparable.)

Dried yeast companies report a very low contamination rate. (Fermentis yeast, for example, reports less than 5 bacterial cells/mL of wort in adequately pitched wort.) Patterson, however, mentions that sometimes the level falls below what can be detected in the lab. And, the experience of many brewers shows that this level does not result in problematic beer.

Chris Colby would like to thank Bruce Patterson of Fermentis for his help.

REHYDRATING DRIED YEAST

In order to perform at its best, dried yeast should be rehydrated. The instructions for doing this are simple. Take a clean, sanitized measuring cup and add about 2–4 fl. oz. (50–100 mL) of water at 95–112 °F (35–44 °C). For exact water volume and temperature, consult the back of your yeast sachet; each strain is different, so don't use a generic procedure. Sprinkle the yeast into the water and whisk it in lightly with a clean, sanitized fork or whisk. All you need to do is get all the yeast wet, not work it into a froth. (It will do that on its own). Let the mixture sit for 15 minutes, then pitch it to your wort.

This procedure is simple, but it's important to follow the instructions carefully and not "improve" upon them. There's a reason for every aspect of the procedure.

Warm water — as opposed to wort or a sugar solution — is the rehydration media because, for optimal health, the yeast need to rehydrate quickly. Sigrid Gertsen-Briand of Lallemand likens yeast rehydration to an umbrella — you want the shriveled cell wall to "pop" open and spring into its natural shape, not slowly unfold. The presence of sugars or other substances in the rehydration water slows the flow of water into the cells. Likewise, until the yeast cells rehydrate and "get their bearings," they are unable to regulate what passes through their cell membrane very well. Wort contains substances (for example sugars) that are beneficial to yeast, but also substances that are toxic to yeast. Healthy yeast cells don't take these substances in. However, yeast cells being rehydrated may let some in while they're still "stunned" from being rehydrated. Once the 15 minutes have passed, the yeast are "inflated," physiologically active — and sitting in water. At this point, continuing to sit in water is not doing them any good. This is why you need to pitch the yeast immediately after rehydration.

Strain	Type	Manuf.	Floc.	Atten.	Temp.	Description
ALE						
Coopers Homebrew Yeast	D	Coopers	High	High	68° to 80° F	Clean, round flavor profile.
Nottingham	D	Danstar	High	High	57° to 70° F	Neutral for an ale yeast; fruity estery aromas.
Windsor	D	Danstar	Low	Medium	64° to 70° F	Full-bodied, fruity English ale.
Safbrew S-33	D	Fermentis	Med./High	75%	59° to 75° F	Versatile strain that can perform in beers up to 11.5% ABV.
Safale S-04	D	Fermentis	High	79%	59° to 75° F	English ale yeast that forms very compact sediment.
Safbrew T-58	D	Fermentis	Low	75%	59° to 75° F	Develops estery and somewhat peppery spiceyness.
Safale US-56	D	Fermentis	Medium	77%	59° to 75° F	Clean with mild flavor for a wide range of styles.
Muntons Premium Gold	D	Muntons	High	High	57° to 77° F	Clean balanced ale yeast for 100% malt recipes.
Muntons Standard Yeast	D	Muntons	High	High	57° to 77° F	Clean well balanced ale yeast.
Alt Ale BRY 144	L	Siebel Inst.	Medium	High	59° to 68° F	Full-flavored but clean tasting with estery flavor.
American Ale BRY 96	L	Siebel Inst.	Medium	high	64° to 72° F	Very clean ale flavor.
English Ale BRY 264	L	Siebel Inst.	Medium	High	59° to 68° F	Clean ale with slightly nutty and estery character.
Trappist Ale BRY 204	L	Siebel Inst.	Medium	High	64° to 72° F	Dry, estery flavor with a light, clove-like spiciness.
Abbey Ale WLP530	L	White Labs	Med./High	75% to 80%	66° to 72 °F	Produces fruitiness and plum characteristics.
Australian Ale WLP009	L	White Labs	High	70% to 75%	65° to 70° F	For a clean, malty and "bready" beer.
Bedford British Ale WLP006	L	White Labs	High	72% to 80%	65° to 70° F	Good choice for most English style ales.
Belgian Ale WLP550	L	White Labs	Med./High	78% to 85%	68° to 78° F	Phenolic and spicy flavors dominate the profile.
Belgian Golden Ale WLP570	L	White Labs	Low	73% to 78%	68° to 75° F	A combination of fruitiness and phenolic flavors.
Belgian Saison I WLP565	L	White Labs	Medium	65% to 75%	68° to 75° F	Produces earthy, spicy, and peppery notes.
British Ale WLP005	L	White Labs	Low	75% to 80%	68° to 75° F	English strain that produces malty beers.
Burton Ale WLP023	L	White Labs	Medium	65% to 75%	68° to 73° F	Subtle fruity flavors: apple, clover honey and pear.
California Ale WLP001	L	White Labs	High	67% to 74%	65° to 70° F	Clean flavors accentuate hops; very versatile.
California Ale V WLP051	L	White Labs	Med./High	70% to 75%	66° to 70° F	Produces a fruity, full-bodied beer.
Dry English Ale WLP007	L	White Labs	High	70% to 80%	65° to 70° F	Good for high gravity ales with no residuals.
Dusseldorf Alt WLP036	L	White Labs	Medium	65% to 72%	65° to 69° F	Produces clean, slightly sweet alt beers.
East Coast Ale WLP008	L	White Labs	Low/Med.	70% to 75%	68° to 73° F	Very clean and low esters.
Edinburgh Ale WLP028	L	White Labs	Medium	70% to 75%	65° to 70° F	Malty, strong Scottish ales.
English Ale WLP002	L	White Labs	Med./High	70% to 75%	68° to 73° F	Very clear with some residual sweetness.
German Ale II WLP003	L	White Labs	Medium	70% to 75%	65° to 70° F	Clean, sulfur component that reduces with aging.
German Ale/Kölsch WLP029	L	White Labs	Very High	72% to 78%	65° to 69° F	A super-clean, lager-like ale.
Irish Ale WLP004	L	White Labs	Medium	73% to 80%	65° to 70° F	Light fruitiness and slight dry crispness.
Southwold Ale WLP025	L	White Labs	Medium	72% to 78%	65° to 69° F	Complex fruits and citrus flavors.
Trappist Ale WLP500	L	White Labs	Low/Med.	75% to 80%	65° to 72° F	Distinctive fruitiness and plum characteristics.
High Gravity Eng. Ale WLP007	L	White Labs	Low	73% to 80%	66° to 70° F	A clean, highly flocculant and attenuative yeast.
10th Anniversary Blend WLP010	L	White Labs	Medium	75% to 80%	65° to 70° F	Blend of WLP001, WLP002, WLP004 & WLP810
European Ale WLP011	L	White Labs	Medium	65% to 70%	65° to 70° F	Low ester production, giving a clean profile.
London Ale WLP013	L	White Labs	Medium	67% to 75%	66° to 71°F	Dry, malty ale yeast for pales, bitters, and stouts.
Whitbread Ale WLP017	L	White Labs	Medium	67% to 73%	66° to 70 °F	British style slightly fruity, with a hint of sulfur.
Essex Ale Yeast WLP022	L	White Labs	Med./High	71% to 76%	66° to 70 °F	Drier finish than many British ale yeasts.
Premium Bitter Ale WLP026	L	White Labs	Medium	70% to 75%	67° to 70 °F	Gives a mild, but complex, estery character.
Pacific Ale WLP041	L	White Labs	Medium	65% to 70%	65° to 68° F	A popular ale yeast from the Pacific Northwest.
American Ale Yeast Blend WLP060	L	White Labs	Medium	72% to 80%	68° to 73° F	Blend celebrates the strengths of California ale strains.
Super High Gravity Ale WLP099	L	White Labs	Low	80%	69° to 74° F	High gravity yeast, ferments up to 25% alcohol.
Bastogne Belgian Ale Yeast WLP510	L	White Labs	Medium	74% to 80%	66° to 72° F	A high gravity, Trappist style ale yeast.
Belgian Style Ale Yeast Blend WLP575	L	White Labs	Medium	74% to 80%	68° to 75° F	Blend of Trappist yeast and Belgian ale yeast.
American Ale 1056	L	Wyeast	Low/Med.	73% to 77%	60° to 72° F	Well balanced. Ferments dry, finishes soft.
Belgian Abbey II 1762	L	Wyeast	Medium	73% to 77%	65° to 75° F	Slightly fruity with a dry finish.
Belgian Ale 1214	L	Wyeast	Medium	72% to 76%	58° to 78° F	Abbey-style, top-fermenting yeast for high gravity.

L-Liquid **D**-Dry **Floc**-Flocculation **Atten**-Attenuation
Temp-Suggested fermentation temperature range

Strain	Type	Manuf.	Floc.	Atten.	Temp.	Description
Belgian Strong Ale 1388	L	Wyeast	Low	73% to 77%	65° to 75° F	Fruity nose and palate, dry, tart finish.
British Ale 1098	L	Wyeast	Medium	73% to 75%	64° to 72° F	Ferments dry and crisp, slightly tart and fruity.
British Ale II 1335	L	Wyeast	Low	73% to 75%	63° to 75° F	Malty flavor, crisp finish, clean, fairly dry.
European Ale 1338	L	Wyeast	High	67% to 71%	62° to 72° F	Full-bodied complex strain and dense malty finish.
German Ale 1007	L	Wyeast	Low	73% to 77%	55° to 68° F	Ferments dry and crisp with a mild flavor.
Irish Ale 1084	L	Wyeast	High	73% to 77%	60° to 72° F	Slight residual diacetyl and fruitiness.
London Ale 1028	L	Wyeast	Low/Med.	73% to 77%	60° to 72° F	Bold and crisp with a rich mineral profile.
London Ale III 1318	L	Wyeast	High	71% to 75%	64° to 74° F	Very light and fruity, with a soft, balanced palate.
London ESB Ale 1968	L	Wyeast	High	67% to 71%	64° to 72° F	Rich, malty character with balanced fruitiness.
Northwest Ale 1332	L	Wyeast	High	67% to 71%	65° to 75° F	Malty, mildly fruity, good depth and complexity.
Ringwood Ale 1187	L	Wyeast	High	67% to 71%	64° to 74° F	A malty, complex profile that clears well.
Scottish Ale 1728	L	Wyeast	High	69% to 73%	55° to 75° F	Suited for Scottish-style ales, high-gravity ales.
Trappist High Gravity 3787	L	Wyeast	Medium	72% to 76%	64° to 78° F	Ferments dry, rich ester profile and malty palate.
Whitbread Ale 1099	L	Wyeast	High	68% to 72%	64° to 74° F	Mildly malty and slightly fruity.
Kölsch 2565	L	Wyeast	Low	73% to 77%	56° to 70° F	Malty with a subdued fruitiness and a crisp finish.
Thames Valley Ale 1275	L	Wyeast	Medium	72% to 76%	62° to 72° F	Clean, light malt character with low esters.
American Ale II 1272	L	Wyeast	High	72% to 76%	60° to 72° F	Slightly nutty, soft, clean and tart finish.
Leuven Pale Ale 3538	L	Wyeast	High	75% to 78%	60° to 75° F	Slight phenolics and spicy aromatic characteristics.
Thames Valley Ale II 1882	L	Wyeast	High	73% to 77%	62° to 72° F	Slightly fruitier and maltier than 1275.
Canadian/Belgian Style 3864	L	Wyeast	Medium	75% to 79%	65° to 80° F	Mild phenolics and low ester profile with tart finish.
Belgian Saison 3724	L	Wyeast	Low	76% to 80%	70° to 80° F	Very tart and dry with spicy and bubblegum aromatics.
English Special Bitter 1768	L	Wyeast	High	68% to 72%	64° to 72° F	Produces light fruit ethanol aroma with soft finish.
Dutch Castle Yeast 3822	L	Wyeast	Medium	74% to 79%	65° to 80° F	Spicy, phenolic and tart in the nose.
Biere De Garde 3725	L	Wyeast	Low	76% to 80%	70° to 95° F	Low to moderate ester production with mild spicyness.
Wyeast Ale Blend 1087	L	Wyeast	High	71% to 75%	64° to 72° F	A blend of the best strains to provide quick starts.
British Cask Ale 1026	L	Wyeast	Med./High	75% to 78%	60° to 75° F	Produces nice malt profile with hint of fruit.

LAGER

Strain	Type	Manuf.	Floc.	Atten.	Temp.	Description
Brewferm Lager	D	Brewferm	High	High	50° to 59° F	Develops witbeer aromas like banana and clove.
Saflager S-23	D	Fermentis	Med./High	80%	48° to 59° F	Produces a fruit esterness in lagers.
American Lager BRY 118	L	Siebel Inst.	Very High	Medium	68° to 72° F	Produces slightly fruity beer; some residual sugar.
North European Lager BRY 203	L	Siebel Inst.	Low	High	68° to 72° F	Well balanced beer, fewer sulfur compounds.
German Lager WLP830	L	White Labs	Medium	74% to 79%	50° to 55° F	Malty and clean; great for all German lagers.
Oktoberfest/Märzen WLP820	L	White Labs	Medium	65% to 73%	52° to 58° F	Produces a very malty, bock-like style.
Pilsner Lager WLP800	L	White Labs	Med./High	72% to 77%	50° to 55° F	Somewhat dry with a malty finish.
So. German Lager WLP838	L	White Labs	Med./High	68% to 76%	50° to 55° F	A malty finish and balanced aroma.
American Lager WLP840	L	White Labs	Medium	75% to 80%	50° to 55° F	Dry and clean with a very slight apple fruitiness.
San Francisco Lager WLP810	L	White Labs	Medium	75% to 80%	50° to 55° F	For "California Common" styles.
Czech Budejovice Lager WLP802	L	White Labs	Medium	75% to 80%	50° to 55° F	Produces dry and crisp lagers, with low diacetyl.
San Francisco Lager WLP810	L	White Labs	High	65% to 70%	58° to 65° F	Used to produce the "California Common" style beer.
German Bock Lager Yeast WLP833	L	White Labs	Medium	70% to 76%	48° to 55° F	Produces well-balanced beers of malt and hop character.
Copenhagen Lager WLP850	L	White Labs	Medium	72% to 78%	50° to 58° F	Clean, crisp north European lager yeast.
Zurich Lager Yeast WLP885	L	White Labs	Medium	70% to 80%	50° to 55° F	Swiss style lager yeast with minimal sulfur and diacetyl production.
Old Bavarian Lager Yeast WLP920	L	White Labs	Medium	66% to 73%	50° to 55° F	Finishes malty with a slight ester profile. Use in beers such as Oktoberfest, Bock, and Dark Lagers.
Mexican Lager Yeast WLP940	L	White Labs	Medium	70% to 78%	50° to 55° F	Produces clean lager beer, with a crisp finish.
American Lager 2035	L	Wyeast	Medium	75% to 80%	48° to 58° F	Bold, complex and aromatic; slight diacetyl.

L-Liquid **D**-Dry **Floc**-Flocculation **Atten**-Attenuation
Temp-Suggested fermentation temperature range

Strain	Type	Manuf.	Floc.	Atten.	Temp.	Description
Bavarian Lager 2206	L	Wyeast	Medium	73% to 77%	46° to 58° F	Produces rich, malty, full-bodied beers.
Bohemian Lager 2124	L	Wyeast	Medium	69% to 73%	48° to 58° F	Ferments clean and malty.
California Lager 2112	L	Wyeast	High	67% to 71%	58° to 68° F	Produces malty, brilliantly clear beers.
Czech Pils 2278	L	Wyeast	Medium	70% to 74%	50° to 58° F	Dry but malty finish.
Danish Lager 2042	L	Wyeast	Low	73% to 77%	46° to 56° F	Rich Dortmund style with crisp, dry finish.
European Lager 2247	L	Wyeast	Low	73% to 77%	46° to 56° F	Clean, very mild flavor, slight sulfur production.
Munich Lager 2308	L	Wyeast	Medium	73% to 77%	48° to 56° F	Very smooth, well-rounded and full-bodied.
North American Lager 2272	L	Wyeast	High	70% to 76%	52° to 58° F	Malty finish, traditional Canadian lagers.
Pilsen Lager 2007	L	Wyeast	Medium	71% to 75%	48° to 56° F	Smooth malty palate; ferments dry and crisp.
Budvar Lager 2000	L	Wyeast	Med./High	71% to 75%	48° to 56° F	Malty nose with subtle fruit. Finishes dry and crisp.
Urquell Lager 2001	L	Wyeast	Med./High	71% to 75%	48° to 58° F	Mild fruit and floral aroma. Very dry with mouthfeel.
Gambrinus Lager 2002	L	Wyeast	Med./High	71% to 75%	46° to 56° F	Mild floral aroma with lager characters in the nose.
Octoberfest Lager Blend 2633	L	Wyeast	Low/Med.	73% to 77%	48° to 58° F	Plenty of malt character and mouth feel. Low in sulfur.
WHEAT						
Brewferm Blanche	D	Brewferm	Low	High	64° to 73° F	Ferments clean with little or no sulphur.
Bavarian Weizen BRY 235	L	Siebel Inst.	High	Medium	50° to 57° F	A very estery beer with mild clove-like spiciness.
Amer. Hefeweizen WLP320	L	White Labs	Med./High	72% to 77%	50° to 55° F	Slight amount of banana and clove notes.
Belgian Wit Ale WLP400	L	White Labs	Low/Med.	74% to 78%	67° to 74° F	Slightly phenolic and tart.
Belgian Wit II Ale WLP410	L	White Labs	Low/Med.	70% to 75%	67° to 74° F	Spicier, sweeter, and less phenolic than WLP400.
Hefeweizen Ale WLP300	L	White Labs	Low/Med.	72% to 76%	68° to 72° F	Produces banana and clove nose.
Hefeweizen IV Ale WLP380	L	White Labs	Low	73% to 80%	66° to 70° F	Crisp, large clove and phenolic aroma and flavor.
American Hefeweizen Ale WLP320	L	White Labs	Low	70% to 75%	65° to 69° F	produces a slight amount of banana and clove notes.
Bavarian Weizen Ale WLP351	L	White Labs	Low	73% to 77%	66° to 70° F	moderately high, spicy phenolic overtones of cloves.
American Wheat 1010	L	Wyeast	Low	74% to 78%	58° to 74° F	Produces a dry, slightly tart, crisp beer.
Bavarian Wheat 3638	L	Wyeast	Low	70% to 76%	64° to 75° F	Balance banana esters w/ apple and plum esters.
Forbidden Fruit Yeast 3463	L	Wyeast	Low	73% to 77%	63° to 76° F	Phenolic profile, subdued fruitiness.
Belgian Ardennes 3522	L	Wyeast	High	72% to 76%	65° to 85° F	Mild fruitiness with complex spicy character.
Belgian Witbier 3944	L	Wyeast	Medium	72% to 76%	62° to 75° F	Alcohol tolerant, with tart, slight phenolic profile.
German Wheat 3333	L	Wyeast	High	73% to 77%	63° to 75° F	Sharp, tart crispness, fruity, sherry-like palate.
Weihenstephan Weizen 3068	L	Wyeast	Low	73% to 77%	64° to 75° F	A unique, rich and spicy weizen character.
Bavarian Wheat 3056	L	Wyeast	Medium	73% to 77%	64° to 74° F	Produces mildly estery and phenolic wheat beers.
Farmhouse Ale 3726	L	Wyeast	Low	76% to 81%	70° to 95° F	Complex aromas dominated by an earthy/spicy note.
Belgian Wheat 3942	L	Wyeast	Medium	72% to 76%	64° to 74° F	Apple- and plum-like nose with dry finish.
LAMBIC						
Brettanomyces claussenii WLP645	L	White Labs	N/A	N/A	N/A	Low intensity Brett character. More aroma than flavor.
Brettanomyces bruxellensis WLP650	L	White Labs	N/A	N/A	N/A	Classic strain used in secondary for Belgian styles.
Brettanomyces lambicus WLP653	L	White Labs	N/A	N/A	N/A	High Brett character. Horsey, Smoky and spicy flavors.
Belgian Sour Mix WLP655	L	White Labs	N/A	N/A	N/A	Includes Brettanomyces, Saccharomyces, and the bacterial strains Lactobacillus and Pediococcus.
Belgian Lambic Blend 3278	L	Wyeast	Low/Med.	65% to 75%	63° to 75° F	Rich, earthy aroma and acidic finish.
Brettanomyces bruxellensis 3112	L	Wyeast	Low/Med.	Low	64° to 70° F	Produces classic lambic characteristics.
Brettanomyces lambicus 3526	L	Wyeast	Medium	Low	60° to 75° F	Pie cherry-like flavor and sourness.
Lactobacillus delbruckii 4335	L	Wyeast	N/A	N/A	60° to 95° F	Lactic acid bacteria.
Pediococcus cerivisiae 4733	L	Wyeast	N/A	N/A	60° to 75° F	Lactic acid bacteria.

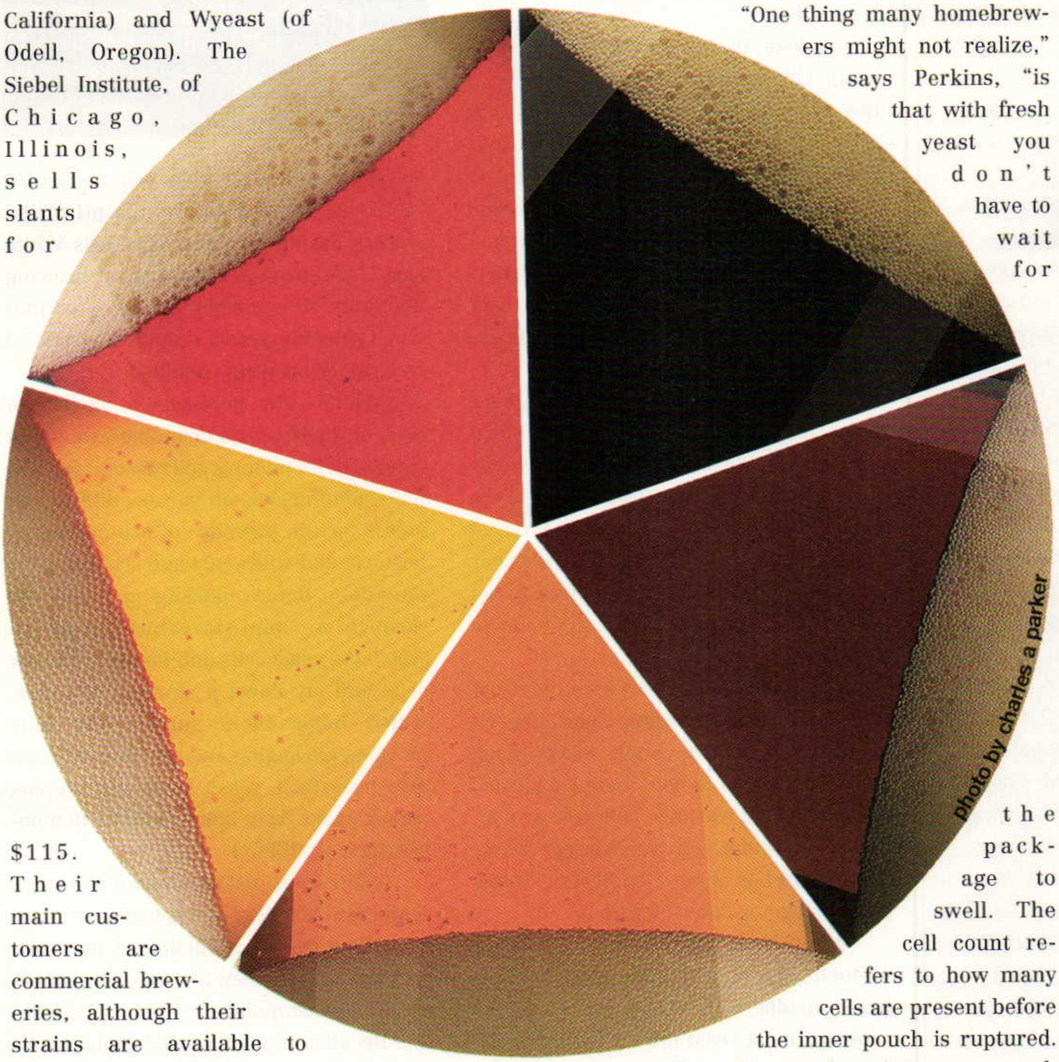
L-Liquid **D**-Dry **Floc**-Flocculation **Atten**-Attenuation
Temp-Suggested fermentation temperature range

LIQUID YEAST

by chris colby

If you attend homebrew club meetings, look at the results of homebrew contests or just hang out at your local homebrew shop for awhile, you know that most homebrewers use liquid yeast. The name "liquid yeast" is somewhat of a misnomer; the yeast itself is not liquid, it's just suspended in a liquid media. As the chart on pages 32–34 shows, there are a wide variety of liquid yeast strains available to homebrewers.

The two biggest suppliers of liquid yeast to homebrewers are White Labs (of San Diego, California) and Wyeast (of Odell, Oregon). The Siebel Institute, of Chicago, Illinois, sells slants for $115. Their main customers are commercial breweries, although their strains are available to homebrewers.



White Labs packages their yeast in plastic tubes. The tubes are actually the blanks for larger plastic bottles, which is why the walls of the tubes are so thick. The 35 mL yeast vials are advertised to contain 35–50 billion cells, but about two months ago White Labs quietly upped their cell count to an average of 100 billion cells. "The actual counts now range from 70–130 billion," says Chris White, president of White Labs.

Wyeast's 125 mL Activator packs are advertised to contain 100 billion cells, but actually average around 120–130 billion cells, according to Les Perkins, microbiologist and quality control manager for Wyeast.

Wyeast strains come in a pouch with an interior pouch of nutrients. When "smacked," the inside pouch ruptures, feeds to yeast in the outer pack and causes the whole package to swell. (The idea for smack packs, incidentally, came from David Logsdon, president of Wyeast who wanted a way for brewers to "feed" the yeast, without the possibility of contaminating the culture.)

"One thing many homebrewers might not realize," says Perkins, "is that with fresh yeast you don't have to wait for the package to swell. The cell count refers to how many cells are present before the inner pouch is ruptured. The cell count doesn't increase much when the pack is activated. The nutrients just activate the yeast. If the yeast is fresh, you can pitch right from the outer pouch."

At packaging, the yeast cells in both White Labs and Wyeast packages are 99% viable. Both companies date their packages so homebrewers can assess their freshness. And, since liquid yeast is raised under sterile conditions (and tested for

MAKING A YEAST STARTER

Many homebrewers simply pitch their liquid yeast straight from the tube or smack pack to their wort. For the best results, however, *Brew Your Own* has always recommended making a yeast starter. By making a yeast starter of the right volume, you can raise the optimal number of yeast cells and ensure that your yeast are active and healthy prior to pitching. Pitching a large number of healthy yeast cells gives a fast start to fermentation, proper attenuation and an appropriate amount of yeast fermentation byproducts in the finished beer. (Underpitched worts can yield overly fruity beers.)

To make a yeast starter, clean and sanitize a starter container — a one gallon jug or half-gallon brewpub growler will work — and a fermentation lock. Make a starter wort with a specific gravity around 1.030. (You don't want the yeast to struggle with a high gravity fermentation when you are growing them up.) Boil the starter wort for 15 minutes, cool it quickly (for example, in an ice-water bath in your sink) and transfer it to your starter container. Aerate the wort (by shaking the jug or by injecting air or oxygen), pitch your yeast and attach the airlock. Let the starter ferment for 2 days at room temperature. A well-aerated, low-gravity starter will ferment completely in this time and most of the yeast will settle out. Pitch the yeast sediment to your beer. For most moderate-gravity ales (up to OG 1.048), a 1–2 qt. (~1–2 L) starter is the right size. To make a starter in this size range, boil 2.6–5.3 oz. (74–150 g) of dried malt extract in 1–2 qt. (~1–2 L) of water. For lagers up to OG 1.048, a 3–4 qt. (~3–4 L) starter is best. For this, use 8–11 oz. (227–312 g) of dried malt extract. For bigger beers, bigger starters are needed — for a beer with an OG of 1.096, you'd need to double your starter size.

purity), there are no contaminating bacteria or wild yeasts in the tubes or packs.

Your local homebrew shop should have its liquid yeast refrigerated and, if you order from a website, you should opt for cooling packs (if available) to keep the yeast cold during shipment. At home, store your liquid yeast in your refrigerator. If a liquid yeast package freezes, the yeast cells inside will rupture and die.

Before pitching liquid yeast to your wort or yeast starter, you should let the culture warm slowly by taking it out and letting it warm to room temperature. (See the sidebar for instructions on making a yeast starter.)

I spoke to Chris White about how White Labs makes their liquid yeast. (I also spoke to Les Perkins and Wyeast's process is similar.) White Labs banks their yeast strains frozen in glycerol at -80 °C (-112 °F). Both White Labs and Wyeast house strains for their homebrewing line as well as yeast for commercial breweries. White Labs keeps over 400 strains at their facility; Wyeast keeps about 300.

Working cultures are grown on agar plates. (Agar plates are petri dishes filled with an agar "jello" containing nutrients for the yeast. The yeast grow on top of the "jello" in colonies, or in streaks.) (Wyeast uses slants — test tubes filled with agar that cooled while the tube rested at an angle. Thus, the agar "jello" slants down into the tube.)

Yeast samples are transferred from the plates to liquid culture and stepped up in volume over a couple weeks. Each step is bar coded to help them keep track of what stage various cultures are at. White says that, on an average week, White Labs has about 50 different strains in one stage or other of growth.

White Labs grows their yeast in an all-malt media. (Wyeast uses a malt-based media with added nutrients). In contrast, most yeast grown for industrial purposes is grown on molasses, made from sugar beets.

The specific gravity of the culture media is low compared to normal beers, and their media (and Wyeast's) is continually-aerated. The temperature is kept higher than typical beer fermentations, but lower than 90 °F (32 °C), the temperature at which yeast grows the fastest.

> "A lot of the conventional wisdom about yeast comes from studies on lager yeast used for making Pilsners."

(Wyeast propagates their yeast at 68–70 °F (20–21 °C) and adjusts the pH of the culture during the process.) Chris White says, "We grow our yeast in a 'brewing mentality.' If you stray too far from that when growing yeast, they don't perform well under brewing conditions."

White Labs performs a variety of tests on their yeasts including examining stained cells under a microscope for viability, plating cells on various differential media for the presence of contaminating bacteria and wild yeast and screening for mutation. Before packaging, yeast go through a "mini-starvation" stage in which the yeast cells quit budding off new cells and lay down a store of glycogen, which helps them survive the time between packaging and pitching. (Wyeast also tests their yeast, including keeping smack packs from individual lots to monitor their shelf life.)

White Labs just obtained a gas chromatogram last year and is using it to analyze the volatile production of the yeast and use that to quantify predictive measures of yeast quality.

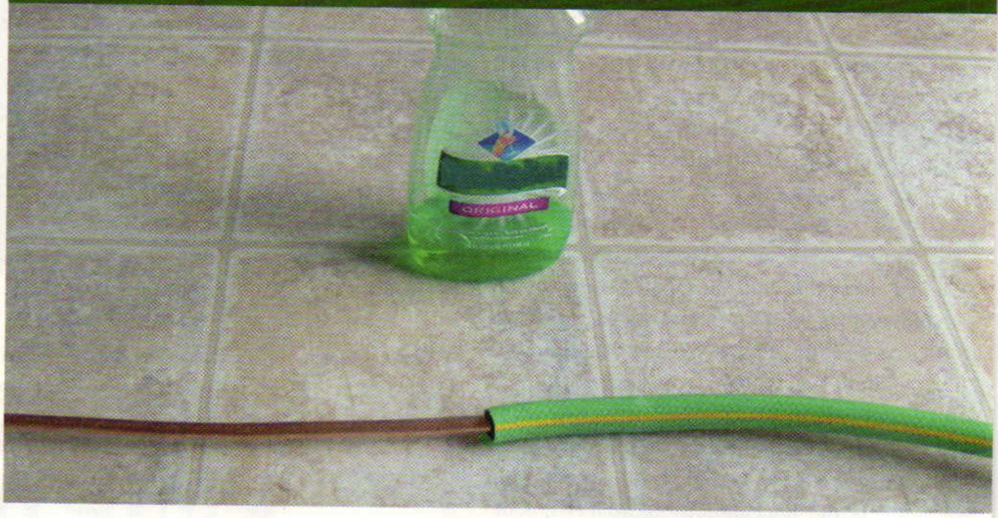
Because liquid yeast needs to be fresh to be useful in brewing, it is grown in much smaller quantities than dried yeast, which can be stored for much longer times (up to two years). "The cost per cell for liquid yeast is much higher than with dried yeast," says Chris White. While dried yeast sachets cost $1.50–2.00, liquid yeast packages cost about 6 bucks.

Although smaller than dried yeast facilities, liquid yeast labs are large compared to homebrew setups. Of their over 100 fermentation tanks, White Labs biggest is 10 barrels (340 gallons/ 1,290 L), although they are getting several 20-barrel (680 gallons/2,570 L) tanks next year. (Wyeast's biggest tank is 20 barrels.) The biggest fermenters are used for the final growth stage of their most popular strains — for example WLP001 (California Ale) for White Labs and 1056 (American Ale) for Wyeast. For less popular strains, smaller fermenters are used. For some commercial strains at White Labs, the final volume is only 26 gallons (100 L).

Working with multiple strains day after day allows the liquid yeast companies to get to know the quirks of individual strains. Perkins reports that Wyeast is conducting experiments and finding some interesting results. "A lot of the conventional wisdom about yeast comes from studies on lager yeast used for making Pilsners. But," he says, "ale strains don't always behave as conventional wisdom says they should." Wyeast has found that pitching rate affects ester production a great deal in some strains, but others are relatively insensitive to changes in pitching rate. The pH of fermenting beer affects the flocculation characteristics of some yeast strains and others show unusual flocculation patterns at different temperatures. "Some strains will drop out at a certain temperature, but then go back into solution if you lower the temperature." Perkins said Wyeast is going to continue their experiments and they will be releasing the results to homebrewers when the studies are complete and they can state the results with confidence.

Liquid yeast companies have brought a lot of strains to homebrewers — and they are continuing to develop more. White Labs recently introduced three *Brettanomyces* strains for homebrewers interested in lambics and "wild" beers. And, they have recently released a clean ale strain (WLP060) that White says works great for Kölsches. Wyeast plans to release a Bière de Garde strain (3725) and a farmhouse ale strain (3726) soon.

Chris Colby thanks Dr. Chris White and Les Perkins for their help.



CHILL ON THE CHEAP WITH THIS EASY PROJECT

story and photos by **Reg Pope**

COUNTERFLOW

AS HOMEBREWERS we all want to cool our wort quickly after the boil. Wort needs to be cooled to a temperature at which the yeast can be safely pitched. Quick cooling also helps with cold break formation and — when some very light base malts are used — helps minimize the production of dimethyl sulfide (DMS), a molecule that lends a cooked corn odor to beer. In addition, moving the wort quickly through the 160–120 °F (71–49 °C) range ensures that contaminating organisms have a smaller chance to gain a foothold at these temperatures that are favorable to their growth.

Cool

We have all utilized the plethora of methods available to cool our wort from boiling to pitching temperature in as fast and safe a manner as possible. Coolers or sinks packed with ice, frozen water jugs and half-filled bathtubs are the most primitive among them. These methods vary in their effectiveness and leave you open to varying levels of risk with regard to contamination of the wort you have worked so hard to produce. However, they all work to an extent . . . at least with a 5 gallon (19 L) batch — or smaller volumes of concentrated wort made on a stovetop. However, try hefting a 15 gallon (57 L) boiling pot into and out of a bathtub.

Cooler

A cleaner and simpler method is to use an immersion chiller. These devices are popular with homebrewers, but their capacity is somewhat limited. The key consideration is volume.

Using the algebraic formula ($\pi r^2 h$) for the volume of a cylinder — which is what a tube is, a long thin cylinder — a ⅜" (95 mm) x 25 foot (7.6 m) immersion coil has 32 cubic inches (537 cubic centimeters) of volume, equivalent to a little over a pint of liquid. That's the amount of wort the chiller displaces and the volume of cooling medium available to do work (move heat out of the wort) during chilling. So, the wort next to this "pint of coldness" is what's being chilled.

You can stir the wort, to get it flowing past the coils, but this takes hands-on effort during wort cooling (and your hands may prefer to be on another type of cold pint at this point in the brewday). Also, opening the brew kettle to stir it with the chiller can allow airborne microorganisms to settle in your wort when it is in a temperature range favorable to their growth. And, if you are worried about aerating your wort while it's hot, you may shy away from swirling your immersion chiller. Enter the counterflow chiller.

The Coolest

What if you could take that volume of wort in contact with the chiller and turn it over at a constant rate? And what if you could take the water and replace it with fresh, cool water at a constant rate as well? If you could do this, what would you have? Essentially, you'd have the benefits of stirring without the effort or risk. This is the theory behind the counterflow chiller. Instead of having the same wort in contact with the cooling coil at all times, fresh hot wort and cold water flow past each other constantly. The cooling water is common tap water and the water and wort never come in direct contact with each other. The wort touches only copper and remains enclosed inside a tube so there is no risk of the aeration or contamination that stirring might introduce.

The word "counterflow" describes the flow pattern of the water and wort relative to each other. The wort entry point is at the water exit and the water entry point is at the wort exit, so the two liquids move past each other in opposite directions. This is important because as the warmest wort encounters the warmest water at the beginning of its residence in the chiller, and meets the coldest water at its lowest temperature as it exits. The hot wort encounter progressively cooler conditions and it travels through the chiller and continually transfers heat to the cooling water.

Parts and Tools List

Parts:
(2) 1/2" copper tee
(2) 1/2" threaded x 3/8" compression fitting
(6 inches or 15 cm) 1/2" rigid copper tubing
(25') 3/8" OD copper tubing
(25') 5/8" garden hose
(4) 1/2" hose clamps

Tools:
tubing cutter
JB Weld
utility knife
screwdriver
drill and 3/8" bit

Other: liquid dish soap

The chiller described here, when tested with 70 °F (21 °C) tap water, reduced boiling wort to within a few degrees of the cooling water, using a simple gravity feed, in no more time than it would take to gravity drain the boiling pot. An additional benefit is a trick I learned from one of our local pros. After the wort is cool and the yeast is pitched, there's nothing left but the clean-up. I capture some of the (now well heated) discharge water while I am cooling, and save it for this use. So, the chiller can actually serve two purposes.

Constructing a Counterflow Chiller

Okay, we now know why we want one. As for how we get one, mass produced units are available to the homebrewer at prices ranging from fifty to over a hundred dollars, depending

- WORT CHILLER

on the construction features of the individual cooler. Kits that provide the parts to allow one to assemble a unit on their own cost as little as twenty dollars. However, once the cost of the additional items that are required to complete the assembly — such as the copper tubing — are added, the cost easily rivals that of a pre-fab unit.

The construction of this unit is surprisingly simple, it takes less than an hour and requires only a few components, readily available at any hardware or home improvement store. As shown, it costs out at $39.

The chiller is a basic "tube within a tube" design. The key to its function is the fitting that allows connection of the input and output hoses and tubes, and connects and seals all of the components of the wort reservoir and cooling jacket.

Constructing the Copper Tees

Construction begins with the copper tees, the threaded/compression fittings and a small length of ½" (1.3 cm) rigid copper tubing to connect them.

You can assemble this chiller in about an hour and it only costs around $40.

At the shop where I purchased my supplies, the rigid tubing was available in a minimum length of 24 inches (61 cm), however only three inches is needed, two lengths of 1½" (3.8 cm). These were cut to length using the tubing cutter.

Dry fit the pieces in case any burrs or rough cuts prevent them from going together easily, and file them if necessary. Mix the JB Weld according to the manufacturer's directions. Assemble the fitting, using a generous amount of JB Weld to secure the parts.

Once assembled, allow these fittings to dry and set overnight at a minimum. (See the photo of this assembly in the center column of this page.)

The Tube Within the Tube

The next step is to insert the copper tubing into the garden hose. Cut off the ends of the hose, taking the last six or eight inches of the hose and the fittings, and save them.

Lay out the hose in as straight a line as possible. Uncoil the ⅜" tubing and straighten it as much as possible as well. These items want to hold a curl and it will be impossible to get them completely straight. However, the straighter you can make them, the easier the next step will be. (To the left, you can see a picture of this step.)

Squirt an ounce or so of the dishwashing liquid into one end of the garden hose. (If the soap is really thick, add a little water as well.) Insert the end of the ⅜" copper tubing into the lubricated end of the garden hose and continue feeding it in until it extends out either end of the hose a few inches.

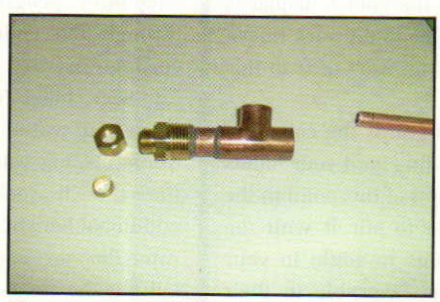
Coiling Your Chiller

The next step is to shape the cooler. I recommend taking the time to do it neatly. Commercial chillers are arranged in a nice, neat, stacked coil for a reason. First of all, it looks nicer. Second, it ensures a trouble free gravity drain. A sloppy coil will result in some parts of the tube being higher than others as the fluid travels around the loop. This will cause fluid to be trapped in the coil when the resistance of its weight exceeds the weight of the fluid behind it. In other words, it will stop draining before it's empty. It may be a small amount of fluid, but it is waste none the less. In addition, there is the potential for contamination associated with poor drainage of wort and water when cleaning the unit.

An empty corny keg is the perfect size to use as the form. Place it near one end of the hose and begin wrapping it around the keg in a spooling fashion. The curve of the keg is not so severe that it will readily cause kinking of the copper tubing, and the hose will act as a sort of protective sleeve during this step, but proceed with care just in case. Hold on to the end of the copper tube to keep it from sliding into the hose and out of reach. When finished, simply slide the keg out of the middle of the coil. There will inevitably be some movement of the tubing inside the hose during coiling, trim the hose and/or tubing so that there is 5 or 6 inches (13 or 15 cm) of tubing


Straightening the copper tubing and hose will make inserting the one in the other easier. Use dish soap for lubrication.


Use a drill with a 3/8" bit to ream out the tee fitting for the chiller. Place the fitting in a clamp to hold it securely.


The copper tee, 1/2" copper pipe and compression fittings are assembled as shown. Use JB Weld to hold them together.


The copper tee fitting slides over the 3/8" copper tubing of the chiller.

protruding from each end of the hose. (This step can be seen in the upper left hand corner of page 38.)

Reaming the Fitting

The end fitting fabricated earlier is made up partially from a fitting that is designed to rest at the end of a length of ⅜" copper tubing and has a small lip of material that facilitates that by providing a "butting" surface. We need this fitting to "float" over our tubing, so that lip must be removed. This is accomplished by simply reaming out the fitting with a drill and ⅜" bit. (This step is shown in a photo on the previous page.)

Affixing the Fittings

Once this is done, the fittings can be slid into place over the ends of the copper tubing, and into the ends of the hose. Remove the end nut and the sealing bushing from the compression fitting — and don't forget to place the hose clamps on the hose before attaching the fitting.

A bit of liquid soap and some elbow grease will be required to get the end of the fitting (tee side) into the end of the hose. Once this is done, position and tighten the clamp. (See the photo on the previous page.)

Attaching the Hose Ends

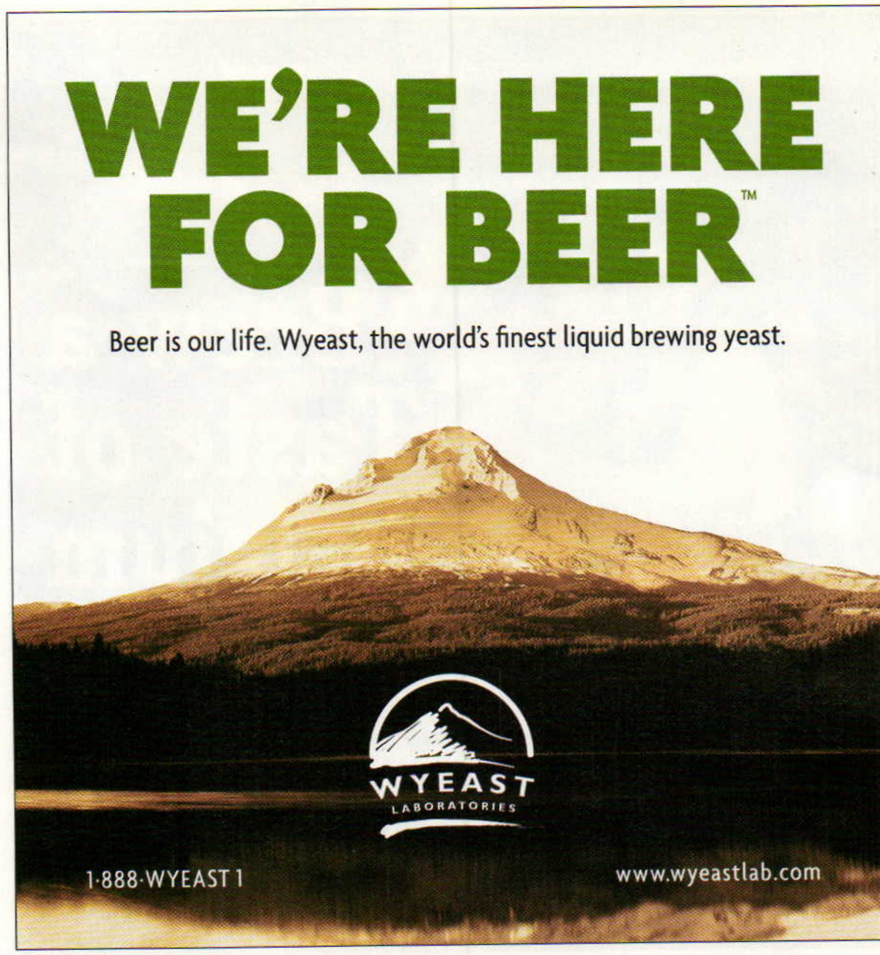
Attach the reserved hose ends in the same manner and apply clamps to complete the assembly.

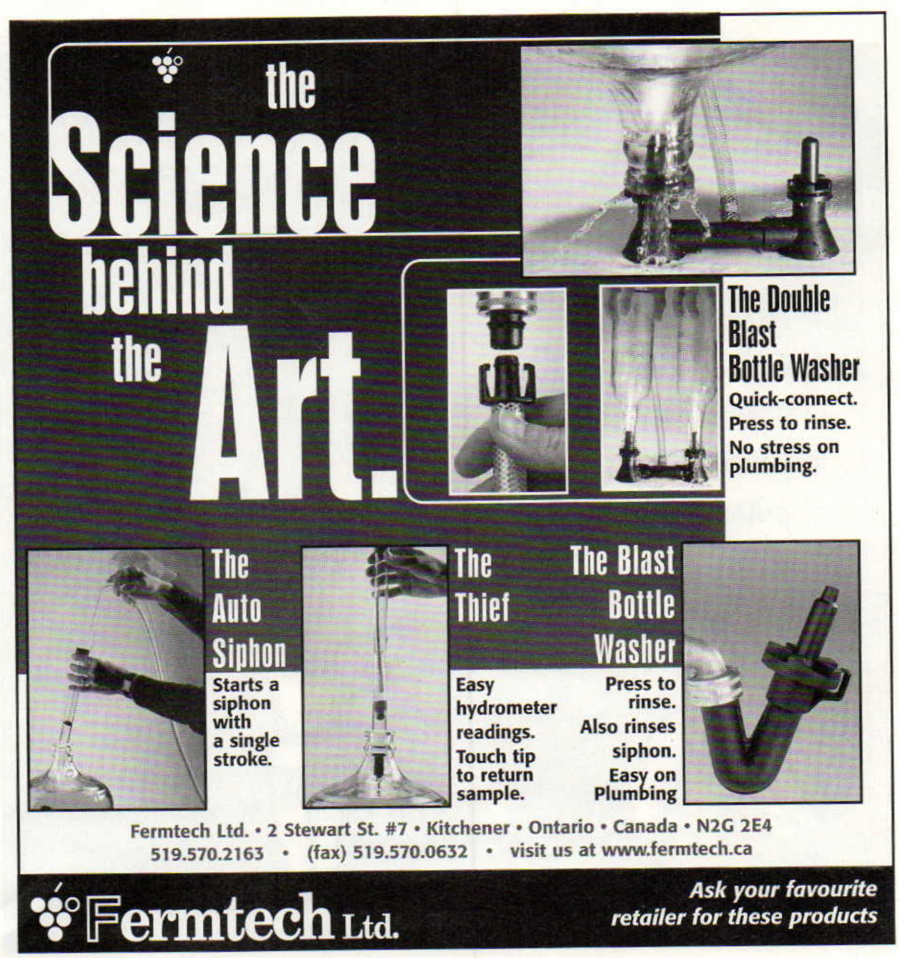
Up until now there was no top or bottom to the unit. Be mindful of your flow pattern now, as you attach the hose ends. The wort will flow via gravity from the top copper tubing access to the bottom one. The water must flow in the opposite direction. Thus the female hose fitting must be at the bottom and the male fitting at the top.

The assembly is now complete. The coil will hold its shape on its own but I added a few mini bungees from the dollar store to help keep it neat. Zip ties can be used for this as well. The finished project is shown on the opening page.

Preparation Before First Use

Ensure all of the clamps are tight and attach a water supply hose to your new chiller. Run fresh water through the cooler to rinse out the residual soap and





check for leaks. This part of the system is open and builds negligible pressure, so leaks shouldn't be a problem. Attach a 3/8" interior diameter (ID) poly tube to the wort inlet (top copper tubing access) and flush out any soap or debris in a like manner.

Using A Counterflow Chiller

Use of the unit is simple. Attach the fresh (cooling) water hose to the water inlet and attach a discharge hose to take the hot water to your drain or capture vessel. Attach your wort delivery tube (I use a fiber reinforced 3/8" poly tube run directly from the outlet valve of my boiling pot) to the wort inlet of the cooler (top copper).

To sanitize the unit, I open the wort valve on the boiling pot and allow hot wort to run through the coil. I run a pint or two of liquid through the cooler without any cooling water, then close the valve on the pot, and discard this wort. I then attach a sanitized 3/8" tube to the wort discharge of the cooler (bottom copper) and turn on the cooling water. Open the boiling pot valve again and run the wort discharge directly into your sanitized primary fermenter. This wort is now cooled well enough to allow you to pitch your yeast.

After use, detach the cooling water hoses and allow the outer sleeve to gravity drain. Rinse the copper tubing portion of the cooler well with water — the hotter the better — and drain well.

I do my initial cleaning of the copper tube and periodic subsequent cleanings with a caustic-citric cycle followed by a hot water rinse. This probably isn't necessary if your routine pays proper respect to sanitation, but it gives me a little added confidence that there are no bugs inside the cooler.

Adding this tool to your process is like going from a bicycle to a Ducati. The old way gets you there, but the new way works oh so much better. Once you have incorporated this simple and economical tool into your routine, you will wonder how you ever managed without it.

Reg Pope is a native son of Chicago, Illinois who now lives and brews (and lives to brew) in the Boise, Idaho valley.

CHILLING OPTIONS

When it comes to chilling your wort, you have a variety of options. Here is a rundown of most of the options that homebrewers have tried over the years — the good, the bad and ugly — and a discussion of their advantages and disadvantages.

Diluting Hot Wort with Cold Water in Your Brewing Bucket

Of the methods used by extract brewers, this is the ugliest because it just doesn't work. To hit the upper end of the ale fermentation range, you would need to boil one gallon (3.8 L) or less of wort and dilute it with 4 gallons (15 L) of refrigerated water (at 40 °F/4.4 °C).

Adding Ice or Frozen Items To Your Hot Wort

This method suffers from the same failing as the above — it takes a lot of ice (or ice bricks or frozen jugs) to cool down wort effectively. It can work with smaller volumes of wort, but the chance of contamination is great even if you have enough cooling material to chill your wort to a reasonable temperature.

Letting the Wort Sit Somewhere Cool Overnight

Believe it or not, some homebrewers in northern states will just put the lid on their kettle and leave it outside overnight to cool. If temperatures are cold enough (and your volume of wort small enough), this will work in reducing the temperature. However, the risk of contamination is severe as the wort will slowly travel through nice, warm temperatures that wort-spoiling bacteria love. Also, if some very lightly-kilned malts are used, you may get a lot of DMS in your beer.

Cooling Your Wort In A Sink or Bathtub

If you place your (covered) brewpot in a sink or bathtub and change the water several times, you can cool your wort fairly effectively. This is especially true if you are only dealing with 2.5 gallons (9.4 L) or less of wort. Swirling the water and wort occasionally will speed cooling. Likewise, adding ice to the sink or tub once after a few water changes greatly increases your cooling power. With regards to water use, this method is fairly efficient as all the cooling water used gets fairly hot before it is let out down the drain. For extract brewers without a wort chiller, this is our recommended method of wort chilling.

Coil Immersion Chiller

This is perhaps the most popular method for chilling wort and it is a good one. A copper (or stainless) immersion chiller will cool wort to about 10 °F (~5 °C) above the temperature of the cooling water. Its major drawback is that it uses quite a bit of water.

Counterflow Chiller

A counterflow (CF) chiller is fast and — due to its design — uses water efficiently. These can be pricey, but you can make an effective CF chiller yourself cheaply. An excellent option for chilling.

The science of brewing has been a subject of great interest to brewers for centuries. Breweries, of course, have an appetite for new ideas spawned from scientific inquiry that may be used to increase profits, either through developing new beers or by improving the quality of existing brands. To be quite honest, much of the research done in the brewing science community has little if any practical application to small-scale brewers, both home and commercial, because the cost of implementation is often very high. However, it is very interesting from an academic perspective and gives smaller brewers a better appreciation for larger breweries. Much research is devoted to improving analytical methods and unless you have a modern laboratory with lots of (expensive) analytical instrumentation, most new methods cannot be used.

A summary of key scientific articles in the brewing science literature for the year 2005.

story by **ASHTON LEWIS**

Technology is another very popular topic because real improvements in efficiency (energy consumption, ingredient yields and throughput) can be realized through new technology. Again, this means spending money and — unless you are in the market for replacing equipment or adding capacity — technological advances are usually not easily applied to current methods. And then there is the obfuscated term known as "basic research." Basic research uses scientific inquiry to expand the general knowledge of a particular field without having any identified practical application. Most topics these days are understood at a pretty deep level, meaning that most basic research is really hard to digest by the layperson and is far from "basic." Applied science develops new and practical techniques based on the expanded knowledge made possible by basic research.

In this review, I summarize some recently presented brewing science that sparked my interest. In an attempt to communicate the gist of the research in an understandable manner, I have taken the liberty to simplify the description of some the methods and technical points discussed in most of these papers. Some of the research summarized below does have practical applications that cost nothing and some of the studies are just plain interesting.

"The Influence of Process Parameters on Beer Foam Stability," by Graham Stewart, Michaela Miedl, Paul Chlup and Alexander Mader, Presented by Graham Stewart on October 16, 2005 at the 118th MBAA Convention in Miami, Florida.

Graham Stewart, a perennial speaker at brewing meetings, is the Director of the International Centre for Brewing and Distilling at Heriot-Watt University in Edinburgh, Scotland. Dr. Stewart worked in research for Labatt's from 1969–1994 and was its Technical Director from 1986–1994.

Stewart is an animated, Scottish lecturer and is a crowd favorite at brewing meetings around the world.

This year Dr. Stewart presented an interesting paper on the effects of proteinase A on beer foam stability. Proteinase A (PrA) is secreted by yeast during fermentation and also leaks from damaged and dead yeast cells. The foam stability of two similar beers brewed by the same brewery were compared over time. The primary difference between the two beers was that one brand was pasteurized in a tunnel pasteurizer and the other brand sterile filtered though a membrane filter. The pasteurized beer showed good and consistent foam stability after 3 months storage at room temperature while the sterile filtered beer showed a significant decline in foam stability over the same period. PrA activity was measured in the two beers; no enzymatic activity was detected in the pasteurized beer but was detected in the unpasteurized beer. Photos of these two beers were shown immediately after pouring into a tall cylinder and after several minutes. The difference in foam stability between the two samples was obvious and striking; the pasteurized beer demonstrated good stability and the unpasteurized beer had very poor stability.

This group also examined the effects of yeast stress on PrA concentration in beer. Dr. Stewart concluded that yeast stress in general increases the content of PrA in beer. The yeast stresses examined in this study included high-gravity fermentation and subsequent use of yeast cropped from these fermentations, prolonged yeast storage and shear stress from beer centrifugation.

"Degradation of a Foam-Promoting Barley Protein by a Proteinase from Brewing Yeast," by Rena Leisegang and Ulf Stahl, Journal of the Institute of Brewing, Volume 111, Number 2, 111–117, 2005.

The degradation of lipid transfer protein (LTP1) and protein Z by yeast proteinase A (PrA) was studied. Enzymatic activity was examined by monitoring changes to two known protein fractions from beer, LTP1 and protein Z, before and after incubation with PrA. Changes to LTP1 and protein Z were tracked using SDS PAGE (a gel electrophoresis method used to separate molecules by molecular weight) and reverse phase HPLC (another method used to fractionate components of a solution). Leisegang and Stahl found that PrA had no affect on protein Z isolated from beer, but did cleave LTP1 isolated from beer. These researchers also showed that PrA had no affect on either LTP1 or protein Z isolated from barley, suggesting that LTP1, but not protein Z, is denatured during the brewing process and is rendered susceptible to PrA activity.

The FOAM-PROMOTING protein LTP1 is degraded by the enzyme proteinase A.

The focal points of this study were protein Z (molecular weight ~40 kD) and LTP1 (9.6 kD). Both molecules are concentrated from beer foam and originate from protease inhibitors found in barley. Native proteins from grain (those not enzymatically cleaved or denatured) are not typically found in beer because of enzymatic action during malting and mashing and because of thermal denaturation during kilning, mashing and wort boiling. Previous studies have identified protein Z and LTP1 as two major protein fractions found in beer foam and have also shown that barley LTP1 does not promote foam as does LTP1 isolated from beer, suggesting that changes to barley LTP1 during malting and brewing have a positive affect on beer foam. The results of this study suggest that reduced foam stability caused by PrA activity is likely due to cleaving of LTP1 and not due to the cleavage of protein Z.

"Electron Paramagnetic Resonance Studies Comparing Wort Boiling Temperatures and Various Levels of Sulfur Dioxide in Packaged Beer," by Robert Foster II, Eric Johann Samp, Cecil E. Giarratano, Stephen Fletcher, Michael Miller and Warren Quilliam, MBAA Technical Quarterly, Volume 42, Number 3, 209–213, 2005.

This study was conducted by a research group at Coors Brewing Company and involved the application of a developing methodology known as Electron Paramagnetic Resonance spectroscopy (EPR). Bob Foster's group used EPR to monitor the effects of wort boiling on free radical activity in wort and the effect of sulfur dioxide concentration in packaged beer on free radical activity. The EPR method detects free radicals (unpaired or "free" electrons associated with staling compounds, for example) by using a spin trap to stabilize the short-lived radicals and the samples later analyzed. EPR results are typically expressed as EPR lag-time (minutes). To determine the EPR lag-time a beer sample is dosed with the spin trap compound and the sample is incubated at 60 °C (140 °F). During this time, beer oxidation is accelerated and with it the formation of free-radicals. A short EPR lag-time is associated with rapid formation of free-radicals and presumably is more susceptible to beer oxidation. This method has generated a lot of interest among brewing research groups because of its potential application to predict beer stability.

Bob Foster's group applied EPR to wort boiling studies. Since wort has no measurable EPR lag-time, a modified scale was developed where EPR signal intensity was measured after 150 minutes of sample incubation. An increase in this value correlates with an increase in free-radical activity. Wort was boiled in the Coors pilot brewery using three different over-pressures: 0 pounds per square inch gauge (psig) (95.5 °C/203.9 °F in Golden, Colorado), 2.5 psig (100.4 °C or 212.7 °F in Golden) and 5.0 psig (104.7 °C or 220.5 °F in Golden). Over the course of a 120 minute boil, the atmospheric pressure sample maintained a relatively flat free radical activity value, the sample boiled at 2.5 psig had a value nearly twice that of the atmospheric control and the 5.0 psig sample had a value three times that of the control. These data clearly show that wort boiling temperature has a demonstrable effect on free-radicals activity.

Another experiment was performed comparing the free radical activity between two wort boils of varying intensity. The high intensity boil had an hourly evaporative rate of 6.9% (8,500 pounds per hour steam flow rate to heating surface) and the low intensity boil had an hourly evaporative rate of 3.7% (5,000 lb./hour steam flow). The free radical activity at the end of the 140 minute experimental boiling duration was 20% higher in the high intensity boil. This suggests that thermally stressed worts (scorched, for example) may be less stable with respect to future oxidation.

Finally, this group looked at a range of beers from around the world and used a trained sensory panel to assess the flavor acceptance of the range of beers. They also measured the level of sulfur dioxide in these beers as well as the EPR lag-time. Sulfur dioxide is an anti-oxidant and is generally believed to prolong shelf-life. (Sulfur dioxide is not a legal additive to beer in the United States, although it is naturally formed by yeast and the concentration in beer is dependent on yeast strain, as well as other factors).

Foster's group found a very strong correlation with EPR lag-time and sulfur dioxide concentration, but flavor acceptance was independent from sulfur dioxide content below about 6.25 parts per million (ppm). Flavor acceptance decreased as sulfur dioxide levels increased above 6.25 ppm, which is consistent with prior studies. Based on previous studies, one may expect that increased levels in sulfur dioxide would decrease beer oxidation and improve the flavor acceptance up to a point where sulfur dioxide becomes detectable as an off-flavor.

The conclusion with the correlation between flavor acceptance and EPR was that EPR lag-time alone cannot predict the flavor acceptance of beer. They did examine two beer samples over a period of storage and determined the EPR lag-time for each beer when the sample was "obviously stale" to a trained expert taste panel. Interestingly, the beer with the shorter shelf-life as determined by the sensory panel had a higher EPR lag-time than the beer with the better sensory shelf-life. The group proffered that every beer should have a sensory-validated EPR lag-time signaling the point when a beer is obviously stale to a sensory panel if EPR is used to monitor staling.

R_X = IPA?

Is beer good for you? Two researchers have concluded that it might be. In their review paper — **"Xanthohumol and related prenylflavonoids from hops and beer: to your good health!" by Stevens and Page, Phytochemistry 65 (2004) 1317-1330** — two authors argue that a compound in hops (xanthohumol) has "broad spectrum" cancer chemopreventative qualities (i.e., the compound acts to prevent cancer in a variety of ways).

Xanthohumol is found only in the hop plant (*Humulus lupulus*). It occurs in the lupulin glands — where alpha acids and other hop flavor and aroma compounds are found — and on the underside of leaves. Xanthohumol comprises 0.1–1% of the dry weight of hop resin. However, the compound is degraded by heat and high concentrations of xanthohumol only appear in beers that had hops added late in the boil or beers that were dry hopped.

The authors cite a number of other studies that suggest xanthohumol is a "broad spectrum" chemopreventative agent that works by inhibiting the activation of procarcinogens (agents that cause cancer), inducing carcinogen-detoxifying enzymes and inhibiting tumor growth at earlier stages. The researchers note that xanthohumol does not have any known cancer treatment potential, only the possible ability to prevent the disease from occurring in the first place.

One of researchers (Stevens) previously measured the level on xanthohumol in various beers. Various American Pilsners contained from 9 to 34 micrograms per liter (μg/L). An IPA from the Pacific Northwest had 160 μg/L of xanthohumol while a porter from the same area topped the list with 690 μg/L of the compound.

Although xanthohumol showed promising activity in *in vitro* studies, the authors concluded that people were unlikely to get enough of the compound through drinking beer. The authors mention that hop growers would certainly welcome a new outlet for their crop and suggest that genetically modified hops may provide an enhanced source of xanthohumol. — Chris Colby

HOPS contain a **COMPOUND** that may help **PREVENT CANCER.**

"Plasma Sterilization - A Brilliant Innovation," by Peter Muranyi and Joachim Wunderlich, Brauwelt International, Volume 23, Number 5, 338–340, 2005.

Plastic bottles are used in the beverage industry for both extended shelf-life and aseptic packaging application. PET (polyethylene terephthalate) is the favored plastic for these applications, but one of the disadvantages to PET is that it softens above about 70 °C (158 °F) making it ill-suited for hot fill applications for the aseptic packaging of foods and beverages. More expensive polymers are required in such applications and methods that permit the use of PET bottles in aseptic packaging lines are of interest.

Current methods rely on the application of either hydrogen peroxide or peracetic acid (also known as peroxyacetic acid) to packaging materials prior to filling. These compounds have the major disadvantage of being hazardous in the work place if not kept within certain safe concentrations. Also, residue removal is difficult when required. Still, these two chemicals are exclusively used to sterilize thermally unstable polymers, such as PET, because they are effective and because there are no other options currently available.

Plasma technology is a possible alternative for sterilizing thermally unstable packaging materials. Currently, plasmas are used in a technique known as plasma-chemical-vapor-deposition or PCVD to apply extremely thin layers (10–100 nanometers) of silicon dioxide (glass) or carbon to PET bottles to improve gas barrier properties. Coated PET reduces oxygen transfer by a factor of 3–30 and carbon dioxide transfer by a factor of 7. This study examined the application of gas plasmas to the sterilization of packaging material.

Gas plasma is the fourth state of matter (after solids, liquids and gases) and gas plasmas contain a mixture of ions, electrons and radicals. When atoms in their excited states return to their base state, electromagnetic radiation in various wavelengths is emitted. Gas plasmas have a glowing appearance and are responsible for natural phenomena such as the Aurora Borealis. The combination of UV radiation, particle bombardment and radicals provides a safe, cost-effective, non-destructive, broad spectrum method of killing bacteria. Test results show that a one second treatment time reduced the population of *Bacillus* *subtillis* endospores, among other organisms, by a factor of 5.8. Current German industry standards require a total reduction of target organisms (e.g., *Bacillus subtillis*) by a factor of 4. Five seconds of exposure reduced the population of more stable spores from thermophilic bacteria and spoilage molds over 5 fold.

Additional work is required in applying this method to high-speed packaging machinery as well as examining how normal environmental soils, such as dust, fingerprints and bio-films, affect the efficacy of gas plasma sterilization.

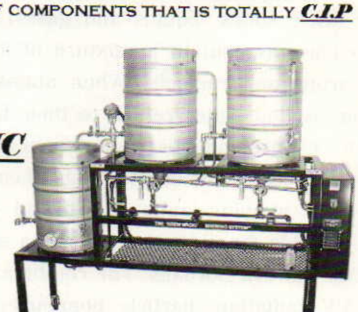
Reviewer's note: Gas plasma sterilization was developed in the early 1980's as an alternative to steam and ethylene oxide sterilization methods used in the medical industry. Batch-type gas plasma sterilization units have been commercially available since the early 1990's and used worldwide in medical and research labs.

"Detection and Identification of Beer-Spoilage Bacteria Using Real-Time Polymerase Chain Reaction," by Matthias Kiehne, Cordt Grönewald, Frédérique Chevalier, MBAA Technical Quarterly, Volume 42, Number 3, 214-218, 2005.

Conventional methods used by brewing laboratories to detect and identify spoilage bacteria typically require 5–15 days and in some cases up to 20 days to return results. With these methods it is nearly impossible to apply laboratory results in such a way to influence the process of the batch from which the sample was taken. Breweries commonly use microbiological monitoring to assess the overall level of plant hygiene, and rapid methods that can quickly detect and identify contaminants are of great interest to the brewing and food industries.

The polymerase chain reaction (PCR) is an enzymatic technique used to amplify DNA and has broad applications, including molecular biology, forensics, food safety and quality control. Methods designed to detect and identify bacterial contaminants amplify specific segments of DNA or RNA using hybridization probes. The nucleotide segments chosen for amplification are like fingerprints and can identify bacterial genus and species. In the method presented by Kiehne, Grönewald and Chevalier, detection is made possible by labeling the hybridization probes with fluorophores that emit light. When both probes are annealed to the target DNA segment light is emitted and is detected in the instrument.

A brewery-specific PCR kit, the foodproof® beer screening kit, was developed by Biotecon Diagnostics (Potsdam, Germany) and used in the Roche Diagnostics (Mannheim, Germany) LightCycler® real-time PCR instrument. The foodproof® PCR kit contains hybridization probes for 25 common beer spoilage organisms. Fifteen different *Lactobacillus* species, six *Pediococcus* species, one *Megasphaera* species and three *Pectinatus* species can be detected and identified in one single test.



The PCR method works by combining a sample that may or may not contain bacteria with the reagents in the test kit. This cocktail is run through programmed heating cycles where enzymes in the cocktail catalyze the replication of specific DNA sequences. This temperature cycle is repeated and each cycle doubles the number of DNA sequences that correspond to the probes. After the PCR cycles are complete, the temperature in the test chamber is increased to 40 °C (104 °F), all probes anneal and the fluorescence signal is maximal, thereby allowing the detection of DNA specific to the hybridization probes.

Beer-**spoiling organisms** can be **QUICKLY DETECTED** using a brewing-specific **PCR** kit.

The next step is identification, accomplished by slowly increasing the temperature in the test chamber and measuring the intensity of the fluorescence signal. As temperature increases, the DNA molecules become less stable and the fluorescent probes "melt" from the DNA and the signal drops. The melting behavior is specific for specific DNA sequences and can be used to identify the bacterial species. The method presented in this article uses a software package to gather and interpret test results by comparing test DNA melting curves to a library for identification.

The foodproof® PCR kits were sent to four different brewery labs for a field trial along with 15 samples containing known contaminants, including pure and mixed samples with up to four different organisms. From these 60 total samples, 56 samples were identified correctly by all four breweries (93.3%), one result was misinterpreted by one brewery (1.7%), and in three samples, the present species were identified but additional species were named (5%). The latter problem can be caused by system contamination from prior samples. This misinterpretation occurred in only one brewery, three laboratories gave 100% correct results.

Test results were produced after a pre-enrichment step to differentiate between living and dead cells (PCR amplifies DNA, regardless of the physiological state of the origin of the DNA) and to ensure detection of trace-level contamination. Normal brewery laboratory personnel were able to detect and identify beer spoilage organisms with impressive accuracy in only 2 days using this method.

So, that's some of what happened in brewing science in 2005. And, as you brew in 2006, rest assured that brewing scientists will be hard at work studying the beverage we enjoy so much.

Ashton Lewis is the technical editor of Brew Your Own *and the Mr. Wizard columnist. He is the brewmaster at Springfield (MO) Brewing Company.*

How Hot Was It?

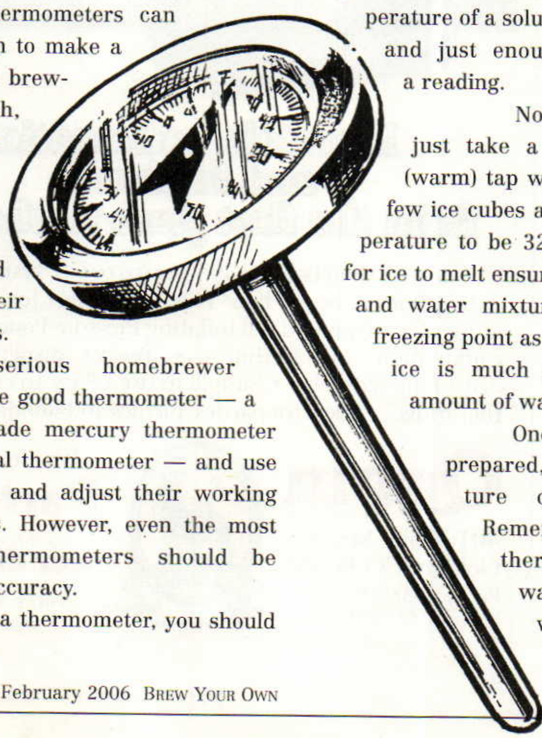
Calibrate your brewing thermometer

Story by Chris Colby

homebrewers make a variety of measurements every brewday. We weigh out our malt and hops and perhaps malt extract. We take the mash or steeping temperature. We either boil down to or top up to our target batch volume and then we take the original gravity. If you haven't calibrated your measuring devices, however, all these measurements could be off, perhaps by a fairly large margin. In this installment of Techniques, I'll show you how to calibrate your "master" brewing thermometer and your working thermometers.

Thermometer

Most homebrewers probably have a variety of thermometers. We may have bimetal thermometers for our mash tuns and hot liquor tanks, glass or digital thermometers for taking spot measurements and "temperature strips" stuck to the side of our buckets or carboys. Many homebrewers, however, may be unaware of how inaccurate thermometers can be. Cheap thermometers can be off by as much as 20 °F (11 °C). Even more expensive thermometers can be off enough to make a difference in brewing. As such, every homebrewer should know how to check and calibrate their thermometers.



Every serious homebrewer should get one good thermometer — a laboratory-grade mercury thermometer or good digital thermometer — and use this to check and adjust their working thermometers. However, even the most expensive thermometers should be checked for accuracy.

To check a thermometer, you should take the temperature of two solutions that you know the temperature of. The Catch-22 here is that, without a calibrated thermometer, how do you know the temperature of a solution? The answer is you rely on the physical properties of water to supply you with two set points.

The best place to start is at the freezing point of water. Pure water freezes at 32 °F (0 °C). If you can make a solution of ice and water right at that point, you can check if your thermometer reads right at freezing. To make a 32 °F (0 °C) solution, do the following:

Take a clean styrofoam cup and fill it with crushed ice, heaped on the top. (Technically, the ice should be made from distilled water, but using tap water won't affect your result by enough to matter in brewing.) Don't add any water to the ice. Put the cup in your refrigerator and wait until enough ice melts to submerge your thermometer to a depth that is adequate to take a reading. (Glass laboratory thermometers will have an immersion line showing how far the thermometer tip should be submerged.) It will take a few hours for the ice to melt to this point, so plan ahead. You want to take the temperature of a solution with a lot of ice and just enough water to take a reading.

Note that you can't just take a (warm) cup, add (warm) tap water, plunk down a few ice cubes and expect the temperature to be 32 °F (0 °C). Waiting for ice to melt ensures the resulting ice and water mixture is right at the freezing point as long the amount of ice is much greater than the amount of water in the mix.

Once the ice water is prepared, take the temperature of the solution. Remember that your thermometer is warmer than the ice water and will warm the local area it is inserted into, so swirl the tip of the thermometer a bit as you take the reading. Keep the thermometer in the slush until it gives a steady reading.

The second point to measure is the boiling point. Water boils at 212 °F (100 °C) at sea level, at standard barometric pressure (29.9 inches of mercury (in. Hg)). But what if you're not at sea level and standard barometric pressure?

Table 1 gives an adjustment factor for boiling water at various altitudes. If you don't know your altitude, you can find out at the US Geological Survey's Geographic Names Information System (or the USGS's GNIS, for acronym lovers) Their web site is located at geonames.usgs.gov (no "www").

If you wish to take barometric pressure into account, you can find your local barometric pressure at the weather channel (www.weather.com) or from a home barometer — if it's calibrated! See Table 2 for the correction due to barometric pressure. Add or subtract the value for the correction from the boiling point obtained from Table 1. Alternately, take your reading when your local barometric pressure is between 29.6 and 30.2 inches of mercury (in. Hg) and you'll be off by a 1/2 degree Fahrenheit (0.28 °C) at most. (There's also a web site that can do these calculations for you — www.biggreenegg.com/boilingPoint.htm.)

Now all you need to do is boil some water, preferably distilled water, and take its temperature. Don't try to kill two birds with one stone and check your thermometer next time you boil some wort. Because of the dissolved solids in wort — sugars, proteins, etc. — it boils at a higher temperature than water (around 215 °F/101 °C for an average-strength wort at sea level).

If you're lucky, your thermometer reads right at both points. If so, you can use this thermometer with confidence (although it's always possible there is a non-linear response over the thermometer's range). Or, perhaps it was off by the same amount at both points. For example, maybe it was two degrees low for both readings. In this case, all you need to do is compensate by simple addition or subtraction. In our example, you would need to add 2 to every reading to get the actual temperature. But what if one reading was right and the other was off? Or one reading was high and one was low? In that case, you'll need to make a calibration curve.

The calibration curve

Once you have your freezing and boiling temperature measurements, you are ready to make a calibration curve for your thermometer. The easiest way to do this is make a graph. Take a piece of graph paper and label the x and y axis from 30 to 220 (or 0 to 100, if you are using Celsius units). Now, make two points on the graph corresponding to your two measurements. The first coordinate gives what the reading should have been and the second coordinate gives what your thermometer read. For example, if your freezing measurement read 34 °F (1 °C), put a point at (32, 34). In other words, go to 32 on the x axis and trace a perpendicular line to 34 and place a dot there. If your boiling reading was 206 °F (97 °C), place a point at (212, 206). (Or maybe you live at an elevation where water should boil at 209; then you'd make a point at 209, 206.) Now draw a straight line between these two points. This line is your calibration curve.

Boiling Point of Water at Different Elevations

Altitude (ft)	Boiling Point
-500	212.9 °F (100.5 °C)
0	212.0 °F (100 °C)
500	211.1 °F (99.5 °C)
1000	210.2 °F (99 °C)
2000	208.4 °F (98 °C)
2500	207.5 °F (97.5 °C)
3000	206.6 °F (97 °C)
3500	205.7 °F (96.5 °C)
4000	204.8 °F (96 °C)
4500	203.9 °F (95.5 °C)
5000	203.0 °F (95 °C)
5500	202.0 °F (94.4 °C)
6000	201.1 °F (93.9 °C)

table 1

There are two ways you can use this curve. The first is to find out what the actual temperature is given your thermometer reading. To do this, take your thermometer reading and find that value on the y axis. Trace a horizontal line at this y value until it intersects the calibration curve, then trace a vertical line straight to the x axis. The line will intersect the x axis at the actual temperature.

The second way to use the curve is to figure out what your thermometer should read at a given temperature. For example, let's say you wonder what value your thermometer will give at 150 °F (66 °C). In this case, just reverse the procedure from the previous example. Find 150 °F (66 °C) on the x axis and trace a vertical line to the calibration curve, then trace a vertical line to the y axis. The thermometer's reading is the value at which the line crosses the y axis.

Effect of Barometric Pressure on Boiling Point

Pressure (in. Hg)	Change in BP (°F)
28.8	-1.87 °F (-1.04 °C)
29.0	-1.53 °F (-0.85 °C)
29.2	-1.19 °F (-0.66 °C)
29.4	-0.85 °F (-0.47 °C)
29.6	-0.52 °F (-0.29 °C)
29.8	-0.19 °F (-0.11 °C)
29.9	0 °F (-0 °C)
30.0	+0.14 °F (-0.08 °C)
30.2	+0.46 °F (-0.26 °C)
30.4	+0.79 °F (-0.44 °C)
30.6	+1.11 °F (-0.62 °C)
30.8	+1.43 °F (-0.79 °C)
31.0	+1.75 °F (-0.97 °C)

table 2

Working thermometers

Once you've calibrated your best thermometer using the methods above, you should use it as a reference to calibrate the rest of your thermometers.

Dial thermometers often have a screw in back that allows you to shift the needle up or down the temperature scale. You should use your calibrated thermometer to calibrate your dial thermometer(s) at a value within the range that you most use the dial thermometer for. For example, when calibrating a dial thermometer on your mash tun, you'll probably want to calibrate it for a value between 148 °F (64 °C) and 162 °F (72 °C) — the span of the starch conversion range.

Let's say you mash at 152 °F (67 °C) frequently. To calibrate your dial thermometer to this temperature, heat some water until your calibrated thermometer indicates the actual temperature is 152 °F (67 °C). Now, take the temperature of the water with your dial thermometer and adjust the screw until it reads 152 °F (67 °C). That's it; now your dial thermometer will read correctly in the vicinity of this point.

You may also want to check the same thermometer out at different temperatures. For example, you may want to see how your 152 °F (67 °C) calibrated thermometer reads at 131 °F (55 °C) (beta glucan rest temperature) or 170 °F (77 °C) (typical mash out temperature). If the thermometer's reading is off, use a permanent marker to highlight any key temperatures that may be important to you right on the dial. Keep in mind that dial thermometers need to be checked occasionally because they can "drift" over time.

For glass spirit thermometers — the kind with the red liquid inside — you can use your calibrated thermometer to check the readings at a variety of useful temperatures. Use a permanent marker (or colored nail polish) to mark your frequently used temperatures right on the thermometer. Likewise, for digital thermometers that can't be directly calibrated, you can make an index card with a two-column chart. In one column, put a list of your frequently used temperatures. In the second column record what your digital thermometer actually reads at those temperatures. Like dial thermometers, digital thermometers should be checked occasionally.

Chris Colby is the Editor of BYO.

Fantastic Plastic Kegs

An economical solution for short-term kegging

Story and photos by Graham Sanders

When we start out in this hobby, homebrewers typically package their beers in bottles. It doesn't take long for the homebrewer to realize that bottles can be a real pain: they take up a lot of space and are very time consuming to wash, sanitize and fill. So, the logical choice is to evolve to kegging. Stainless steel kegs are the best choice for long term storage, but there are less expensive alternatives that work well for the short-term (up to three weeks).

Plastic keg systems

Plastic kegs are a good alternative, because although they have a degree of oxygen permeability, they can sustain a beer for up to two weeks (possibly longer) without ill effect. Also, they are available in a wide array of sizes from 1 to 20 liters, so you can choose a size that you and your brewing friends can drink before the beer has a chance to oxidize. Another bonus — many of these kegs are small enough to throw in your kitchen fridge so no need for a kegerator!

All these keg systems work off small disposable gas bottles (soda chargers) that are used in devices such as soda-water dispensers, or those home made soft drink machines you get at department stores. The CO_2 source in these keg systems is not meant to gas the beer. The beer gasses itself through priming sugar that you add to the keg, similarly to the priming done in a bottle. The CO_2 source that you use helps maintain the pressure once you start pouring the beer. These keg systems have a device that allows you to add small amounts of CO_2 to maintain the pressure in the keg when you start pouring. **The procedure is simple:**

1. After fermentation is finished the beer is transferred to the plastic kegs.

2. You add a measured amount of priming sugar to the keg.

3. Seal the keg and let stand for two weeks to naturally carbonate.

4. After two weeks the beer will be carbonated and you put the keg in the fridge.

5. Pour from the keg through its tap, adding gas from your CO_2 source to maintain the pressure.

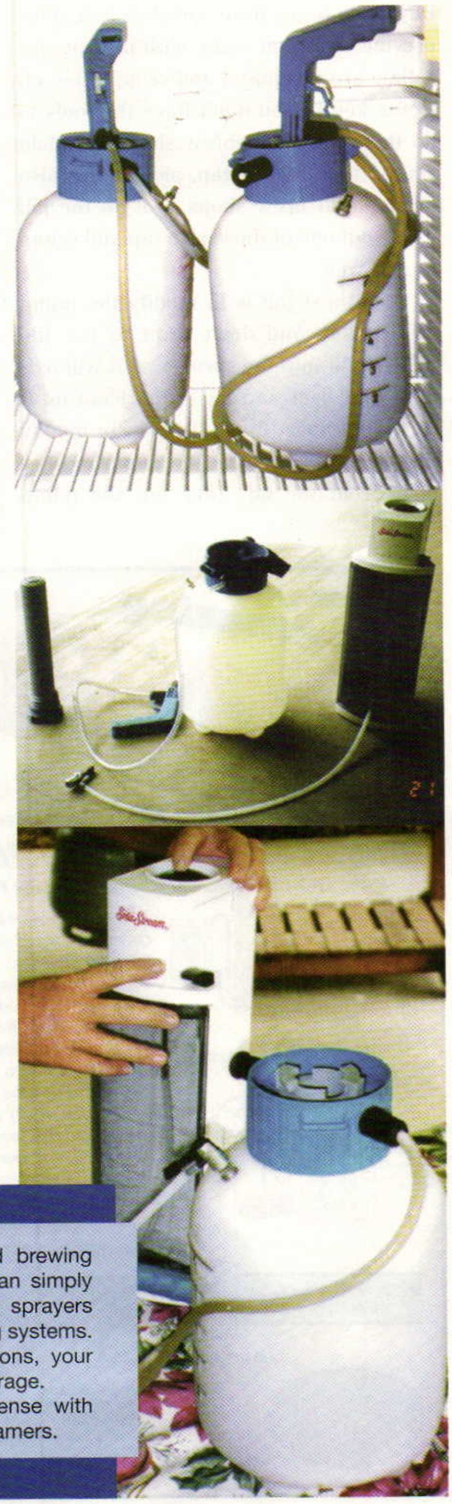
Homemade plastic kegs

It may surprise you that these kegs are the plastic spray bottles you find in the gardening section of any hardware store. They are the ones made of thick food-grade plastic that have a pump in the center of the lid. Be sure to find one that has an opening at the top big enough to get your fingers in. This is necessary to fit a tire valve.

Modifying the plastic kegs

The first job is to fit a tire valve to the keg above the liquid line (tire valves can be found at any tire store). To do this, drill a hole equal to the size of the tire valve, then fit the valve into the hole, being sure to create an air-tight seal with a rubber washer and food-grade glue. You need to get the chrome plated or stainless steel valves that are safe for beer. You normally should replace the rubber washer that seals it to the container with a new one available from any hardware store.

Next job is to check the lines. You should take them apart and remove any inbuilt filters. These filters will cause the beer to foam up. Be sure to replace the



(Top): The hobbies of gardening and brewing come together on more occasions than simply hop and malt growing. These garden sprayers have been modified to work as kegging systems. (middle): With a few quick modifications, your sprayer can function for short term storage. (bottom): These kegging setups dispense with the use of CO_2 injectors like soda-streamers.

lines with foodgrade lines if the hoses from the sprayer are not adequate.

Change the fittings

I have found that in many of these containers the fittings do leak over time. The original fittings are not designed for long-term pressure and most will slowly leak. What I recommend is to remove all the original fittings and replace them. Buy some hoses from your brew shop (or use the ones that came with the sprayer if they are adequate) and crimp them on to the keg (if you don't have the tools to do this, most homebrew shops can help you out). As for the tap, picnic taps, also available at brew shops, will do the job nicely. Fit one of those as a tap and crimp this as well.

The next job is to modify the pump mechanism. You don't want to use the pump built into the sprayer as it will oxidize your beer and has a lubricant on it that will impart funky flavors. To modify the pump you remove the pump mechanism from the lid. Take out the pump handle, then use cleansers and sanitizers to get all the grease out of the pump housing. At the bottom of the housing you will find a one-way valve. Remove it and seal the hole with a screw and a washer. Another way to seal the valve is to use a food grade glue. This is what we have done in this example. Either way, seal the pump and sanitize it — that's it!

Supply of CO_2

The final item needed is a source of CO_2 for your keg. We opted for a soda-stream dispenser that takes a small CO_2 cylinder available in most department stores. All you do is modify the dispenser by fitting a tire valve to its hose. This valve can then be used to pump CO_2 from those disposable CO_2 sources into your keg through the tire valve you installed earlier.

Using the system

Let's start with cleaning the keg. First, never scrub the keg as it will scratch and these scratches will harbor germs. The kegs clean very easily with either a hot caustic solution or bleach. Just add the solution and hot water and seal the keg. Make sure it gets into the top and runs through the line as well. Also, be sure to rinse the keg thoroughly to remove all traces of the cleaner before use (don't forget to rinse the line).

Next you will need to prime the keg with sugar. This will depend on the volume of the keg, but a heaping teaspoon of priming sugar per quart or liter of beer is not a bad place to start. Transfer your beer to the keg after it has finished fermentation. Let the plastic keg sit at your fermentation temperature for about two weeks to build up pressure. After two weeks it can be poured as you wish, just put it in the fridge first to chill. As you pour your beer you will notice the pressure will drop and the pour will slow. This is when you will need to put more CO_2 into the keg to maintain the pouring pressure.

Graham Sanders is a "down under" homebrewer and writes for Australian Craftbrewers at www.oz.craftbrewer.org.

A Delicate Balance

Balancing your dispensing system ensures a perfect pour

by Bill Pierce

One of the real pleasures of homebrewing is serving your own beer from your own tap. A properly set up and maintained home dispensing system allows you to pour correctly carbonated beer that has the appropriate head and appearance for style. However, it can also be the source of frustration if things are not done right. You can end up with a glass full of foam or flat and lifeless beer, depending. Both of these pitfalls can be avoided with a little knowledge and planning.

The science behind the bubbles

During fermentation, one molecule of glucose is broken down into two molecules of ethanol and two molecules of carbon dioxide (CO_2). The CO_2 that is produced is soluble in beer and results in residual carbonation. All beer contains at least some dissolved CO_2, and most styles are additionally carbonated, whether by fermentation of added sugar or by "force carbonation" with additional CO_2.

The total amount of CO_2 dissolved in the beer is measured in "volumes," which is the volume the gas would occupy if it were removed from the beer and kept at standard temperature and pressure (STP — (32 °F (0 °C) and 1 atmosphere of pressure) divided by the volume of the beer. This is also used to describe the carbonation level of a beer. For example, American lagers generally are carbonated to about 2.6 volumes of CO_2. Less carbonated styles such as many British ales can have a carbonation level as low as 1.2–1.3 volumes, while some sprightly German wheat beers may be carbonated to levels above 4.0 volumes.

The solubility of CO_2 increases as the temperature decreases. There is also some decrease in solubility as the specific gravity increases, but the effect is small and can be disregarded for the gravity of beer. The solubility of CO_2 also increases with increasing gas pressure. In order to achieve the correct volumes of gas in beer, it must be stored under pressure (either in bottles or kegs).

May the force (carbonation) be with you

The correct procedure for force carbonating beer to the appropriate carbonation level is outlined in an article in the Summer 2000 issue of *BYO* ("3 Ways to Carbonate Your Keg," by Ashton Lewis). To summarize, you can set the regulator pressure to the appropriate level (from the formula below, a carbonation chart or brewing software) and let the beer carbonate over a period of several days. Or you can use the "rock and roll" method (which is less exact but requires less time) of setting the regulator to a high pressure and shaking the keg vigorously for several minutes and repeating several times over a period of a couple of hours. A third method is to use an airstone, which greatly increases the surface area and reduces the required time with no decrease in accuracy.

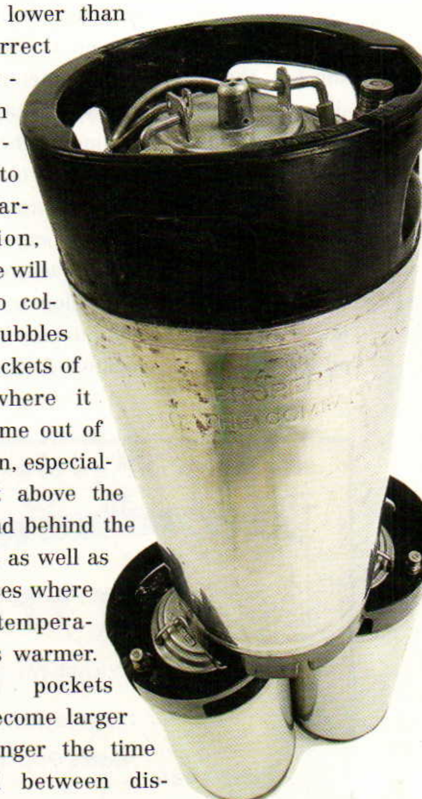
The formula for setting the regulator to the correct pressure, P (in pounds per square inch, or PSI) for the desired level of carbonation, V (in volumes of CO_2) at a beer temperature of T (in °F) is:

$$P = -16.6999 - (0.0101059 * T) + (0.00116512 * T^2) + (0.173354 * T * V) + (4.24267 * V) - (0.0684226 * V^2)$$

Problems down the line

Assuming the beer is carbonated to the appropriate level, it still has to make its way from the keg, through the line, out the tap and into the glass — and this is where problems can occur.

If the dispensing pressure is too low, the beer will pour too slowly and excessive foaming can result, to the point where little beer and mostly foam ends up in the glass. Furthermore, over time the beer in the keg will lose carbonation as more CO_2 comes out of solution as it attempts to achieve equilibrium with the headspace. At extreme underpressure the beer can become nearly flat. If the dispensing pressure is too high, it, too, can result in excessive foam from the beer pouring too quickly from the tap. With time, the beer will become overcarbonated as more CO_2 goes into solution, further complicating the situation.



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At lower than the correct pressure, in addition to low carbonation, the line will tend to collect bubbles and pockets of CO_2 where it has come out of solution, especially just above the keg and behind the faucet, as well as in places where the temperature is warmer. These pockets will become larger the longer the time period between dispensing beers. The first beer will have a shot of foam, followed by clear beer, followed by more foam. After pouring a few beers, the problem may dissipate, only to return again after a rest. Low-pressure problems also tend to show themselves early when a keg is nearly full.

At higher than optimum pressure, there will be overcarbonation and symptoms similar to those that occur at low pressure. The difference is that they tend to appear and grow worse as the keg is emptied. If a fresh keg is foamy, the odds are that it is not an overpressure problem. The reason is that, as the keg empties, more CO_2 occupies the larger headspace as the difference between the equilibrium pressure and dispensing pressure increases. Again this causes excessive foaming when the beer is first dispensed, until there is less CO_2 and more beer in the line.

A matter of balance

Calculating the correct dispensing pressure and making changes to the system is known as "balancing" and is critical to pouring a perfect beer. Balance is not only dependent on the carbonation level and the temperature of the beer, but several other factors also enter into the equation. These include the overall height difference between the keg and the tap, the length and diameter of the dispensing line and the type of tap being used. Changes to any one of these will change the balance of the system.

Between the keg and the tap, there is resistance to the flow of the beer. Gravity (the difference in height) accounts for 0.5 PSI per foot (11.3 kilopascals per meter), a positive value if the tap is located above the keg, negative if the tap is below it. A standard beer faucet has a resistance of 2 PSI (13.8 kPa); the shank adds another 1 PSI (6.9 kPa). A picnic or "cobra" tap has a resistance of about 0.5 PSI (3.4 kPa). Additionally, the beer line itself offers the following resistance based on the inside diameter. (These figures are for flexible vinyl beverage tubing):

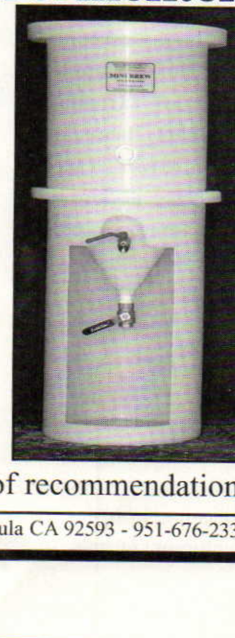
3/16 in. (4.75 mm) inside diameter (ID):
3.0 PSI/ft. (67.9 kPa/m)
1/4 in. (6.35 mm) ID:
0.8 PSI/ft. (18.1 kPa/m)
5/16 in. (7.94 mm) ID:
0.4 PSI/ft. (9.0 kPa/m)
3/8 in. (9.53 mm) ID:
0.2 PSI/ft. (4.5 kPa/m)

Finally, some additional pressure is necessary to achieve a proper flow rate. The generally accepted desirable pour rate for beer is considered to be 1 US gallon (3.8 L) per minute or 1 US pint (473 mL) per 7–8 seconds. For most systems, a value of 5 PSI (34.5 kPa) is sufficient for balancing calculations.

Assuming that the other values remain the same, the easiest way to balance the system is to adjust the line length so that the total resistance of the system equals the carbonation pressure minus the required 5 PSI (34.5 kPa) for a proper flow rate. Round the result to the next highest foot (0.3 meter).

For example, for a pale ale that is carbonated to 2.3 volumes of CO_2 at 46 °F (8 °C), the correct carbonation pressure (from the force carbonation formula) is 13 PSI (89.6 kPa). The beer is dispensed through a standard shank and beer faucet at a height of 2 ft. (60.9 cm) above the center of the keg. Here are the calculations for the required length of 3/16 in. (4.75 mm) diameter beer line in order to balance the system:

Gravity resistance: +2 ft. (60.9 cm) * 0.5 PSI/ft (11.3 kPa/m) = 1 PSI (6.9 kPa)
Shank resistance: 1 PSI (6.9 kPa)
Faucet resistance: 2 PSI (13.8 kPa)
Fixed resistance of the system (not



including the line): 2 + 1 + 1 = 4 PSI
(13.8 + 6.9 + 6.9 = 27.6 kPa)

Carbonation pressure of the beer (2.3 volumes of CO_2 at 46 °F/8 °C): 13 PSI (89.6 kPa)

Pressure required to dispense beer at 1 gallon (3.78 liters)/minute: 5 PSI (34.5 kPa)

Pressure needing to be balanced: 13 - 5 = 8 PSI (89.6 - 34.5 = 55.1 kPa)

Resistance to be supplied by the line: 8 - 4 = 4 PSI (55.2 - 27.6 = 27.6 kPa)

Resistance of 3/16 in. (4.75 mm) ID beer line: 3 PSI/ft. (67.9 kPa/m)

Length of 3/16 in. (4.75 mm) ID line required to achieve 8 PSI (55.1 kPa) resistance: 4/3 = 1.33 ft. (40.5 cm)

Rounded to next highest foot (0.3 meters): 2 ft. (61 cm)

Therefore, 2 ft. (61 cm) of 3/16 in. (4.75 mm) ID diameter tubing will balance this system for the example beer.

(**Note:** This length seems short by homebrew standards because 5 PSI is a higher "overpressure" than most homebrewers use. Lowering the dispensing pressure to 0.5–1.0 PSI will result in a line length more in line with usual homebrew setups. Experiment with flow rates to find one you like.)

Achieving new balance

Of course you may choose to serve a variety of styles at different carbonation levels and perhaps at different temperatures. This will affect the system balancing equation somewhat. You can recalculate the new carbonation pressure and line length necessary to balance the system, and adjust the dispensing pressure and replace the line with the proper length. If the difference is small, you may choose to ignore the slight imbalance; balancing a system does not require extreme precision. Or you may use what is called a "choker," a short length of smaller diameter line installed at the faucet shank. A more elegant solution is to purchase and install a line restrictor, which allows you to vary the flow of beer through the line. These devices are available from draft beer equipment suppliers.

Try to maintain an even temperature throughout the system. Carbon dioxide tends to come out of solution and collect in warm places, especially near the tap. This is why you may want to discard the first small amount of beer and foam that is in the line after the system has not been used for a while. If the taps are enclosed in a tower, insulate the lines or provide them with a supply of cold air.

Beer line deposits also can increase restriction and cause dispensing problems. This is another reason to regularly clean the lines and taps. And finally, keep your glassware clean, well rinsed and free of soap deposits — and store them at room temperature. Frozen glasses or mugs will cause foaming and greatly reduce beer aroma and flavor. The proverbial "frosty mug" is a gimmick that does not improve the quality of the beer.

Bill Pierce writes the Advanced Homebrewing column in each issue.

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Becoming Certified

What the Beer Judge Certification Program is about

Story by Roger Savoy • Rensselaer, New York

Tuesday evening — Our class of 30 is working again and going over our homework. Over the next two and a half hours our instructor lectures, draws diagrams and writes out equations. The last half-hour is a practical and every one takes notes on our projects before we begin to discuss them. For eight weeks of summer school, a dedicated bunch of men and women are seeking to improve themselves. When class is over we all go downstairs to the bar, grab a beer and continue discussing our lesson.

Ever enter a homebrew contest? Perhaps after seeing your score sheet you briefly wondered about the judges. What qualifies them to be a judge? Well there's actually some rigorous training. We're going through that now with about 30 hours of class and practicals. Sure, you think, "30 hours of drinking, easy," but you'd be surprised at how much work there is.

The organization that trains new judges is the Beer Judge Certification Program (BJCP). The BJCP's purpose is to promote beer literacy, the appreciation of real beer and recognize beer tasting and evaluation skills. The BJCP certifies and ranks beer judges through an examination and monitoring process. Founded in 1985, there are over 2,000 members throughout North America and the world.

Our instructor is George DePiro, head brewer at C.H. Evans Brewing Co. and the Albany Pump Station in Albany, New York. George has been a homebrewer for years, head brewer at the Pump Station since it opened and is himself a BJCP judge. He is a font of wisdom and provides a lot of information for us to master. Eight three-hour sessions followed by two reviews cover every aspect of brewing and evaluating beer. Who would believe you could take notes on malt for five hours? There's enough science to make me get out my daughter's chemistry and biology textbooks for a quick review. And of course, there's history too — why beer styles developed as they did, stout in Dublin and Pilsner in the Czech Republic, for example. We also were assigned to write essays. Our homework while George was touring breweries in Europe was:

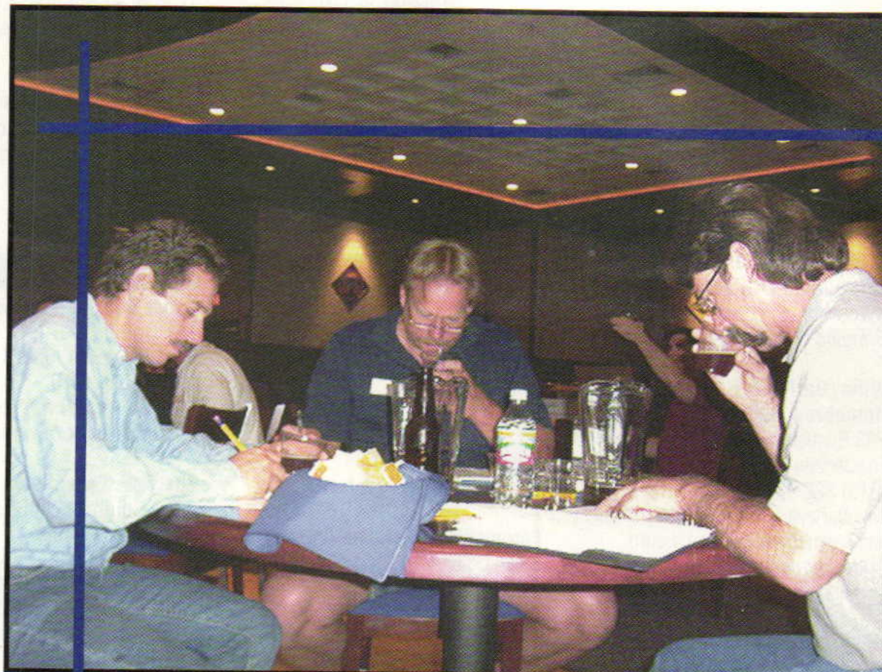

photo courtesy of Chico Homebrew Club

The Beer Judge Certification Program (BJCP) promotes beer literacy and appreciation through education, testing, certification and the evaluation of judges through ranking. BJCP judges like the ones above judge homebrews and give feedback.

1. Explain the lambic style and describe each of the following: faro, framboise, gueuze and kriek.

2. Describe and differentiate the taste and aroma characteristics of the following beer styles and give commercial examples of each: a) American brown b) Munich dunkel c) robust porter.

3. Explain how the following grains are produced, and what effect each has on beer: Black Patent? Chocolate malt? Dextrin malt? Roasted barley? Munich malt?

The lecture's end brings the serious work of tastings. Evaluation is, after all, the reason for being a judge. There's vocabulary to learn and everyone must understand the beer and be able to describe it accurately. We sample flaws in beer such as oxidation, diacetyl, skunkiness and more in order to recognize them.

We also evaluate several mystery beers each night knowing only the style. This is "nose in the glass, sip and write everything you can about the beer on your score sheet" work. All's quiet until we discuss the beer and then there is the test to get ready for — three hours long and quite difficult. Sample tests are on the BJCP Website (www.BJCP.org) if you're curious.

If you want to get involved, volunteer at the next homebrew contest. Contests always look for stewards to assist judges. Or you can organize a contest yourself! Those are some ways to earn points towards being a judge. You'll find a wealth of information about beer and the BJCP at www.BJCP.org along with information on the point schedule. There's a Talon Barley Wine, Old Nick Barley Wine and a Warsteiner Pils in my fridge — Time to do my homework!