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SEPTEMBER 2004
Volume 10 Number 5

Brew Your Own

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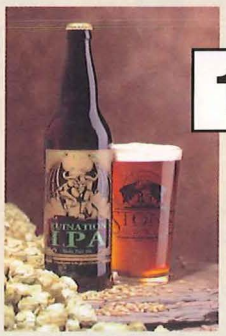

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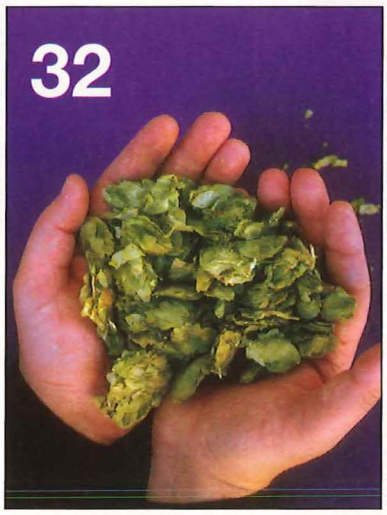

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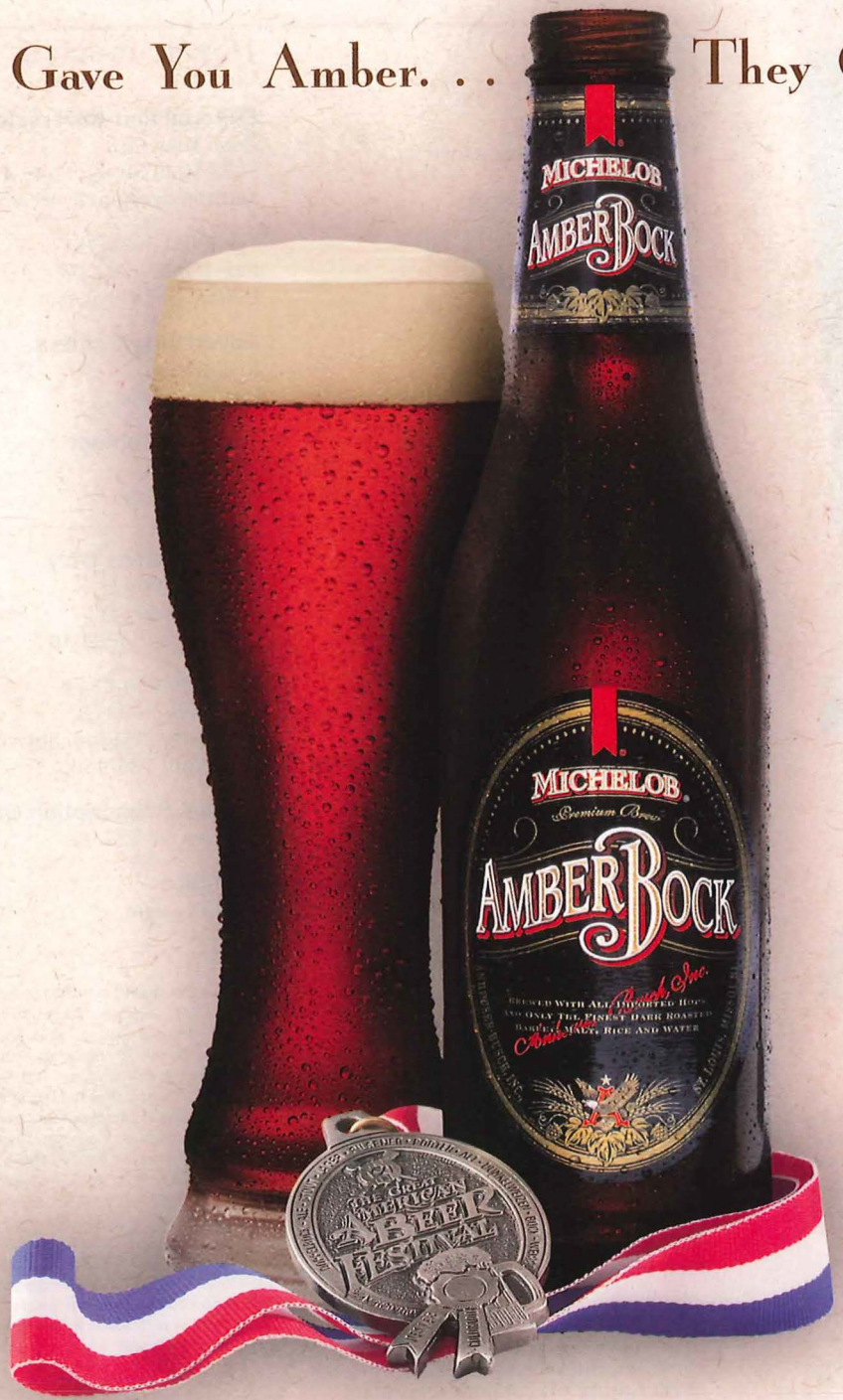

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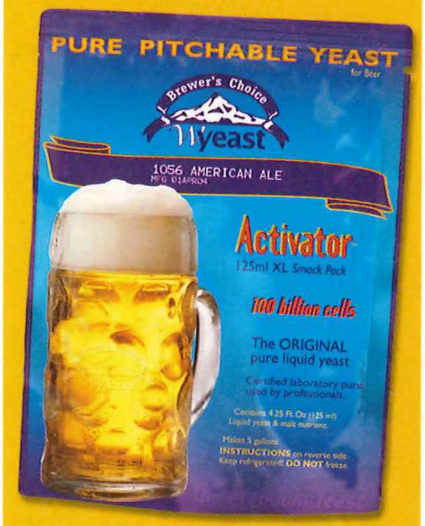

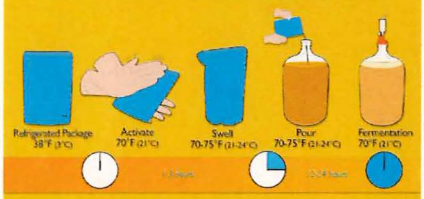

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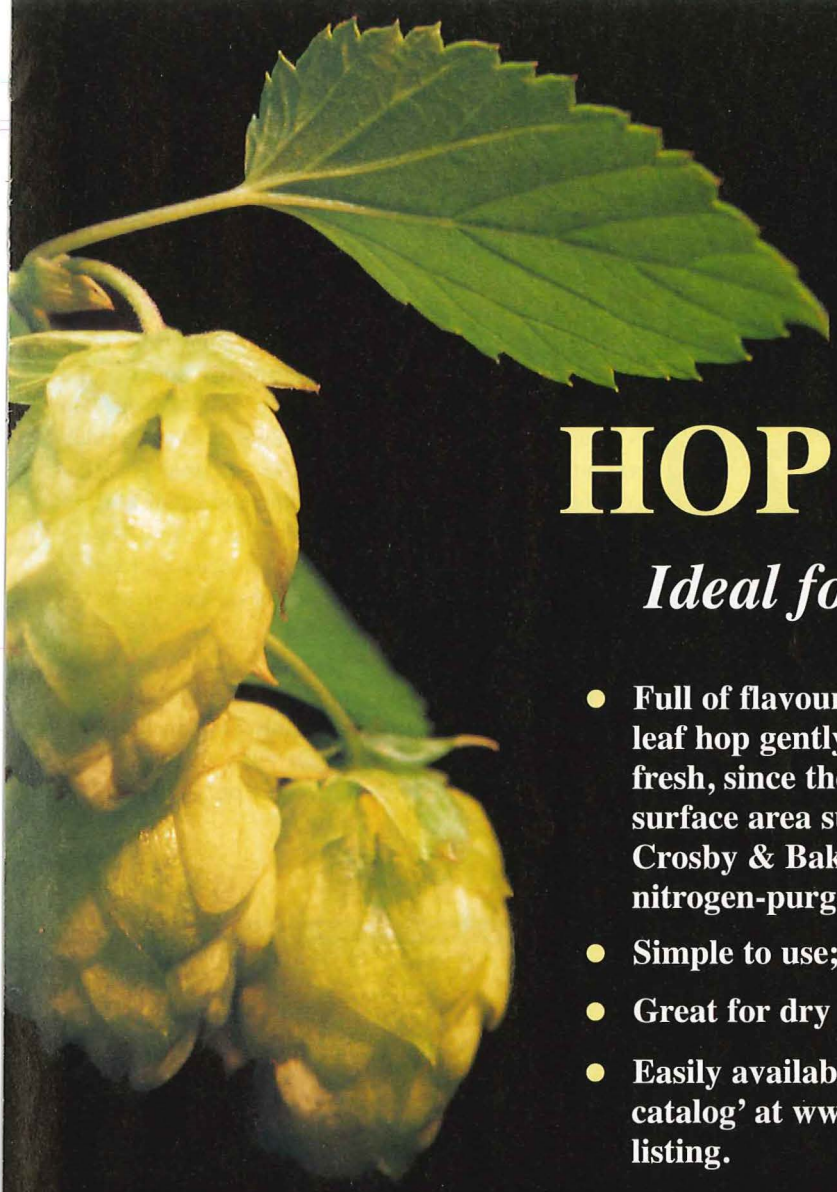

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BYO RECIPE STANDARDIZATION

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

Extract values for malt extract:
liquid malt extract (LME) = 1.033–1.037
dried malt extract (DME) = 1.045

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

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

CONTRIBUTORS

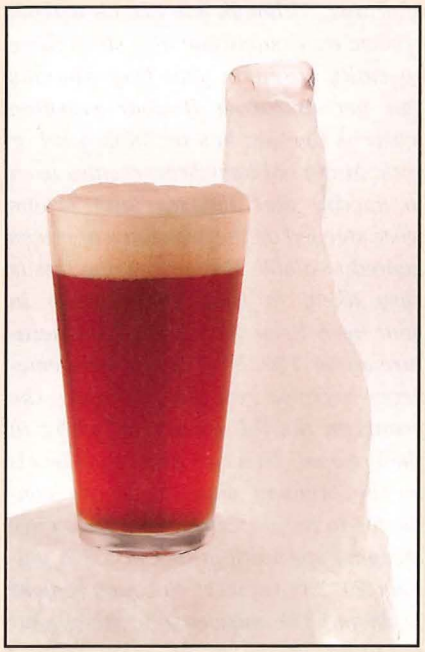
Terry Foster was born and educated in London. He holds a doctorate in chemistry and has been brewing for more than forty years. Terry wrote two books in the Classic Beer Style series — "Pale Ale" and "Porter." He is also the author of "Dr. Foster's Book of Beer," which was published in 1978. He divides his time between Connecticut and the United Kingdom and keeps himself busy by homebrewing, helping out at a New Haven brewpub and playing lots of tennis. When not doing any of the above, he manages to find the time to write an occasional article for *Brew Your Own* magazine.

His first *BYO* contribution was the January–February 2003 cover story on "Perfect Porter." Since he literally wrote the book on pale ale, we had him follow up with the September 2003 cover story on this classic British style. On page 26 Foster returns with an an oldie but goodie on "Old Ales."

Steve Holle is the author of "A Handbook of Basic Brewing Calculations" (2003, Master Brewers Association of the Americas). The idea for the book developed after Steve started homebrewing and began looking for ways to gain better control over his results. While studying for the Diploma in Brewing through the Institute and Guild of Brewing (IGB) in London, the practicality of a text that would help brewers and students translate brewing theory into practice became even more evident. The result is a peer-reviewed handbook that includes a wide range of brewing equations covering everything from water to draught dispense. Steve has also written articles for various commercial and home brewing periodicals covering both technical and cultural topics on brewing, with a particular emphasis on German beer.

Steve now holds that Diploma in Brewing from the IGB and has completed courses through Doemens Akademie in Munich and the University of California at Davis. In addition to the IGB, Steve holds memberships in the Association of Brewers in Boulder, Colorado and the Master Brewers Association in St. Paul, Minnesota. He's also a member of the The North Texas Homebrewers Association (in North Texas no less). Steve not only likes to write and brew beer, he likes to drink it. In fact, Steve was a 2003 finalist in the Wynkoop Beerdrinker of the Year contest.

You can listen to Steve Saturdays from 5 to 6 PM on the Beer Show broadcast over 990 AM in Dallas or over the internet at www.990mainstreet.com. When not writing or talking about beer, Steve works in commercial real estate finance in Dallas, Texas. In this issue, he utilizes his brewing knowledge in the story "Controlling Beer Bitterness" on page 32. *Enjoy!*



The Nitty Gritty

The all-grain recipe for Flatonia Bock in Chris Colby's article, "Chip Off the Old Bock" (July-August 2004) specified 2.66 pounds of corn grits. My local homebrew shop does not carry grits, but I found some at my local supermarket. The problem is, they are all labeled as "degerminated and fortified" and contain reduced iron on their ingredient list. Are these usable? Everything I've read about iron states that it is bad for brewing, even in very small amounts.

Chris Dilmor
San Francisco, California

Article author, and BYO *editor, Chris Colby responds: "When using corn grits as an adjunct, do not use grits that are fortified with iron. Iron can cause a number of problems in homebrew including off flavors and haze. Find a store that carries organic foods and look for grits whose only ingredient is degerminated corn grits. Another name for corn grits is polenta."*

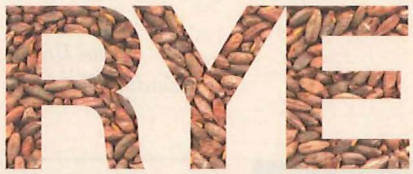
The UR-Al

The profile of Al Korzonas (Homebrew Nation, July–August 2004) did not include the fact that he is the author of "Homebrewing: Volume 1" (1997, Sheaf and Vine). A newly corrected version (not a new edition) is available now. See www.brewinfo.com/hbv1.html for more information.

The 411 on FWH

I'm very much looking forward to trying Denny Conn's Rye IPA ("Give Rye a Try," May–June 2004), but there's a term I'm not familiar with in the recipe. The first item in the hop bill says, "4.9 AAU Mt. Hood whole hops (FWH)" What exactly does "FWH" mean? The other hops have boiling times listed.

Rob Lewis
via email

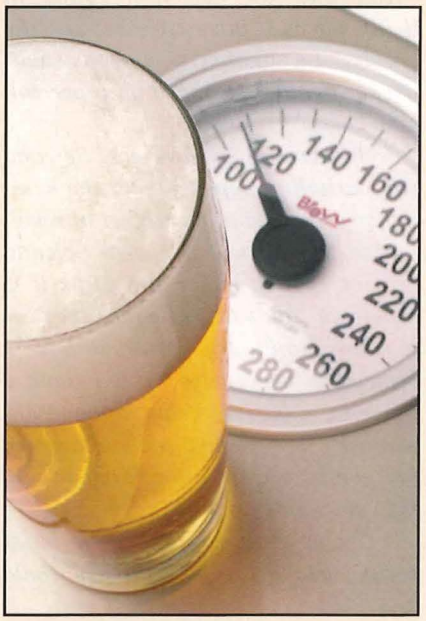


"FWH" is an abbreviation for first wort hops. First wort hops are added to your wort as it is being run off into the kettle, prior to the boil. We should have spelled that out.

Low Carb Letter

We have found that the Atkins diet is a serious way to reduce our weight and keep it off. However as enthusiasts for "real beer," we are struggling with this life style change. Your article on low carb beers ("Low Carb Creations," by Chris Colby, May–June 2004) is appreciated.

I am going to brew up a batch using Beano and Splenda. Given that Splenda is made from sugar and has a similar taste and mouthfeel, I would have thought it would add gravity at the same rate as indicated by its sugar equivalency (but less than an equivalent weight of sugar). However, after doing a quick experiment with a hydrometer, it looks like it adds about 0.006 SG versus sugar at 0.047. That fits with the fact that my wife says you cannot make a thick syrup out of it. Do you agree with this? I am trying to sort out how to interpret my FG readings.



Also, I was surprised that your bitter recipe called for crystal or any other malt other than pale malt and perhaps a touch of chocolate for color. I see that your crystal is 60 °L, presumably also for color since 0.5 lbs. looks about right for a bitter. I realize the color can be a different with chocolate even with a similar SRL rating, but given the objective of reducing carbs, what are your thoughts about leaving out the crystal and substituting just enough chocolate to achieve the same SRL level? Using ProMash to play with this, it looks like about 0.17 lbs. of 350 °L chocolate malt can replace the 0.5 lbs. of crystal. My understanding is that chocolate leaves less gravity in the beer than crystal, plus of course you use much less for the same SRL.

Nick Riehle
vial email

Author and BYO *editor Chris Colby responds: "Your measurements of the specific gravity of Splenda solutions make sense. Splenda is a no-calorie*

sweetener that is meant to be substituted for sugar on a per volume basis (i.e. if a recipe calls for a cup of sugar, a cup of Splenda can be used instead). However, a cup of sugar weighs much more than a cup of Splenda, which is very lightweight and 'fluffy.' Because Splenda has less solids in it, it doesn't increase the specific gravity of a solution as much as sugar does when it is swapped on a per volume basis.

"In low-carb homebrews, Splenda can partially compensate for the missing sweetness and mouthfeel of residual carbohydrates. However, Splenda doesn't exactly mimic the carbs it is replacing. You will still notice the beer is substantially dry, yet it will have a somewhat sweet edge to it. I think a Splenda addition helps a bone-dry low-carb beer regain some character, but you may want to experiment with how much you add.

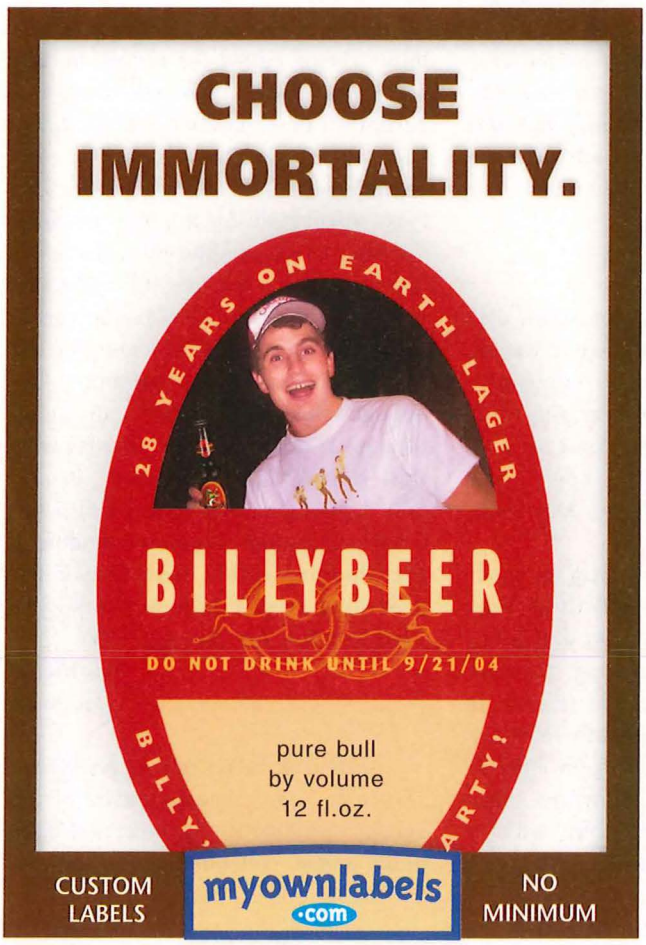
"As for crystal malt in the bitter recipe, you are right that you could add a smaller amount of chocolate malt to get the same color and have fewer carbs. However, a small amount of chocolate malt does not give the same flavor as a moderate amount of crystal malt (60 °L). I did not seek to absolutely minimize the amount of carbs in the recipes in the article. Rather, I tried to lower them to a reasonable level for low-carb dieters, yet still have the beer retain some character of the respective beer styles."

A Harsh Question

I recently took the plunge and entered two of my beers in a homebrew contest. My friends and I really like the stuff I make, but both of the beer judges said my beers were astringent. Other than that, they didn't seem to have too much bad to say about them. I am an extract brewer, but I do full wort boils on a burner setup out on my back porch.

Tom Drake
London, England

Astringency comes primarily from tannins that get extracted from the husks of grains. Although you are an extract brewer, we assume you also steep some specialty grains in your beer. Tannins can get extracted if your steeping water is too hot, has too high a pH or both. Many old homebrew recipes used to specify that the specialty grains were steeped as the brewing water was heated to a boil. However, doing this is very likely to cause astringency in your beer. Keep the steeping temperature under 170 °F (77 °C). Many homebrew recipes call for steeping the grains in the full amount of water in the brewpot. This can lead to pH levels in the brewing water that are conducive to tannin extraction. (If you are steeping specialty grains in 5.5–6 gallons (21–23 L) of wort, this may be your problem.) The answer is to steep your specialty grains in no more than 3 quarts (~3 L) of water per pound (0.45 kg) of grain and keeping the temperature under 170 °F (77 °C). ■



brewer PROFILE

Michael J. Hidinger • Schenectady, New York

photos courtesy of michael j. hidinger

(top): These yarrow plants grow in Michael's backyard.
(bottom): Michael's Yarrow Ale contains cranberry blossom honey for flavor.

I began homebrewing in the winter of 1995. I was starting to explore ancient Celtic and Germanic culture, and had taken a mythology class the previous semester. At the time, there were micro and craft brews filling the shelves of local stores. Somewhere in the middle of all this, I decided I wanted to try brewing my own beer. I remember looking up homebrewing supplies in the phone book and finding a company with an 800 number. A couple weeks later I had my first homebrewing setup: a basic equipment kit. I plan on updating my setup sometime but I'm still brewing with the same hardware, though my approach to brewing and the styles I brew have changed.

My first beer was a German alt beer kit, and it turned out pretty well. The kit was loaded with liquid and dry malt extracts, as well as grains for steeping. Then came some pale ales and continental light style kits. Friends sampled my brews and I received good feedback. I stopped brewing for a while, but I was still learning about brewing.

In the summer of 1995 I had read Ralph Metzner's "The Well of Rememberance: Rediscovering Earth Wisdom Myths of Northern Europe." At the end of the book was an appendix essay by German anthropologist Christian Rätsch called "The Mead of Inspiration and Magical Plants of the Ancient Germans." This short essay was filled with herbal and brewing folklore and, to my astonishment, spoke of beer without hops. This sparked an ongoing interest in unhopped ales. Later, I found Stephen H. Buhner's book, "Sacred and Herbal Healing Beers." This book was enough to get me to start brewing again.

When I returned to homebrewing I started exploring herbal brews right off. My first attempts were mediocre — I was getting confused by ancient and native techniques. Then I realized that I should brew just as I had done before, except replace the hops with other herbs — then the magic started happening again.

The funniest experience I've had was brewing with ground ivy (also called alehoof and cat's paw): the herb blooms in spring with bluish-purple flowers and smells sweet, like spring itself. Well, when I added it to the boil it smelled like roasting lamb. I thought about ditching the batch, but went through the entire process and the ale came out okay. No roast mutton smell or taste, just a subtle spicy bitterness.

I only get to brew a couple times a month, so I try and create ales that are anything but ordinary. I've brewed ales with ginger, heather, elderflowers, dandelion roots, and many other herbs. One of my favorite homebrewed ales was a yarrow ale with cranberry blossom honey. Check out my recipe below!

reader RECIPE: Yarrow Ale with cranberry blossom honey

Ingredients for 5 gallons (19 L):

1 can (3.3 lb.) unhopped amber malt extract (brewer's choice)
2 lbs. (0.9 kg) amber dry malt
1 lb. (0.45 kg) cranberry blossom honey
Dried yarrow leaves and flowering tops
1 packet brewing yeast of choice
¾ cup of wildflower honey (priming)

Step-by-step

Preparation of yarrow: cut or snap off the upper portion of the plant, leaving the roots and bottom of the plant in the ground (so they will grow back for future batches). Two big handfuls is typically enough to make one batch, they shrink as they dry, so what seems like a lot of herbal material will look much smaller when it's time to stuff the grain sock for steeping.

Boil 1 gallon of water and add the liquid and dry malt extracts. Add your yarrow (in the grain bag) and let boil for one hour. Remove the grain bag and transfer the wort to the fermenter.

Now add the cranberry blossom honey, stir, then top up with the remaining four gallons of water. Let cool to room temperature and pitch your yeast.

When the ale is fermented and ready to bottle, boil a cup of water and stir in ¾ cups of wildflower honey. Let cool, add to brew and transfer whole mix into a bottling bucket. This ale takes a while to mellow out: there is a "medicinal" tangy taste at first. This is from the cranberry blossom honey. The yarrow will add a subtle spiciness and mild bitterness. As time goes by, the honey will mellow and the ale will reach its true taste potential. The "medicinal" tangy taste evolves into a smooth sweetness that is balanced by the yarrow's bitterness.

homebrew CLUB

Redstick Brewmasters

Baton Rouge, Louisiana

In 1973, when homebrewing was Blue Ribbon malt, cane sugar and bread yeast, a group of graduate students at the Louisiana State University Department of Marine Science got together and formed the Redstick Brewmasters. LSU is located in Baton Rouge, and "Baton Rouge" is French for red stick.

In 1974, the first Red Stick "brewoff" took place. The first place award was a glass-bottomed aluminum tankard. The winner had to drink a sip of the first place beer from the tankard, which he then kept until the next brewoff. Records are skimpy but it is known that Andrew Short took first place in 1974 and John Harper was first in 1975.

In 1977, club members Charlie Milan and Nelson May introduced Munton & Fison extract and brewers yeast to our club. This was a big step up and we simmered along for the next eleven years. As graduates left the Marine Science department, new blood came in. Soon the membership boasted doctors, lawyers and possibly one Indian Chief.

One afternoon, during happy hour at the Chimes Bar, the first group of officers was elected: Charlie Milan, President; Nelson May, Vice President; Rick Shaw, Chairman of the Board; and Erick Swenson, Secretary and Treasurer. When you get a good thing going, you don't try to fix what isn't broken. The same people have the same offices today and total active membership hovers in the twenties.

We now host a spring brewoff in May. There is always good Cajun food, accompanied by several kegs of homebrew. The contest format is simple: two beers, one light and one dark. Alternating years, one of the beers will be a recognized style and the other will be an open category of opposite color. For example, in 2000 the beers were California Common and "Clone Wars From The Dark Side," followed in 2001 with American Brown Ale and "Is It True Blonds Have More Fun?" The first place winners in each category are required to brew the club-supplied beer for the next brewoff.

The Cajun style gumbo contest is held in early December. First, you have to make a "roux." A roux is flour slowly browned in oil. Next come the shallots, celery, green pepper, andouille (a local smoked sausage), seafood such as shrimp, crawfish, oysters or crabs, onions, garlic, spices, but no okra! And oh yes, it has to have beer in it. The first place gumbo cook gets his name engraved on the Golden Crawfish, and gets to keep it on his mantle for a year.

The Redstickers have started to make their presence known on a national scale — AHA awards for brown ale and Kölsch and blue ribbons at the Dixie Cup, Crescent City Competition and Bluebonnet Challenge.

– Marlon Lang

photos courtesy of Marlon Lang

The Redstickers are a competitive bunch and enjoy hosting various events. Their Cajun style gumbo contest and spring brewoff are always enjoyable and delicious!

we want you

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BYO

If we publish your article, recipe, photos, club news or tip in Homebrew Nation, you'll get a *BYO* Euro sticker.

replicator

by **Steve Bader**

Dear Replicator,

I just had a bottle of Stone's Ruination IPA. Wow! From the first sip it's an all out assault on your senses. With 100+ IBUs, all other IPAs pale in comparison. I didn't even realize that I was a masochistic hophead until I tried this. I have to make this one. Can you help?

Jim Heintzel
Gaffney, South Carolina

So you love hops? And alcohol? And massive flavor? This beer is for you. Ruination was originally an anniversary beer for Stone Brewing, but demand was so high that they eventually made it part of their everyday lineup.

I spoke to Chairman Greg Koch and Head Brewer Lee Chase about their obsession with hoppy beers to get the lowdown on making Ruination IPA. At over 100 IBUs, this beer is way up on the hop bitterness scale. Lee says that Stone tries to keep it simple when making their beers. For Ruination they employ a single infusion mash at low temperatures to create the maximum amount of fermentable sugars. They add the finishing hops in the whirlpool (at the end of the boil, just prior to going through the wort chiller) and then add the dry hops to the fermenter just as the beer hits terminal gravity.

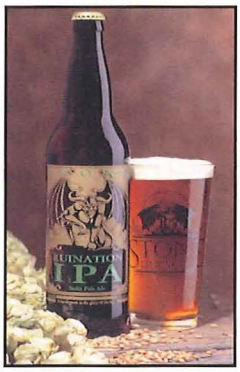
For more information visit their Website at www.stonebrew.com or call (760) 471-4999.

Stone Brewing - Ruination IPA

(5 gallons/19 L) OG = 1.075 FG = 1.010
IBU = 100+ SRM = 6 ABV = 7.9–8.5%

Ingredients

6.6 lbs. (3 kg) Northwestern gold (light) malt extract syrup
2.0 lbs. (0.9 kg) Northwestern gold (light) dry malt extract
1.0 lb. (0.45 kg) Briess 2-row malt
1 lb. (0.45 kg) Briess crystal malt (15 °L)
1 tsp. Irish moss (60 minutes)
36.0 AAU Magnum hops (bittering hop) (2.25 oz./64 g of 16.0% alpha acids)
15.7 AAU Centennial hops (aroma/finishing hop) (1.5 oz./43 g of 10.5% alpha acid)
21.0 AAU Centennial hops (2.0 oz./56 g of 10.5% alpha acid)
White Labs WLP001 (California Ale) yeast or Wyeast 1056 (American Ale) yeast
0.75 cup of corn sugar (for priming)



Step-by-step

Steep the 2 crushed grains in 3 gallons (11.4 L) of water at 149 °F (65 °C) for 30 minutes. Remove grains from wort, add Magnum hops, malt syrup and bring to a boil. Add Irish moss and boil for 60 minutes. Add the first addition of Centennial hops at the end of the boil, and let steep for 5 minutes.

Add wort to 2 gallons (7.6 L) cool water in a sanitary fermenter, and top off with cool water to 5.5 gallons (20.9 L). Cool the wort to 75 °F (24 °C), aerate the beer and pitch yeast. Allow the beer to cool over the next few hours to 68 °F (20 °C) and hold at this temperature until the yeast has finished fermentation. Add last addition of Centennial hops for dry hopping. Dry hop for 3 to 5 days, then bottle your beer, carbonate and enjoy!

All-grain option:

Use 14.6 lbs. (6.6 kg) 2-row malt and 1.0 lbs. (0.45 kg) of crystal malt (15 °L) in your grain bill. Mash your grains at 149 °F (65 °C) for 60 minutes. Collect enough wort to boil for 90 minutes and have a 5.5-gallon (20.9 L) yield (~7 gallons or 26.6 L). Decrease Magnum boiling hops to 1.75 oz. (50 g) to account for higher extraction ratio of a full boil. The remainder of the recipe is the same as above.

homebrew calendar

September 10-12
Emerald Coast Brew Fest and Beach Party
Pensacola, Florida

Sample from a range of Southeastern brewpubs and breweries, specialty beers, and of course, a wide selection of homebrews. Food, live music, and the Beer Olympics — Keg Toss, Izzy Dizzy, and Bungee Beer are just a few of the events — will all be part of the Escambia Bay Homebrewers' three day party. For more information, visit http://emeraldcoastfest.tripod.com.

September 30
The Keg Ran Out Club 10th Annual World Brewers Forum
Denver, Colorado

The KROC World Brewers Forum features world-class speakers, homebrew and prize giveaways, last year's Forum had over 400 attendees. This year, speakers will include Randy Mosher and Charlie Papazian. Proceeds from the event will be donated to a Denver charity. For more information, visit http://kroc.org.

September 30-October 2
Great American Beer Festival
Denver, Colorado

For the twenty-third year, the Association of Brewers will host the Great American Beer Festival. Last year, the festival featured over 1,400 beers for tasting, over 2000 beers judged in 65 categories by judges from 6 countries and an attendance exceeding 22,000. Beer tasting sessions go on all three days at the Colorado Convention Center and an award ceremony takes place Saturday afternoon. General admission costs $35 in advance. For more information visit www.beertown.org.

BREWER'S DICTIONARY

N is for . . .

natural conditioning: A secondary fermentation that occurs during ageing. During this maturation period there are still live yeast in the beer.

Ninkasi: The Sumerian goddess of beer.

noble hops: A variety of hops grown in Germany and Belgium. They are renowned for their flavor and aroma.

nonhopped: any style beer or malt extract that has not had contact with hops.

nonflocculating yeast: Bottom fermenting yeast that do not form clumps while fermenting.

Northern Brewer: A variety of hops grown in Kent, England, containing 8.5–11 percent alpha acids. It also grows in the northwestern United States, to even higher alpha acid levels.

nose: A term used in tastings to describe the overall fragrance, aroma and bouquet of a beer or wine.

Nugget: A variety of hops that grow in North America. This hop strain typically has about 9–13% alpha acid content.

nutrients: like any living creature, yeast require nutrients to remain healthy while performing their duty (i.e. fermentation). The essential nutrients are nitrogen and phosphorous, which are typically packaged and sold as "yeast nutrients" to add right after pitching your yeast.

Nuts and Bolts: A mix of a mild and bitter ale that is popular in England (most popular in the East Anglia region).

home hop grower

John Stika • Dickinson, North Dakota

PHOTOS COURTESY OF JOHN STIKA

I began growing hops in 1994 two years after I started homebrewing. The weather in southwestern North Dakota can get rather extreme at times (-30 °F in winter to 100+ °F in summer), but my hops continue to thrive. I have one each of Hallertau, Cascade and Tettnanger. They grow on the north side of my garage where it isn't too hot and dry in summer. I have diverted the downspout from the front of the house to irrigate the hop bed whenever it rains (our annual precipitation is only 16 inches). In the fall each plant is cut back to the ground and covered with a healthy layer of compost to protect them through the winter (and nourish them during the next growing season).

This year I have already harvested about two pounds (0.9 kg) of hop cones that I have used in my own brews or given away to fellow brewers. I usually begin harvesting hops around the middle of August into late September. The crop is then dried in a food dehydrator for several hours at a low temperature, cooled and stored in sealed plastic bags in the freezer or refrigerator until the time comes to put them to use in brewing.

Since it is difficult to assess the bitterness (alpha acid content) of my homegrown hops, I usually use them for flavor and aroma additions late in the boil.

I also make my own malt from locally grown barley. I have made two batches of beer so far composed entirely of homemade malt and homegrown hops.

The best use for my homegrown hops is dry hopping. I have made some wonderful pale ales with my Cascade this way. I use an ounce of fresh hops and let them soak for 3–5 days. This makes for extra hoppiness in the bottle or glass.

(top): Stika grows three hop varieties — Cascade, Hallertau and Tettnanger.
(bottom): John and his wife pick the ripe hops that grow up the side of their house.

Bitter Ale

Make your bitter a bit better

by Thomas J. Miller

There are lots of reasons to be bitter. Car won't start, stepped in a puddle, batch of beer won't carbonate. . . But rather than feel bitter it's better to make bitter: easy drinking, a generous dose of hops, plenty of flavor and history make the bitter ale a style fit for every homebrewer's quiver.

Brewer: Andy Ingram is the owner and head brewer of Four Peaks Brewing in Tempe, Arizona.

Our award winning "8th Street Ale" is based on Young's Ramrod beer. A gentleman by the name of Barry John, who worked for Youngs & Company in London for 35 years, worked with me on the recipe. The definition we give for our bitter ale probably makes it closer to a "best bitter" in technical brewing circles, but we take the liberty of calling it an "ordinary bitter." The ordinary bitter has a starting gravity around 1.032. Ours is closer to 1.048, which is why I admit that the brew is closer to a "best." Either way, it's bitter . . . and delicious!

What I focus on in the brewing process is the ingredients. Maris Otter malt is the traditional English malt used in bitter ales — in fact, for some brewers, it is considered a "must have" if you are going to make any English style beer. But I have a bulk silo and dealing with one special grain for one beer just makes no sense from an economical standpoint.

Instead what I use as the base malt is Cargill's two-row Metcalfe. It is from their Prairie Malt branch. I find it to be light and clean, with really clean flavors. To create the sweetness, flavor and color we would get from the Maris Otter malt, but don't get from the regular two-row malt, we have to use a variety of other malts in the grist. I add Carapils, crystal (80 °L) and 5% Munich malt. This combination, in my opinion, provides the toasty maltiness and color that the beer would otherwise lack.

Another malt choice, however, could be Briess Munich (10 °L). I think this grain would work well as the base malt and would provide the color and flavor you are looking for in your bitter ale. Vienna malt (at around 6 °L) may even be a better choice because it has better enzymatic qualities, which means it will convert better during the mash if you use a high percentage of it in your grist.

Of course, if you choose to use either Munich or Vienna malts, be sure to cut back on the crystal malts (and all other dark malts). Dark copper is the darkest color I would recommend to anyone looking to make a bitter ale. I actually prefer to go even lighter than that — I never go beyond the 10–11 SRM range as a general rule of thumb for this brew.

Brewing is nothing more than a simple, one-step infusion mash. We shoot for 154 °F (68 °C) and typically get full conversion in fifteen minutes. We continue mashing for another thirty minutes after that, but anything beyond that would really just be overkill. Our malts are so modified that this is more than enough time for the mash.

We bitter with U.K. Golding. No other hops are added until the whirlpool. We use U.S. Fuggles in a hop back. We spent a lot of time debating whether we would dry hop this beer but ultimately decided against it. We thought we would get better character and flavor from a hop back. This device essentially holds about 20 pounds (9 kg) of Fuggles and we run the post-boil wort through it. The wort goes through the hops at approximately 208 °F (98 °C) into the heat exchanger and then finally on to the fermenter.

> "The brew ends up with 21 IBUs, but my personal opinion is it drinks even more than that."

The brew ends up with 21 IBUs, but my personal opinion is it drinks even more than that. The fresh hop aroma and flavor from the hop back gives the sense that it is a hoppier ale than the number 21 indicates.

We are lucky to have a proprietary ale yeast that is a derivative of the London Ale yeast. Basically, this yeast was isolated and given to us. It is very clean and has the capability to ferment much cooler than most other ale yeasts. We ferment at 63 °F (17 °C). This cuts down on esters, though I'm of the opinion that our beer style has a bit of apricot character.

Brewer: **Ed Herrmann is the brewmaster at Upland Brewing Company in Bloomington, Indiana.**

It is safe to say that we take a different approach with our bitter ale. Our Upland Pale Ale is really more of an American bitter than your traditional English bitter. Even so, it won the Silver Medal in the bitter category at the 2003 Great American Brewing Festival.

We use lots of Cascade hops when making this beer. That is one of the things that really sets it apart. We originally thought of it as a crossover beer. It was meant to be one of those brews that someone switching from mass-produced beers to craft brews could get excited about.

We like to see a light malt character in this beer. It should not have any roasted grain flavor. The malt character should be evident and present, but certainly not overwhelming.

Because the name suggests the beer is going to be "bitter," it is a good idea to select the right kind of bittering hop, which are not all made in the same way. Some might have a high alpha acid but also be high in co-humulone. We like the Cluster hop variety because they work well for hearty bittering. The Cluster gives our bitter a smooth and pleasant bitterness that the style calls for. It is safe to say that a good bitter ale should be smooth, like a session beer. Ours has that flavor quality, but is a little high in alcohol content to quite qualify for session drinking.

A good homebrewing grist for a ten-gallon batch of bitter ale might look something like this: 18 pounds (8 kg) of pale malt, 1.5 pounds (0.7 kg) of Munich malt and 0.3 pounds (0.1 kg) of crystal (40 °L). If you want to try and make this beer the way we have, try the same hops we use with a similar schedule for your first batch. Of course, if you find you desire more or less in the way of bitterness you can always make changes in hop selection for future batches.

We use a British ale yeast and ferment at a cool 63 °F (17 °C). Most brewers go warmer than that because it allows the beer to turn around more quickly and gives more zip to the brew. I find the cooler fermentation temperatures result in a smoother beer.

Homebrewers should feel free to experiment with any ideas they glean from professional brewers, other homebrewers and books. What I have learned in my years of brewing is that following the recipe is just a starting point: all the other details — like fermentation temperature and cleanliness, to name just a couple — are the determinant factors in the beer's final quality. ■

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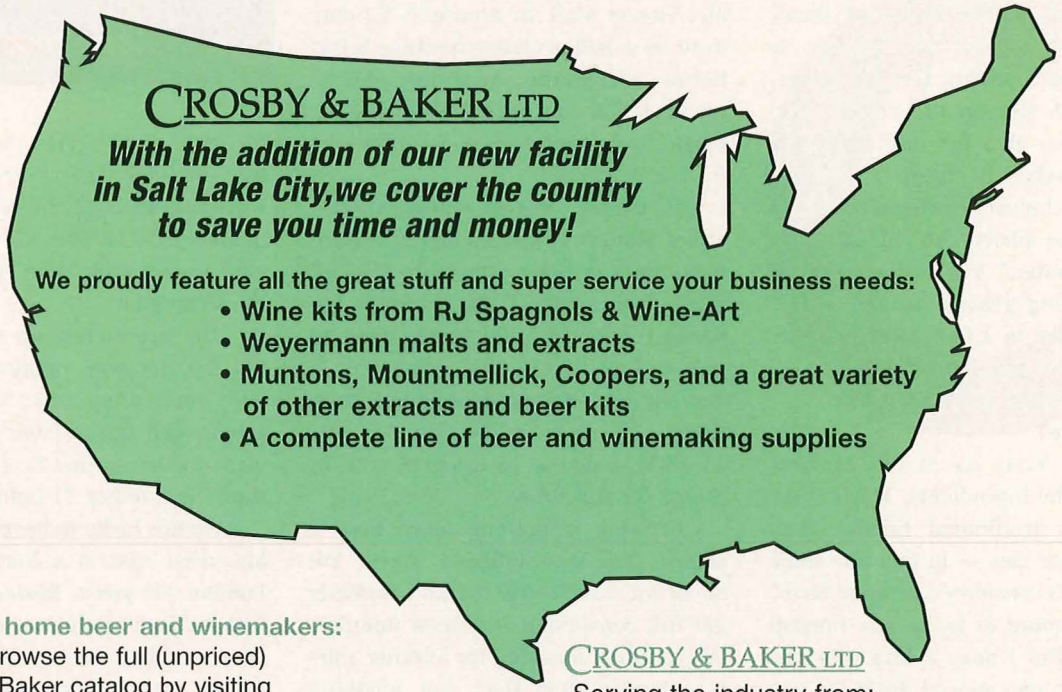

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Mashing methodology

"Help Me, Mr. Wizard"

A dry malt extract exclusive and some finicky fruit

Step it up?

My neighbor and I have been doing single infusion mashes for about four years. We started doughing in at 104 °F (40 °C) and holding this temperature for 20 minutes. This has increased our efficiency. We have read that instead of doing a single infusion, it is better to do a step at 140 °F (60 °C) and a step at 158 °F (70 °C) for a total of one hour, with the understanding that the amount of time spent during the hour at 140 °F and 158 °F will change depending on the brew you're making. What's your take on this advice?

David Reaser & Ray Redcay
Bethlehem, Pennsylvania

The topic of mashing technology and mashing biochemistry is a topic of deep personal interest and is one that I have written much about over the years in this column. I advocate using certain brewing implements and brewing techniques when needed. Mashing is certainly an area where different options abound. A brewer can choose from infusion mash tuns, stirred mash mixers (heated pot and spoon for the homebrewer), double mash set-ups for either decoction or adjunct mashes and then a whole sub-set of options for the type of wort separation method. When it comes to the mash profile itself, the options are wide open since the mash profile is a combination of temperatures held for various times to accomplish the brewer's goal.

The brewer's goal is where I keep my attention glued. There are many new brewing technologies springing up in the world of commercial brewing that attract many brewers because the methods are new, and this attraction to technique often takes the focus off of the most critical element — namely the brewer's goal!

The brewer's goal in mashing is two-fold. The primary goal is to convert starch from the variety of starchy ingredients into fermentable sugars so that yeast may gobble them up and transform wort into beer. This goal is crude and we can accomplish our primary goal and produce beers with a very high residual extract as well as those with virtually no remaining carbohydrates.

The secondary goal of mashing, and arguably a much more important one, is to take control of the transformation of starch. In order to control these reactions it is critical to understand the reactions themselves and this means boning up on mashing biochemistry — aka enzymes. I will avoid covering this topic in depth because I want to cover new ideas, but here's a quick rundown on enzymes in the mash.

Enzymes are most active when their "temperature optimum" and "pH optimum" are both met. If the mash temperature exceeds the optimum temperature of a specific enzyme, say beta-amylase, the enzyme irreversibly denatures and permanently loses activity. The various relevant enzymes active in malt have a range of temperature optima from ~104 °F (40 °C) to 158 °F (70 °C).

The rate of enzymatic reactions is highest when the concentration of enzyme and substrate are high. This means that reaction rates drop off as time passes and there becomes a point of diminishing return where extending the mash time does not have any real affect on the mash. It also means that if the concentration of a certain enzyme group is very low in malt, for example proteolytic enzymes, there will not be much change in the wort attribute by the enzyme group. In other words, if they ain't at the party, they can't contribute to the fun!

Most all-grain brewers are fluent in the material above and many can recite the various temperatures and enzymes active over these ranges as easily as their own birthdays. The real question is picking the appropriate tool for a particular brew. This requires defining the finished brew and choosing a strategy to get there.

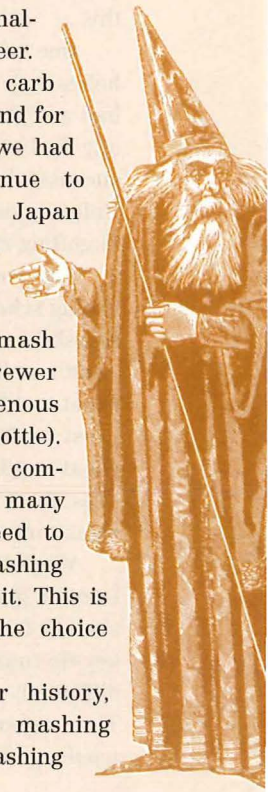
At the most recent Craft Brewers Convention in San Diego, Dr. Michael Lewis and Dr. Charlie Bamforth (past and present brewing science gurus at U.C. Davis) gave a wonderful presentation where they challenged brewing practice and demanded us as brewers to defend why we do what we do. To rephrase the thought, they challenged the audience to think about the brewer's goal and to critically evaluate their methods selected to strive towards this goal.

One of the many topics covered was mashing time and temperature. Many big brewers have gotten side tracked in the last year with their inexplicable pursuit of low carb beers. Anheuser-Busch, the company many believe to have accidentally created this monster, has recently gone after the South Beach Diet because this diet has incorrectly labeled beer as high in carbohydrates, specifically the disaccharide maltose. It seems that the author of this diet never studied microbiology and fails to recognize the fact that yeast consume maltose to transform wort to beer.

Before we had low carb beers, we had light beers and for a brief flash of U.S. beer we had dry beers, which continue to remain very popular in Japan where the style first began with Asahi Super Dry. All of these beer styles require long, multi-temperature mash profiles unless the brewer decides to use exogenous enzymes (enzymes from a bottle).

The result with these commercial trends is that many brewers have felt the need to use multi-temperature mashing because other brewers do it. This is not the best reason for the choice of method.

Further back in beer history, Germans used decoction mashing and, more recently, step mashing



to produce wonderfully delicious lagers. The conclusion by many is that these mash profiles are required to produce great lagers.

The Lewis & Bamforth talk had a take home message that was so refreshing in the obvious Homer Simpson "Doh!" sense ... malt today is not the same malt we read about in text books. Modern malt is powerfully enzymatic and usually very evenly modified. It is also much paler than malts of yesteryear. The suggested mashing strategy was to minimize mash time in an effort to get the good things from the malt and to minimize the extraction of the unwanted compounds, such as the flavors from the husk that can give a gold brew astringent or grainy characters. Measuring yield, which you are doing, is a good measure of success when it comes to mashing.

Another key variable to consider is fermentability. If your goal is a dry beer and you are not going as low as you like, you may need to add some lower temperature rests; 140 °F (60 °C) is a good rest for this purpose. I brew several beers where I like to drive my finished gravity down from 12 °Plato to 2.2 °Plato and use rests for varying lengths at 140 °F (60 °C) to accomplish this . . . or so I thought.

One of our standard brews is a helles-style lager. This beer has always had a slight astringency that I personally find objectionable and have been successful decreasing its intensity. Unfortunately, I've been unsuccessful in getting rid of it entirely.

The wort is produced by the following schedule:

- mash-in at 140 °F (60 °C) and rest for 30 minutes
- heat to 149 °F (65 °C) and rest for 20 minutes
- heat to 154 °F (68 °C) and rest for 45 minutes
- mash-off at 169 °F (76 °C)

Why? Because that's how a brewer brews a good helles! (Mr. Wizard occasionally falls into the monkey-see-monkey-do routine.) I approached this beer differently and questioned my goals. The experiment was to minimize mashing time by eliminating the rest at 140 °F (60 °C) and getting on with things! The result, now duplicated, is hard for me to believe. The ever-present astringency is gone and the final gravity is unchanged.

My point to this long anecdote, is to focus on your goals and choose the appropriate method to achieve them. If something is not working the way you like, change it! In your case, if a simple infusion mash is not providing the flexibility in wort profile required to brew the beers you desire, change it. If your beers taste great and your goal is to be more efficient be careful. Increasing efficiency usually comes at a price. That price may be buying a better mouse trap, inventing a better mouse trap or sacrificing flavor for efficiency.

My advice to you and your neighbor is to brew the same beer with your old and new methods. Compare the two methods by measuring initial and final gravity, calculating your efficiencies and finally by tasting the finished brews. To paraphrase a recent ad campaign, "No brewing technique is 100% efficient . . . choose on taste!"

All dried up

For an all extract brew, is it ok to only use dried malt extract without liquid malt syrups?

Tom Havens
Fort Wayne, Indiana

There is absolutely no reason not to use dried malt extract (DME) exclusively for your recipes, although there are fewer choices in color with dried extracts than there are with liquid extracts. One thing to keep in mind is that special malts are required to provide various colors and flavors. The exclusive use of dried malt extract requires the extract brewer to add hops to the wort, as there are no pre-hopped DMEs on the market.

The way I view this scenario is much like all-grain brewing where the pale malt is used as the backbone of the beer and various special malts are selected to build upon the base. Hopping techniques further build upon the base and the brewer selects the variety used for bittering and aroma, the time of addition and the amount added. I see nothing wrong or problematic with exclusively using DME as the base extract for brewing and have made many, many brews this way.

The one thing to bear in mind with extract brewing in general is that any grain added to a steeping bag should be compatible with the method. These ingredients include crystal or caramel malts and roasted grains. Grains requiring mashing, such as pale malts, Munich malt, rye malt, wheat malt and adjuncts like rice and corn must be mashed to convert their starch to fermentable sugars.

If you choose to use this method, you can easily convert an all-grain recipe to a DME-based recipe by multiplying the weight of pale malt by 0.7 and substituting the pale malt with DME. This only works for beers that do not use other malts — such as wheat or Munich malt — in the formulation. I think your understanding of this subject is fine. Go for it, Tom!

Freaking fruit

Recently I made a batch of wheat beer and decided to add a little summer taste with lemon. I put the zest of two lemons into the primary fermenter. Waiting for a good crisp summer brew, I was a little disappointed when what I got was a fair wheat beer with a lemon aftertaste which was more like a fermented lemon flavor. How could I keep the taste of the citrus fresh? Should I have added it in the boil, or the second fermentation maybe? Perhaps I ought to have used lemon juice instead of the peel? I am thinking of trying something new with a cervesa and adding agave, sugar and lime but I want the lime to be clean and crisp, not mellow and fermented tasting. Is there anything you can do to help? I just wanted to let you know that as a new brewer, only about a year now, I have found a great deal of information from your magazine, it has given me more information, ideas and saved me more money in wasted batches! Keep the great info and recipes coming!

Robert A. Papsis
Lewiston, Maine

Your description reminds me of something in between a malternative and the classic beach side invention of a cold brew garnished with a wedge of lime. I must confess I too like certain beers enhanced with citrus flavors. Lager and lime, wheat beer with lemon and Belgian-style ales flavored with orange peel are examples of such pairings.

Maintaining a fresh citrus flavor in beer can be very difficult — no matter if you attempt to get the flavor from fresh fruit added early in the process or from juice prior to bottling. This is analogous to maintaining a fresh hop aroma in beer. Most brewers agree that very few beers, even when dry hopped, maintain all of the hoppy goodness found in hops prior to their addition to wort or beer.

The common citrus oils (lime, lemon, orange and grapefruit) are all primarily comprised of a compound called d-limonene, a monoterpene that has the distinctive orange aroma. Bergamot oil (used to flavor Earl Grey tea) is not dominated by d-limonene, an oddity among citrus oils, and is primarily made up of linalool, an oxygenated monoterpene, and linalyl acetate giving Bergamot oil a floral character. The "d" preceding limonene is a stereochemical modifier and signifies that there is a mirror image cousin called l-limonene; l-limonene smells like fresh pine needles.

The compounds making lemon, lime and orange oil smell different from one other are a variety of other terpenes, such as farnasesne, caryophyllene and pinene, to name a few, as well as other aroma compounds. Interestingly, these same terpenes are found in hops and explain why citrusy and piney are two common hop aroma descriptors.

If you want to maintain the citrus oil aroma you should use the same practices employed to preserve hop aroma, such as late hopping and dry hopping. Belgian-style white ale or wit bier is flavored using the peel of the bitter Curaçao orange and most recipes I have seen call for adding this ingredient late in the boil. I have used Curaçao orange peel added in the kettle and to beer during aging and have been happy with both methods.

Peel oil is only one component of what one perceives as citrus flavor. The other key components are sugar and acid. Most citrus juices have a specific gravity of about 1.048 because they contain sugar, like other commonly eaten fruits. They are also high in citric acid. The combination of sweet and sour give balance to citrus juices and some are more drinkable than others. Lime and lemon juices are more acidic than orange and grapefruit and are made more palatable as a beverage by adding "ade" behind their respective name. To transform lime or lemon juice to limeade or lemonade involves diluting the juice with water, thus diluting the acid to a palatable level and then boosting the sugar level back up to the undiluted strength by

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adding sugar. Orange juice, grapefruit juice, limeade and lemonade all contain that "clean and crisp" flavor you are seeking.

When the balance of the juice is disrupted so is the clean and crisp flavor. This problem is not unique to citrus beers and many fruit beers turn out to be a disappointment because they lack the fruity flavor of the juice used in the formulation. One reason is that the fruit sugar is fermented and that component of the fruit juice flavor is lost. In the case of wine, that's a good thing since the goal is not to produce alcoholic grape juice unless of course we're thinking of Mad Dog 20/20! The other component that is diminished is the acidity and that is primarily caused by dilution.

Okay, now for some frank advice on what you are projecting. Adding acid to the finished product is a common method used by commercially produced citrus flavored beverages. Go to the store and read the labels on non-alcoholic citrus drinks and you find that many contain various acids, with citric and phosphoric being the most common. Lowering the pH of a drink gives it that acidic zip you seek. This method will help achieve your desired result.

Once upon a time I experimented with a blend of high-quality fruit juices, malic acid, lactic acid and acetic acid (found in lambics) to produce a blend that could be added to light beers (such as wheat beers) to produce a pseudo-lambic. The resulting beer was delicious, but the blend was too expensive to be commercially viable. We sold a pilot run of this elixir to a brew-pub and it cost $90 to flavor one keg — unfortunately far too much for most brewpubs to afford. The key to this brew was the acid blend. Without it the beer was too cloying and lacked the crispness and drinkability you desire in fruit beers.

You can add the acid in the form of lime or lemon juice if you simply add enough fruit. Although many brewers cringe when people want fruit in their beer the result is quite refreshing. I personally enjoy wheat beer with lemon and light lagers with lime. To really get that fruity tang, one quarter lemon per half liter gives a good, assertive flavor. This translates into the juice of 10 lemons or limes per 5 gallon batch. So, you could add this juice right before bottling, but the juice is fermentable and there is yeast in any unfiltered beer. This means you would have to filter and preferably pasteurize (or chemically stabilize your brew) to prevent fermentation. This is not an attractive alternative to most of us, who appreciate the flavor components of unfiltered yeast in a brew.

My honest and least sexy suggestion is to do what so many beer drinkers do when they want a lemon or lime flavor in their beer . . . cut a piece of fresh, juicy citrus fruit, hold it over your glass, give it a squeeze and drop it in your brew — simple and effective! ■

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Scottish Ale

The cool brew from Scotland

by Horst D. Dornbusch

The Scottish or Scotch ale is one of the four classic, opaque, darkish brews that have originated on the British Isles. The other three are stout, porter and brown ale. Perhaps the most defining characteristic that sets the dark brews of Scotland apart from other darker beers is their clean, crisp taste. The Scottish beers lack the dryness of an Irish stout, the toastiness of a London porter, and the estery complexity of an English brown. Though not without residual sweetness, even the heaviest Scottish or Scotch ales usually also lack the syrupy sweetness of some of the imperial stouts.

To me, the ales from Scotland are more akin to German than British ales. Because of their fermentation regimen (explained further down) and their clean finish, I liken them to the altbier — only a bit darker and less hop-accented.

Scotch — not just a whisky

There is no clear demarcation between a Scottish and a Scotch ale, except that the latter tends to be stronger and heavier than the former. In the old days, Scottish ales used to be classified by the prices paid of one cask-full: 60 shillings, 70 shillings, 80 shillings, up to 140 shillings. Even though the price bears no relationship to the strength of the brew, more often than not, beers above the 80-shilling ale — which is regarded by many nowadays as the classic version of the style — seem to have been considered "wee heavy" and were termed Scotch ales. An 80-shilling Scottish ale, often called "export," usually had an alcohol by volume content (ABV) of 4–4.5%, while a 90-shilling Scotch ale could jump in strength to as much as 7–7.5% ABV. Perhaps surprisingly Scottish ales below a minimum "export" strength of about 4% ABV were often labeled as "heavy," even though we would not think of that alcohol level as particularly heavy nowadays.

In a way, Scotch ale is to Scottish ale what bockbier is to regular Bavarian dunkel or what barleywine is to regular British ale. The Scottish is the "regular" brew, while the Scotch is the beefed-up version. In actual usage, though, their parameters overlap on a sliding scale, as do the terms Scottish and Scotch. Most — though definitely not all — Scottish ales in the 60 to 80-shilling range have an ABV between 3.2 and 4.6%. The weakest Scottish ales may be on a par with the mild ales of England, with hardly more than an OG of 1.030 (7.5 °P) and an ABV of about 2.5%, while the strongest renditions may come in at an OG of 1.050 (12.5 °P) and an ABV of perhaps 4.7–4.8%. Scotch ales, on the other hand, may start at an OG of 1.070 (17.5 °P) and an ABV of 6%.

As elusive as the Loch Ness monster

The wide range of gravity and alcohol values for the dark beers from Scotland are a dead give-away of the relative vagueness of this style. In fact, closer examination reveals that very little is definite about it at all. Greg Noonan, owner and brewmaster of Vermont Pub and Brewery, writes in his book "Scotch Ale" (Brewers Publications, 1993) " . . . records [about brewing Scottish ale], if they survive at all, are generally so sketchy that little usable information can be extracted from them . . . Moreover, since the Middle Ages brewing [in Scotland] has either been a very haphazard cottage industry, or was controlled by guilds that jealously guarded their craft. These have been succeeded by equally secretive

SCOTTISH ALE by the numbers

OG	1.030–1.050 (7.5–12.5°P)
FG	1.012–1.014 (3–3.5°P)
SRM	12.5–17
IBU	29–35
ABV	2.4–4.7%

RECIPE

Scotiae Cerevisia

(5 gallons/19 L, all-grain)

OG = 1.046 FG = 1.014
SRM = approx. 17 IBU = 32
ABV = 4.2–4.3%

Ingredients

8.5 lbs. (3.9 kg) pale ale malt
2.5 oz. (70 g) roasted barley
0.5 oz. (15 g) black malt
0.5 lb. (225 g) white table sugar (during primary fermentation)
11 AAU Goldings hops (45 min) (2.4 oz./68 g of 4.6% alpha acid)
0.5 oz. (14 g) Goldings hops (aroma)
0.5 oz. (14 g) Fuggles hops (aroma)
2 pkg. Wyeast 1728 (Scottish Ale) or White Labs WLP028 (Edinburgh Scottish Ale) yeast
1 cup dried malt extract (for bottling)

Note that the total grain bill is based on a brew system with a nominal extract efficiency of 65%. If your setup is better or worse, adjust the grain quantities accordingly. For grain bill variations and malt brand recommendations, see main text.

Step by Step

Mill and mash the grains for about 90 minutes at 154–156 °F (68–69 °C). Then sparge to a gravity of approximately 1.044. Boil for 15 minutes, add the bittering hops and boil for another 45 minutes. Shut down and add the aroma hops. Check the kettle gravity. If it is above 1.046, liquor the wort down. Heat-exchange immediately to 55 °F (10 °C), aerate and pitch the two packages of yeast (or a starter).

Ferment for 5 days and add the white table sugar. Ferment for another 5 days and crash the

continued on page 20

Scottish recipes continued

continued from page 19

temperature to at least 40 °F (4 °C) to force the yeast to sediment. After another two days, rack your brew and keep it around 40–50 °F (4–10 °C) for two to three weeks. Rack it again, prime it and package the beer in bottles or keg. The brew improves if it is allowed to mellow in a cool, dark place (or a refrigerator) for one to three months. Serve at approximately 55 °F (13 °C).

Scotiae Cerevisia

(5 gallons/19 L, extract with grains)

OG = 1.046 FG = 1.014
SRM = approx. 17 IBU = 32
ABV = 4.2–4.3%

Ingredients

5.26 lbs. (2.4 kg) pale ale liquid malt extract
2.5 oz. (70 g) roasted barley
0.5 oz. (15 g) black malt
0.5 lb. (225 g) white table sugar (during primary fermentation)
11 AAU Goldings hops (45 min) (2.4 oz./68 g of 4.6% alpha acid)
0.5 oz. (14 g) Goldings hops (aroma)
0.5 oz. (14 g) Fuggles hops (aroma)
2 pkg. Wyeast 1728 (Scottish Ale) or White Labs WLP028 (Edinburgh Scottish Ale) yeast
1 cup dried malt extract (for bottling)

Step by Step

Mill or crush the specialty grains and place in a steeping bag. Immerse in 1 gallon of 170 °F (77 °C) water for about one hour. Remove the bag and rinse it with 2 cups of cold water. Do not squeeze bag! Combine the steeping liquid with the brewing liquor and bring to a boil. Stir in the liquid malt extract in and bring back to a boil. Add the bittering hops and follow the equivalent instructions for the all-grain brew.

Scotiae Cerevisia

(5 gallons/19 L, extract only)

OG = 1.046 FG = 1.014
SRM = approx. 17 IBU = 32
ABV = 4.2–4.3%

Ingredients

2.25 lbs. (1.0 kg) pale ale liquid malt extract
4.25 lbs. (1.9 kg) amber ale liquid malt extract
0.5 lb. (225 g) white table sugar (during primary fermentation)
11 AAU Goldings hops (45 min) (2.4 oz./68 g of 4.6% alpha acid)
0.5 oz. (14 g) Goldings hops (aroma)
0.5 oz. (14 g) Fuggles hops (aroma)
2 pkg. Wyeast 1728 (Scottish Ale) or White Labs WLP028 (Edinburgh Scottish Ale) yeast
1 cup dried malt extract (for bottling)

Step by Step

Mix the two malts with your hot brewing liquor in the kettle. Bring the wort to a boil, add the bittering hops, and follow the equivalent step-by-step instructions for the all-grain version.

commercial breweries, protecting their trade secrets."

The selection of ingredients and the brewing process are probably more significant determinants for Scottish beers than are their statistical profiles. Yet even these are not always clear.

Our focus in this article must be somewhat more narrow than that of Noonan. Thus, we will concentrate on a compromised version of the brew, a rough interpretation of a 70 to 80-shilling rendition. Ours may have less authentic historical standing than other brews from Scotland, but is a fair representation of the core elements of Scottish ale.

In addition, it has the advantage of being conveniently achievable by today's homebrewers working with modern ingredients. I simply call this brew Scotiae Cerevisia, which is Latin for "beer of Scotland." In terms of composition, my Scottish ale is strongly influenced by the two brews from Scotland that are most readily available where I live, in Massachusetts.

These come from the Belhaven Brewery Company of Dunbar, 50 miles east of Edinburgh. Belhaven is one of the classic makers of the Scottish and Scotch ales. It has been brewing the style since 1719. The brewery's two bottled export varieties are its Scottish Ale at 3.9% ABV and its St. Andrews Ale at 4.6% ABV.

Ingredients

Traditionally, Scottish barleys were floor malted which yields base malts with a slightly darker complexion of approximately 3–4 °L compared to pneumatically malted ale base malts (which usually have a color of 2–3 °L). If available, you can try Crisp pale ale malt at 3.5–4.5 °L as a base malt. Otherwise use any top quality pale ale malt augmented for color by 0.5 pounds (approximately 225 grams or about 2 cups) of Briess Victory at 25–30 °L or Weyermann CaraAmber at 23–31 °L.

These malts will also contribute a touch of bready, biscuity flavor to the brew. The base malt is usually mixed with some roasted barley (such as Briess at around 275–325 °L) and a

smidgen of black malt (such as Briess at 475–525 °L or, for a mellower flavor, de-husked Weyermann Carafa Special Type III at 488–563 °L) for color and flavor. Crisp's roasted and caramel malts are also good choices. Scottish ales are invariably opaque.

A few rare renditions may be as pale as 10 SRM, but most have a color rating of approximately 12.5–17 SRM. Because of the clean finish of a Scottish ale, use only malts from 2-row instead of 6-row barley.

Given the great traditional variations in composing a Scottish ale grain bill and the resulting flavor and beer color, you can replace a portion of the pale base malt with one or several of the following (based on 5 gallons or 19 liters of wort):

For enhanced residual sweetness, use up to 0.5 lb. (approx. 225 grams or about 2 cups) of Briess Caramel malt (60–120 °L) or Weyermann CaraMunich Type I (80–100 °L). Crisp, Simpsons, Hugh Baird and Pauls malts are also recommendable malts fitting of the Scottish Ale profile.

Some Scottish brews sport a slightly smoky note in their flavor profile, reminiscent of Scotch whisky. Some homebrewers use a few ounces of peat-smoked Hugh Baird malt or 0.25–0.5 lbs. (0.11–0.22 kg) of beechwood-smoked Weyermann Rauchmalz to mimic this, although this is not the real origin of the smoke notes in Scottish ales. (It is thought that this is a character of certain yeast strains.)

The Scottish ales are also often brewed with some sugar added to the fermenter, not the kettle, while primary fermentation is active, often just to bump up the alcohol content. In our recipe we will follow that custom by adding about half a pound (roughly a quarter kilogram) of white table sugar to the brew on the fifth day after pitching.

The bittering hop in Scottish ales is usually a Goldings variety, while the aroma hops is usually Fuggles or a combination of Goldings and Fuggles. Typical IBU values range between 29 and 35. Scottish ales are rarely dry-hopped, though the exported Belhaven St. Andrews Ale (36 IBU) is.

Choosing the right yeast for a Scottish ale can be tricky, because Scottish ales have been traditionally fermented at about 50 °F (10 °C), which is the natural ambient temperature in which these brews have emerged, but which is much too cold for virtually all ale yeasts that are readily available. Ale fermentation at this low temperature keeps the level of esters, higher alcohols and other byproducts of yeast metabolism low, which accounts for the beer's clean taste. Yeasts used in Scottish ales must also be fairly low attenuators and efficient flocculators so that the fermentation stops at a relatively early stage and some residual sweetness is preserved after the first racking. (In English beers, incidentally, residual

sweetness often stems from crystal malts, which are not traditionally used in Scottish beers.)

I have used Wyeast 1728 (Scottish Ale) as well as Wyeast 1007 (Altbier) yeasts with success (although altbier yeast is highly attenuative). Both have a working range down to 55 °F (13 °C), which is the temperature I use for primary fermentation. White Labs WLP028 (Edinburgh Ale) yeast is also a clean fermenting strain that gets the job done well.

Much of the water in Scotland, unlike the water in Burton-upon-Trent for instance, tends to be quite soft. This is the brewing liquor preferred by the traditional Scottish ale brewer. Due to the the geology of Scotland, however, one can find both hard and soft water sources virtually adjacent to each other and both have been used by Scottish breweries.

For all intensive purposes, we assume that your regular tap water will be suited for brewing the Scotiae Cerevisia recipes included. However, If you decide you want to make adjustments to your brewing liquor and are looking for tips on water correction, see Don Million's "Water Treatments" article in the January–February 2002 issue of *Brew Your Own*. The preferred mash pH for Scottish ales is a fairly normal 5.1–5.3.

"The finish of a Scottish ale relies more on clean maltiness than hop aromatics to make an impression."

Brewing Techniques

Perhaps the key process variables that turn ale into Scottish ale are:

- Mash in for a single-infusion at a relatively high temperature of 154–156 °F (68–69 °C) with a saccharification rest of about 90 minutes. This promotes the formation of plenty of unfermentable sugars for the full body required for a Scottish brew.

- Boil the bittering hops for no more than 45 minutes to minimize the amount of astringency leached into the brew and thus enhance the brew's smoothness.

- Use flavor hops sparingly. The finish of a Scottish ale relies more on clean maltiness than hop aromatics to make an impression.

- Because we are fermenting Scottish ale at the bottom of the yeast's working

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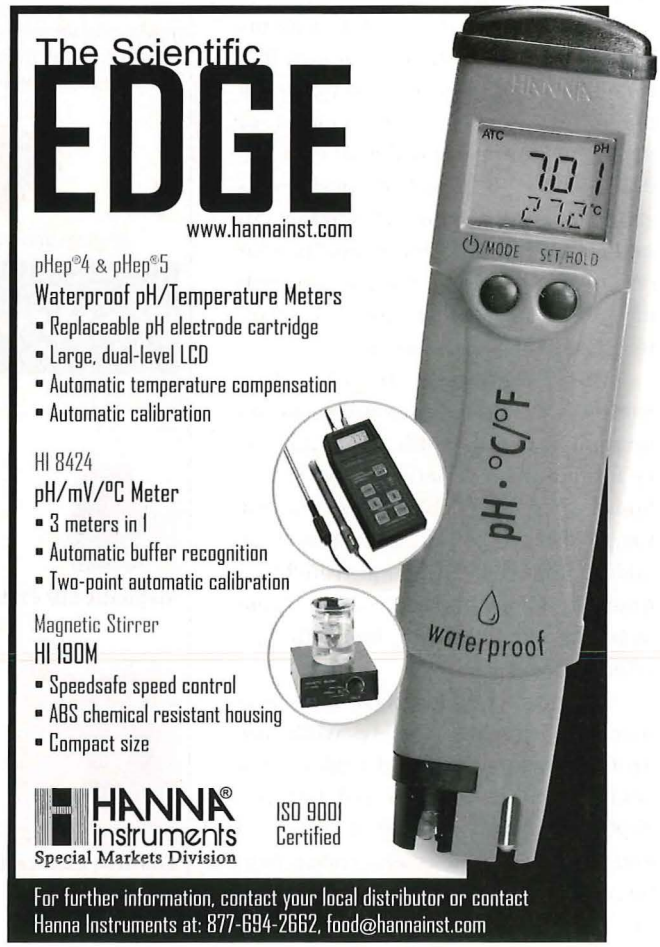


range, fermentation tends to start more slowly than normal and yeast reproduction is slightly impeded. To compensate, pitch twice as much yeast as you would for a "normal" ale. Therefore, the recipe calls for two packages of yeast.

• Because high gravities are an additional impediment to yeast getting started, add the brewing sugar not to the kettle but to the fermenter after fermentation is already securely progressing.

• Lager and condition Scottish ales, similar to altbiers, at a temperature below 50 °F (10 °C) for a few weeks, and serve them at about 55 °F (13 °F).

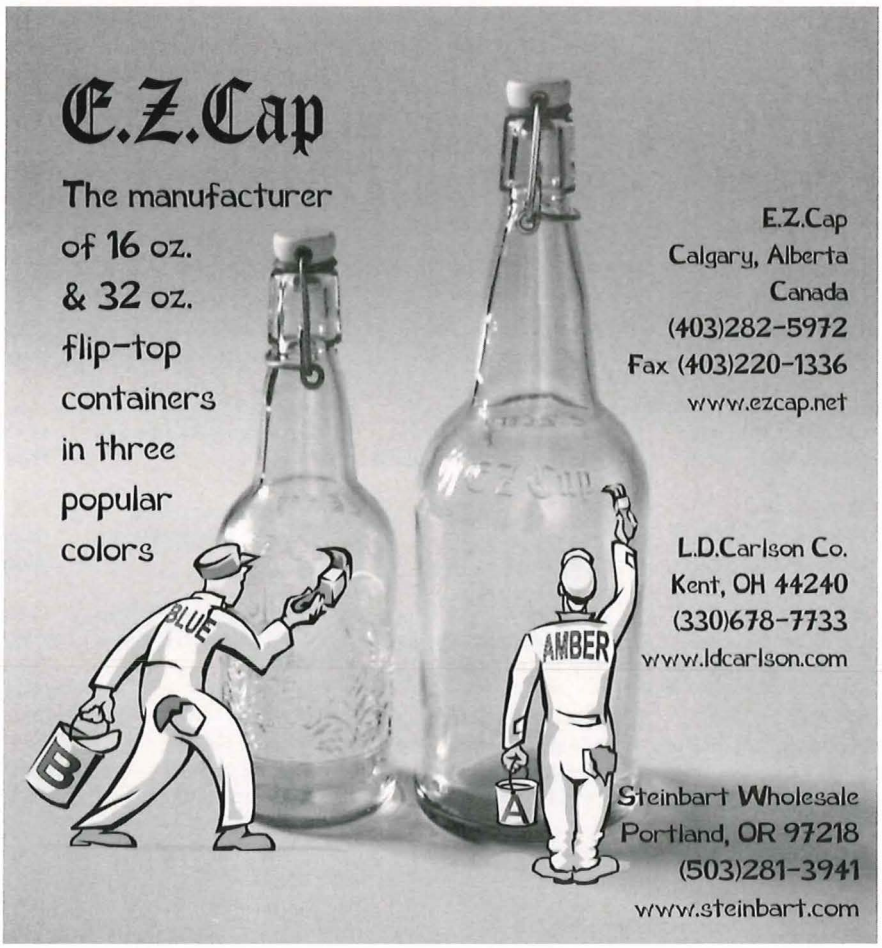
Extract Scotch

The simplest way for the extract brewer to make a Scottish ale is to use a hopped kit with yeast and instructions. There is the Muntons Premium Range Scottish Style Heavy Ale and the Golden Range Highland Heavy Scottish Ale. Simply stir enough of the canned malt into your brewing liquor until you reach the target gravity from our recipe, ferment and package as per supplied instructions.

For those who don't mind a bit more work, mix unhopped pale/light and amber extracts roughly one-third/two-thirds, then follow the instructions from our recipe from boiling to packaging. At our target gravity, an all-pale liquid malt extract (LME) would produce a wort of roughly 5–6 SRM, and all-amber LME one of roughly 20–22 SRM (these figures can differ widely among LME brands!).

The mix should yield a brew very close to our target color of roughly 17 SRM. In an extract mix for Scottish ale, I would stay away from both extra-light and dark extracts, because the former would render the brew too pale, while the latter might contain crystal and chocolate malts which would render the brew's flavor too harsh. ■

Horst Dornbusch is the author of "Prost! The Story of German Beers" (1997, Brewers Publications).



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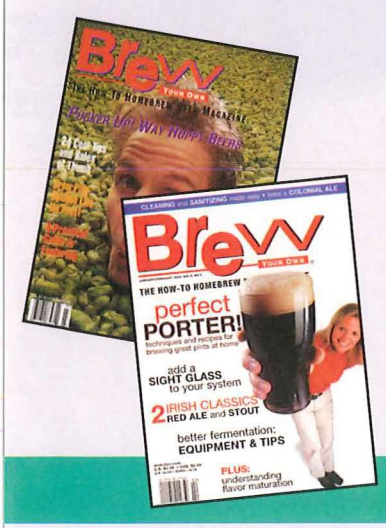

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Old Ales

By **Terry Foster**

The old Victorian hotel above the river is magnificent. Our bedroom, complete with a classic four-poster bed, is reached from the bar by an equally impressive wide staircase. So why did I keep bouncing from one side to another? I knew I hadn't had that much beer to drink, just a couple of pints of bitter and two or three more of a dark ale — and I knew it wasn't very strong because it was so smooth and slipped down my throat so easily.

The next day I asked the barman a little more about that ale. It turned out that it was Theakston's Old Peculier, at a little over 6% alcohol by volume (ABV). There were no microbreweries in England in those days and I was used to beers at 4.0% ABV or less. No wonder navigating the staircase had been so difficult!

Old Peculier is a dark, moderately strong, lightly hopped, full-bodied beer, considered by some to be a classic old ale. It remains a classic of today, although its original gravity has been dropped a couple of points, to 1.058 from 1.060.

> "Old Peculier is [...] considered by some to be a classic old ale."

The Emergence of Old Ale

In the first half of the 18th century, English brewers began move away from long storage of beers. The equation was quite simple — a lot of money could be saved if you got the return on the cost of brewing in 2–3 months, instead of a year or more. So brewers started to produce what they then called "running beers," which were shipped from the brewery to the pubs after a much shorter storage period than had previously been the case. Of course, it wasn't quite as simple as that at first, as this meant a decided change in flavor. One way around this, was to keep smaller amounts of beer for a very long time, and use for blending with fresh beer to get the kind of taste the drinker was looking for. In some cases this was done at the brewery, while in others some aged beer was shipped along with running beer, and blended by the publican himself. There was even a machine invented and patented as far back as 1790, for mixing "mild" and "stale" porter.

In those days these words had a different meaning than they do today. "Mild" simply meant new, while "stale" referred to well-matured beer. Mild stayed around until the present day, although modern mild bears little resemblance to that of early 19th century milds. But the term "stale" did disappear. By the 1850's, when porter was declining in popularity, some brewers were offering "Old Ales" directly to the public houses. These were beers brewed specifically to be kept for a year or more at the brewery and apparently brewed to their own separate recipes. In other words, they were not meant for use in adjusting the flavor of running beers. These kind of beers later came to be known as stock ales. Aged porters kept for this purpose became known as keeping porters by brewers, and were not normally sold to the public.

Old ales had another significant characteristic — an acidic flavor. In 1890 an English brewing consultant stated that this was a "sub-acid" flavor. Around 1900 the yeast responsible for secondary fermentation in English stock ales was identified in the Carlsberg laboratories in Denmark, and given the name *Brettanomyces*. This species is responsible for the so-called "horse-blanket" flavor in spontaneously-fermented Belgian lambic beers. However, analysis of old and stock ales, both English and American, carried out by Wahl-Henius around 1880–1900 indicated that they contained significant amounts of lactic acid. This would most likely be the source of the "sub-acid" flavor, and probably came from *Lactobacilli* in the staves of the wooden storage vessels used in those days.

Information on 19th century old ales as such is scarce. From those recipes that are available, they were usually brewed to around 1.080 OG, mainly from either all pale malt, or combinations of pale with amber malt. Mashing temperatures were probably on the high side (154 °F or higher) so as to give a dextrinous wort, and a relatively high finishing gravity, around 1.025–1.035.

OLD ODDITY

(5 gallons/19 L, extract with grains)

OG = 1.058–1.063 FG = 1.015–1.020
IBU = 30 SRM = 24 ABV = 5.6–6.2%

Ingredients

6.6 lb. (3.0 kg) pale liquid malt extract (Coopers or More Beer English Extract)
1.0 lb. (0.45 kg) dry malt extract
1.0 lb. (0.45 kg) crystal malt (60 °L)
0.25 lb. (114 g) chocolate malt
7.33 AAU UK Fuggles hops (60 mins) (1.5 oz./42 g of 5.0% alpha acids)
0.5 oz (14 g) Fuggles hops (15 mins)
Wyeast 1028 (London Ale) or White Labs WLP013 (London Ale) yeast
0.5 cup corn sugar or dried malt extract (for priming)

Step by Step

Add crushed specialty malts to 1 gallon (3.8 L) of water in your brewpot, heat water to about 170 °F (77 °C) and strain off malts. Add water to the "grain tea" to make about 3 gallons (11.4 L) and bring this liquid to a boil. Once it begins boiling, turn off the heat and add the malt extracts, stirring well to ensure the extracts dissolve properly. Bring the wort to a boil and add the bittering hops. Boil for one hour, with flavor hops added for the last 15 minutes. (As an option to increase hop utilization, you can withold 3–4 lbs. (1.4–1.8 kg) of extract until the final 15 minutes of the boil.) Strain, or siphon, the wort off from the hops and add cold water sufficient to obtain the starting gravity of 1.060. Cool the wort to around 70 °F (21 °C), pitch with yeast starter and allow to ferment. After 5–7 days of fermerntation, the final gravity should have been reached. At this point, rack into a glass fermenter. One to two weeks later, rack again, prime with dried malt extract or corn sugar, and rack beer into keg or bottles. Allow to condition for at least three months before drinking. Note that although this is not intended to be a clone as such, this beer should be somewhat similar to Old Peculier — smooth and very drinkable for its strength.

OLD SOLDIER ALE

(5 gallons/19 L, all-grain)

OG = 1.070 FG = 1.018–1.025
IBU = 35 SRM = 21 ABV = 5.9–6.9%

Ingredients

12 lb. (5.5 kg) 2-row pale malt (for example, Maris Otter)
2.0 lb. (0.9 kg) Munich malt
0.5 lb.(0.227 kg) crystal malt (60 °L)
2.0 oz (57 g) chocolate malt
8.0 AAU Willamette hops (90 mins) (1.45 oz/41 g of 5.5% alpha acid)
1.5 oz (43 g) Willamette hops (end of boil)
White Labs WLP004 (Irish Ale) or Wyeast 1084 (Irish Ale) yeast
0.5 cup corn sugar or DME (priming)

Step by Step

To ensure a good fermentation, it is best to make a half-gallon starter of the original yeast culture. Three days before brewday, make starter by boiling 0.50 lb. (0.23 kg) of dried malt extract in 0.50 gallons (1.9 L) of water.

Use a single-step infusion mash at 153–155 °F (67–68 °C) for 1–1.5 hours. (Use ~4.6 gallons (17 L) of water at 165 °F (74 °C) for mash in.) Sparge for one hour, with water no hotter than 175 °F (80 °C), until run-off reaches SG 1.010–1.012. (Expect to collect around 7.3 gallons, although this can vary considerably depending on your system.)

Boil the wort for 90 minutes, with bittering hops added after the first foamy head subsides. Add flavor hops as the heat is turned off at the end of the boil.

Adjust wort volume with cold water (if needed), and cool to about 70 °F (21 °C). Pitch with yeast starter and allow to ferment. After 5–7 days, final gravity should have been reached; rack into a glass fermenter. One to two weeks later, rack again, prime with dried malt extract or corn sugar, and rack into keg or bottles. Allow beer to condition for at least three months before drinking.

The name of this beer commemorates the fact that this is being written on the 60th anniversary of D-Day.

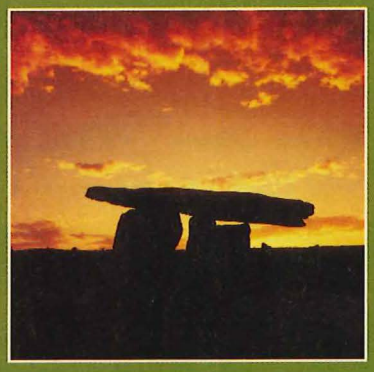
Modern Old Ales

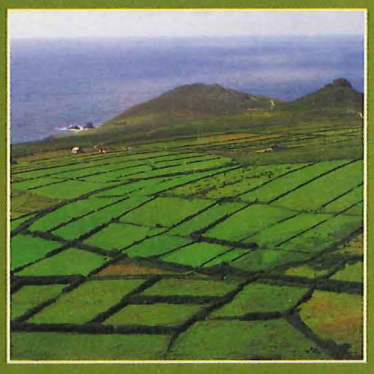
In 1880 England instituted a tax system based on the original gravity of beers. This made strong beers significantly more expensive to brew than weaker ones. Consequently, from that time there began a decline in average beer strengths. The inevitable result of these factors was that Old Ales as such became much less popular.

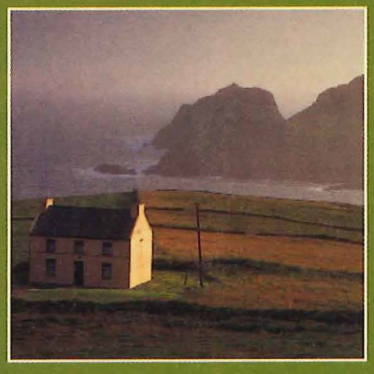
By the time I started drinking beer in the late 1950's, you would occasionally come across the odd draught beers called old ale, but this was often just a marketing trick. Such beers, as they were not old in any sense, and were simply running beers, amounted to nothing more than a slightly stronger than usual mild. There were some genuine old ales, but now they were likely to be only bottle-aged.

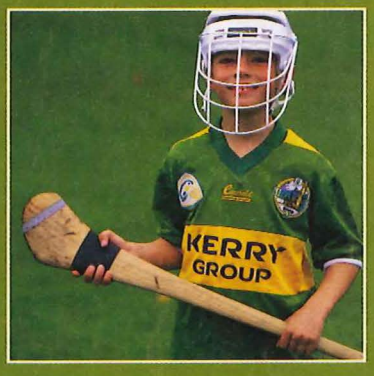
A change in this approach came from Eldridge, Pope, a small brewery in Dorset, when in 1968 they introduced Thomas Hardy Ale, commemorating the writer's death sixty years earlier. Although produced only from pale malts, its high OG of 1.125 resulted in it being a dark amber color, and it was stored at the brewery for a year or so before release. It was originally intended as a one-off, but was successful enough that the company decided to continue it. It was produced as a bottle-conditioned beer, and vintage-dated, with the early bottles recommending on the label that it could be kept for a as much as 25 years before drinking! The important point about this is that Hardy Ale was presented as a beer of distinction, as a result of which it gradually achieved cult status among England's beer-drinkers. Eldridge, Pope hived off their brewing operation in the 1990's, and this beer continued to be produced by the now aptly-named Thomas Hardy company, who finally gave up their namesake ale in 2003. It is now brewed by the micro O'Hanlon's, largely for the American market.

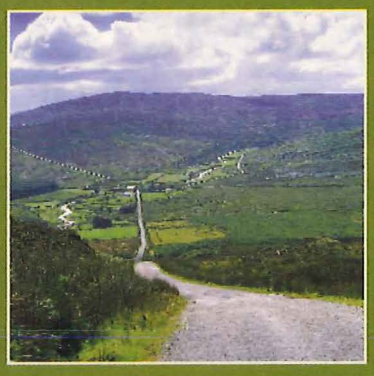
In the early 1970's came the start of CAMRA, the consumer organization pledged to prevent the disappearance of cask-conditioned ale in Britain. A side effect of this campaign was a renewal of interest in beers of unusual distinction and character. A notable

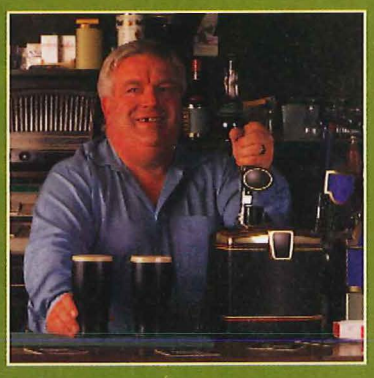


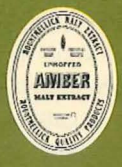












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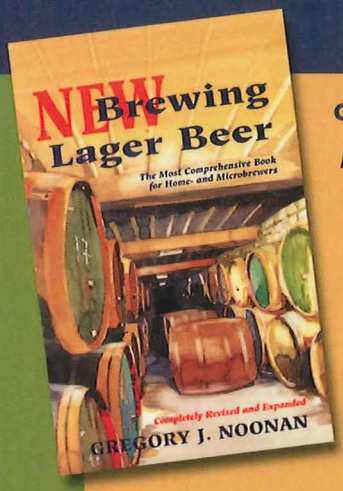

Greg Noonan's classic brewing title, *New Brewing Lager Beer* returns to print after being unavailable for nearly two years. Often cited as a classic of the craft brewing literature, Noonan's book gives small-scale brewers a practical education in brewing theory and practice while revealing proven formulas for producing classic lager styles from Bock to Vienna.

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example was that of Old Peculier, which rapidly developed a high reputation. Theakston's small family brewery, in a misguided attempt to expand rapidly, went through a number of contortions before falling into the hands of Scottish Newcastle, who themselves had by then become the biggest brewers in Britain. The good news about that was that Old Peculier now had a lot of marketing muscle behind it, and became more widely available in Britain and North America. Just this year, the circle was completed, and the Theakston family bought back their brewery in Masham, but that's another story.

All this helped to revive interest in other similar beers, such as Gale's Old Prize Ale, Robinson's Old Tom and the related Winter Warmers and Barleywines. The result is that although old ales are only produced in limited quantities, and there are only a relatively small number of commercial versions, there are enough for us to define the style.

These beers should be amber to dark brown in color, with the emphasis on malt character, rather than hop aroma and bitterness, which should be muted. Fruity, estery notes, and some diacetyl can all contribute to the complexity of these beers.

Brewing Old Ales

Pale malt is the main source of fermentable extract, although a mild ale malt would work well, too. We want to emphasize maltiness in this beer, so a relatively high mash temperature of around 154 °F (68 °C) is appropriate. Substituting 15–20% of the pale malt with Munich malt will also help in this respect. This kind of beer works very well with pale malt extract as a base.

To increase the mouthfeel and add a little sweetness, crystal malt is a must. Go for the darker, more caramelized varieties, (from 60–80 °L), but don't overdo it. We are looking for subtle complexity in this style, and don't want any flavors sticking out like a sore thumb. For my taste, 1/2 to 1 lb. per 5 gallons is sufficient. For more complexity, and an increase in color, a little roast malt works wonders. For

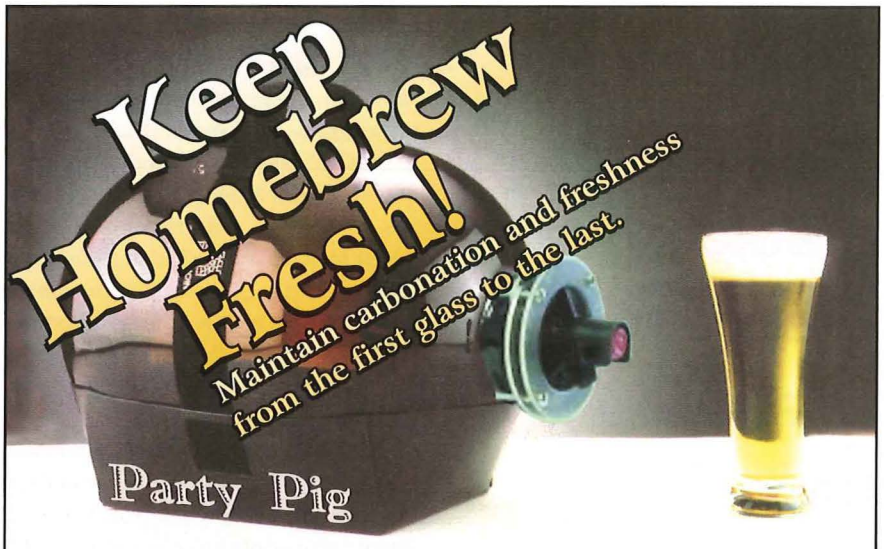
me, chocolate malt works best, adding a slight reddish hue, and a muted roastiness. Black malt is favored by some brewers, but can add some harshness we don't want in this brew, so must not be overdone. In both cases, I would add no more than 1/4 lb. roast malt.

There are two other candidates for addition here, flaked corn and corn or cane sugar, both being used in Old Peculier. These should only be added at the rate of around 10% of the total grist, and will only increase alcohol and make the beer lighter for a given gravity. The reason why British brewers use these is simply to reduce the nitrogen content of the beer. In other words to lower protein residues, and thus reduce chill-haze. Frankly, I do not think chill-haze is really a problem in a beer of this color, and I do not normally use these adjuncts myself. If you feel the need to add fermentable material in order to hit target gravity, then why not either use malt extract, or a dark sugar. The latter will add a slight rum note, which goes quite well in this type of beer.

When it comes to hopping old ales, we certainly do not want to overdo it. I actually think you want to be in the range 30–40 IBU for bitterness, although the BJCP homebrew contest guidelines give 65 IBU as the top end of the range. Preferably, you want a fairly mild hop, for both bittering and aroma and English Fuggles fit the bill admirably, but can be substituted with Challenger or Northdown.

You simply need a good top-fermenting ale yeast, preferably one which will give some fruity estery flavor to the beer, rather than a so-called "clean" yeast. White Labs WLP002 English Ale, or WLP004 Irish Ale are good, as are Wyeast 1028 London Ale, and 1098 Whitbread. Aim for 65–70 °F for the primary, but with these yeasts, it won't matter too much if the temperature drifts a little above 70 °F. Properly brewed, an old ale makes an excellent fireside companion in a cold winter. And the next winter. And . . . ■

Terry Foster wrote about pale ales in the September 2003 issue of BYO.



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Your recipe predicts that your beer will have 45.27 IBUs . . . but will it? What you need to do to hit your target bitterness, and how to tell if you've succeeded.

by Steve Holle

PRACTICAL APPROACHES to CONTROLLING BITTERNESS in HOMEBREWS

The goal of homebrewing should be the production of unique creations that are fresh, flavorful and absent of defects. Secondarily, many homebrewers attempt to hit target values of gravity, bitterness and color based on a beer's recipe or homebrew contest style guidelines. Too often homebrewers obsess over hitting their targets and deem themselves failures if the beer does not measure up exactly to its specifications.

Hop bitterness is one component that homebrewers seek to manipulate, but cannot precisely control. Yet, with an awareness of the relevant variables and the methods to manage them, the homebrewer can successfully produce a beer that contains bitterness within the desired range.

There are formulas to predict the bitterness in beer. However, these equations can lead to a false sense of accuracy because the homebrewer cannot directly measure many of variables that go into these equations nor the final value being calculated (IBUs). Therefore, homebrewers should focus less on the number of decimal places in their formulas and more on consistently repeating the procedures that influence bitterness. Consistency in using fresh hops, creating the same boiling intensity, boiling the hops for the planned length of time and taking the same amount of time chill the wort will enhance a homebrewer's ability to get a predictable amount of bitterness.

What is an IBU?

Bitterness is usually described by the term "International Bitterness Units" (IBU), which is defined as the milligrams of isomerized alpha acids in one liter of beer. Homebrewers seeking to predict the number of IBUs in their beer usually use some form of the following equation:

$$IBU = \frac{W_{oz} \times AA \times U \times 7{,}490}{V_{gallons}}$$

where W_{oz} is the weight (in ounces) of the hops; AA is the alpha acid rating of the hops expressed as a decimal (i.e. if the hops contain 7% alpha acids, AA = 0.07); U is the utilization percent, also expressed as a decimal (i.e. 25% utilization means U = 0.25) and $V_{gallons}$ is the volume of wort, in gallons. (The number 7,490 is a conversion factor that shows up when English units are used.) Thus, to control bitterness in beer, we need to focus on controlling the variables in the equation.

Weight of hops

Most homebrewers measure their hops on a kitchen scale calibrated in units of ¼ of an ounce. Given that most hop additions are at most a few ounces, there is room for significant differences in IBUs to arise from small, unmeasurable differences in the weight of the hops. If your beer requires a 1 ounce addition of hops, your kitchen scale will likely read "1 oz." for all weights from just over ⅞ (0.875) ounce to just under 1 ⅛ (1.125) ounces. For a 10% alpha acid hop, this range corresponds to a difference of 9 IBUs in your beer! Also keep in mind that just because your bag of hops says "1 oz." on it, does not mean that the hops weigh one ounce. The guy at the homebrew shop who packaged the pellet hops can make a mistake, too. And finally, it should go without saying that your scale needs to be calibrated or your measurements can be considerably off.

photo courtesy of Hop Union

The Bitterness and Alcohol Content of Selected Commercial Beer Brands

	IBU	Alc% v/v[b]		IBU	Alc% v/v[b]		IBU	Alc% v/v[b]
Stouts			**Pale Ales**			**Wheat**		
Beamish Stout[1]	39	5.2	Bass[3]	20	4.9	Shiner Hefeweizen[3]	21	5.2
Kirin Stout[1]	40	6.4	Fuller's ESB[3]	30	5.9	Pete's Honey Wheat[3]	18	4.8
Murphy[2]	36	4.2	Sierra Nevada[3]	33	5.5	Celis White[3]	15	3.8
S. Smiths Oat. Stout[2]	30	4.5	Liberty Ale[3]	32	6.2	Widmer Hefeweizen[3]	34	4.9
StrongAles			Arrogant Bastard[3]	67	7.2	Franziskaner Hefeweizen[3]	13	5.1
Old Nick[3]	36	6.9	Rogue Dead Guy[3]	43	7.1	Paulaner Hefeweizen[3]	14	5.6
Maredsous Dobble[3]	15	7.9	Sam Adams Light[3]	9	4.0	**Strong Lagers**		
Rogue Imperial Ale[3]	67	9.2	**Pilsners**			EKU Kulminator[2]	30	11.9
IPAs		-	Pilsner Urquell[3]	34	4.3	Einbecker Helles Bock[2]	38	6.7[a]
Bridgeport IPA[3]	50	5.6	Dinkel Acker[3]	28	5.1	Einbecker Dunkeles Bock[2]	38	6.7[a]
Full Sail IPA[3]	59	6.3	Paulaner[3]	25	5.1	Samichlaus[2]	27	15.0
Pyramid IPA[3]	63	6.5	Bitburger[2]	38	5.1			

[1] Lewis, M. J. (1995). Stout. Brewers Publications, Boulder

[2] Jackson, Michael (1997). Michael Jackson's Beer Companion. Running Press. Philadelphia.

[3] Jurado, Jaime . The Brewer International. (2001) vol. 1(12); (2002) vol. 2(2); (2002) vol. 2(12).

[a] The author provided the starting gravity of 1.065 and the alcohol content was estimated assuming 65% RDF.

[b] Note: some values for alc% were given in w/w by the author and converted to v/v by dividing w/w by 0.79.

Percentage of Alpha Acids Remaining in Baled Hops after 6 Months of Ambient Storage

Cluster 85%	Bullion 50%	Chinook 63%
Saazer 55%	Fuggle 74%	Crystal 41%
Galena 76%	Hallertau Tradition 49%	Hersbrucker 61%
Hallertauer 54%	Styrian 73%	Brewers Gold 34%
Perle 78%	Santiam 45%	Liberty 56%
Spalter 55%	Willamette 68%	Mt. Hood 38%
Nugget 74%	Cascade 42%	Tettnanger 57%
		Centennial 33%

Alpha Acid Content

Hop growers measure the level of alpha acid and express it as a percentage reported to one decimal place (5.8%, for example). The producer-supplied alpha acid rating represents the alpha acid rating at the time of harvest.

However, alpha acid levels are subject to deterioration during storage from the effects of heat, light, air and humidity. Furthermore, some hop varieties are subject to faster deterioration than others are. Hop producers use the "hop storage index" (HSI) to indicate the stability of the alpha acids. Your homebrew store or grower's website may provide the HSI, which can be used as an indicator that some varieties should be used more quickly than others. If not, the chart of data from S.S. Steiner — on this page — indicates the relative stability of several common hop varieties when stored at room temperature.

If the brewer stores the hops in an airtight container in a cool environment, protected from light and humidity, the rate of deterioration slows con-

siderably. Alpha acid loss rates stated in the table are not representative of properly stored hops, which may be less than 10%. Producers may protect their hops from deterioration in sealed foil bags that have been vacuum-packed or filled with an inert gas like nitrogen. Once opened, the rate of deterioration will increase. Because pellet hops are tightly compressed, their alpha acids receive less exposure to air than whole leaf hops, and the pellets are, therefore, more stable. Storing hops in the freezer in a gas impermeable container or bag with as much air removed as possible is a good way to store hops.

While the homebrewer cannot know the degree of deterioration of alpha acids in the hops at the time they are purchased, he or she should be aware that fresh, properly stored hops more closely reflect the alpha acid rating on the package than improperly stored hops from last season. (Note: growers harvest hops in late summer and new harvests come to market around the first of the year). Be aware that the predictive ability of the preceding calculations may decline as the age of the hops increases, especially if the hops are poorly stored.

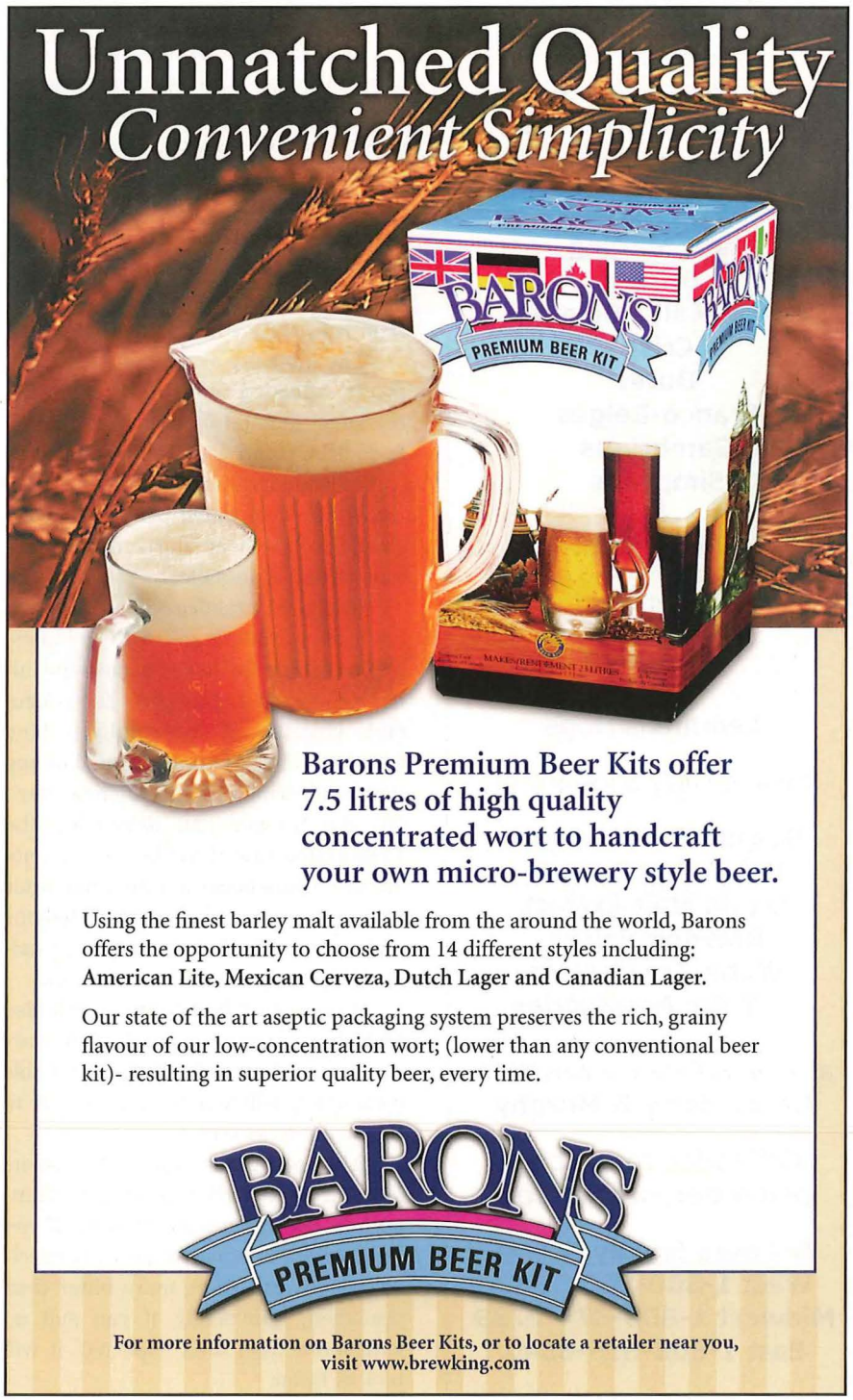
Utilization Rate

The utilization rate is the amount of isomerized alpha acids that end up in your beer divided by the amount of alpha acids added to the kettle. Depending on a number of factors, you may extract and isomerize from 0 to 40% of the alpha acids from your hops. (*BYO*'s standard assumption in our recipes is that pellet hops yield 25% of their alpha acids in a one-hour boil.)

The primary factor affecting the utilization rate is the length of time they are heated. The bitter alpha acids will not go into solution unless they become isomerized through heating. The longer they are heated, the greater the isomerization rate. As such, adding your hops to the boil at the correct time is important if you wish to control your beer's bitterness. Keep in mind that changes in the way you chill your wort affect the amount of time the hops are heated. For example, if you switch from an immersion chiller to a counter flow chiller, you may alter the final IBUs of your beer. An immersion chiller cools the entire wort at (roughly) the same time. A counterflow chiller leaves an ever decreasing amount of hot wort in the kettle as chilling proceeds. Thus, your beer may taste more bitter if you switch to a counterflow chiller, especially if you use a lot of late-addition hops.

There are many other factors that affect the utilization rate.

A number of different authors provide tables that suggest various utilization rates dependent on hop form (pellet or whole hop), boiling time and wort gravity. (For example, a widely used set of tables is found in Randy Mosher's The Brewer's Companion published by Alephenalia Publications, Seattle. Likewise, computer programs such as



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ProMash allow users to select utilization tables based on the work of Rager, Tinseth and others.) Homebrewers should note that these tables are educated estimates based on various factors listed above, but they have not actually been measured on their systems. To really determine your utilization rate, you would need to brew a series of test brews, have your beers analyzed for IBU content and calculate your utilization factor by rearranging the terms of the equation on page 32.

In the absence of constructing your own utilization table or equations for your system, a homebrewer should simply choose one particular utilization method and stick with it. Although the method you pick may not yield the actual utilization numbers for your system, at least it will be consistent.

Boil Intensity and Volume

The intensity of the boil is another factor affecting utilization. Applying the same amount of heat to the kettle from brew to brew will help ensure the same isomerization and evaporation rates over a specified period. Brewers should set the heat source to a consistent setting if possible.

It is good practice to boil the wort for a short time (e.g. 15–20 minutes) before adding the hops because the initial, unhopped boiling gives the coagulable proteins an opportunity to bind with harsh husk tannins instead of hop tannins. During this "pre-boiling" period, the brewer can determine the evaporation rate if the brewer has not already established a rate from prior brews. For example, if 0.25 gallons evaporate in the first 15 minutes, 1 gallon will evaporate during one hour.

A consistent boil intensity will also allow homebrewers to hit the same target gravity brew after brew, and this consistency will help them get closer to their bitterness target.

The amount of alpha acids isomerized during the boil is going to be diluted in a certain volume of wort. If you end up with less wort than you expected, your wort will be more bitter than predicted. Conversely, if you end up with more wort than expected, it will be less bitter.

To ensure that your target gravity can be hit consistently, you should calibrate both your kettle and fermenter. A "dip stick" with markings every ¼ or half gallon is what many homebrewers use to determine how much wort is in their their kettle. Likewise, bucket fermenters or carboys can be calibrated by adding one-half to one gallon of water at a time and marking the outside of the fermenter with a permanent marker or masking tape. Don't rely on calibrations printed on your bucket (or the fact that your carboy is "full") to measure your volume.

Verifying Your Results

A homebrewer can perform an informal test of the accuracy of their predictions with side-by-side tasting of beers of similar known IBU and alcohol content. (Note: The perception of bitterness decreases with increasing beer gravity. Comparing bitterness is best done with beers of similar style and original gravity.) The table on page 34 gives some examples.

Conclusion

Homebrewers can calculate IBU predictions for their beers, but most lack the means to actually measure their IBUs. These calculations are valuable tools, but require repeatable procedures and attention to detail to allow the brewer to actually land near the desired target. In addition, obtaining accurate values for the variables used to predict IBUs is problematic. At best, a homebrewer may be fairly consistent in producing a predictable amount of bitterness, even if his estimation of IBUs is off a bit. However, if you know what a 45 IBU beer tastes like on your system, who cares if it's exactly 45 IBUs or not? By understanding the variables involved, you can manipulate the flavor of your homebrew, which is far more important than being numerically accurate. And remember, subtle nuances are part of what make homebrewing such an interesting adventure. ■

Steve Holle is the author of "A Handbook of Basic Brewing Calculations" (published by the Master Brewers Association of the Americas).

BITTER beer recipes

ATTACK of the HOP CLONES

BREW These Bold, Bombastic BITTER BEERS

by **Chris Colby**

Like hops? Well, with the kind help from some of the most popular brewers of hoppy beers, we've rounded up a bunch of recipes that are sure to get any hophead salivating. To get the most from these clones, keep the following in mind: No wimpy boils! You will need to perform a vigorous full wort boil and still yield the correct amount of wort when you are finished. All-grain brewers should review their notes to determine their evaporation rate, and don't be afraid to add some water if you yield less than 5 gallons (19 L) of wort. Extract brewers should realize that you can't make these beers by boiling a couple gallons of wort on your stovetop — you won't get the full amount of bitterness that way. Either get a kettle big enough to do a full wort boil or make two separate 2.5-gallon (9.5-L) batches — each boiled vigorously with half the malt and hops — and combine them. (See the "Texas Two Step" article in the October 2003 issue of *BYO* for more information on this. This takes a little more work than an ordinary batch of extract beer. But when you taste the hoppy beer, you'll be glad you did.) No underpitching! These beers are big as well as hoppy, so pitch enough yeast for a healthy fermentation.

continued on page 43

90-Minute IPA clone (Dogfish Head)

(5 gallons/19 L, all-grain)
OG = 1.088 FG = 1.021
IBU = 90 SRM = 13 ABV = 8.7%

Ingredients

16.5 lbs. (7.5 kg) Pilsner malt
1.66 lbs. (0.75 kg) amber malt (35 °L)
16 AAU Amarillo hops (90–0 mins)
(2.0 oz./57 g of 8.0% alpha acids)
8.0 AAU Simcoe hops (90–0 mins)
(0.62 oz./17 g of 13% alpha acids)
8.0 AAU Warrior hops (90–0 mins)
(0.53 oz./15 g of 15% alpha acids)
1 oz. (28 g) Amarillo hops (dry hops)
0.5 oz (14 g) Simcoe hops (dry hops)
0.5 oz. (14 g) Warrior hops (dry hops)
1 tsp. Irish moss (15 mins)
Wyeast 1099 (Whitbread Ale) yeast
0.75 cups corn sugar (for priming)

Step by Step

Mash in at 122 °F (50 °C), then raise the temperature to 149 °F (65 °C) until conversion is complete. Mash out to 170 °F (77 °C). Boil the wort for 105 minutes. Starting with 90 minutes left in the boil, begin slowly and evenly adding hops to the kettle. (This works out to a little over 0.25 oz. (7 g) of hops every 7.5 minutes.) Start fermentation at 71 °F (22 °C) and let raise to 74 °F (23 °C). Dry hop in secondary at 71 °F for 3–5 days, then cool to 32 °F (0 °C).

Extract option:

Replace Pilsner malt with 8.0 lbs. (3.6 kg) dried malt extract and 1.75 lbs. (0.79 kg) of Pilsner malt. Steep crushed grains in 1.1 gallons (4 L) of water at 150 °F (66 °C) for 45 minutes. Follow the remaining instructions in the all-grain recipe.

Thanks to Sam Calagione and Andy Tveekrem of Dogfish Head for their help in constructing this clone.

AleSmith IPA clone (AleSmith Brewing Company)

(5 gallons/19 L, all-grain)
OG = 1.073 FG = 1.014
IBU = 93 SRM = 9 ABV = 7.6%

Ingredients

14.66 lbs. (6.6 kg) Gambrinus
2-row pale malt
2.0 oz. (56 g) crystal malt (15 °L)
2.0 oz. (56 g) CaraPils malt (6 °L)
2.0 oz. (56 g) Munich malt (10 °L)
2.0 oz. (56 g) wheat malt
1.0 oz. (28 kg) honey malt
7.0 AAU Columbus hops (FWH)
(0.5 oz./14 g of 14% alpha acids)
7.0 AAU Simcoe hops (FWH)
(0.53 oz./15 g of 13% alpha acids)
3.25 AAU Columbus hops (60 mins)
(0.23 oz./6.5 g of 14% alpha acids)
1.33 AAU Amarillo hops (30 mins)
(0.17 oz./4.8 g of 8.0% alpha acids)
2.25 AAU Simcoe hops (15 mins)
(0.17 oz./4.8 g of 13% alpha acids)
2.66 AAU Columbus hops (10 mins)
(0.19 oz./5.4 g of 14% alpha acids)
2 AAU Cascade hops (5 mins)
(0.4 oz./11 g of 5.0% alpha acids)
5 AAU Cascade hops (1 mins)
(1.0 oz./28 g of 5.0% alpha acids)
0.5 oz. (14 g) Columbus hops (dry hop)
0.5 oz. (14 g) Amarillo hops (dry hop)
0.5 oz. (14 g) Cascade hops (dry hop)
0.25 oz. (7 g) Simcoe hops (dry hop)
0.25 oz. (7 g) Chinook hops (dry hop)
1 tsp. Irish moss (15 mins)
White Labs WLP001(California Ale)
0.75 cups corn sugar (for priming)

Step by Step

Mash at 152 °F (67 °C) for 60 minutes. Boil for 90 minutes, following hop addition schedule. Whirlpool wort and let sit for 15 minutes before you begin cooling. Fermentation temperature 68.5 °F (20.3 °C).

Extract option:

Replace pale malt with 7.25 lbs. (3.3 kg) light dried malt extract and 1.0 lb. (0.45 kg) 2-row pale malt. Steep crushed pale malt plus specialty malts in 64 oz. (1.9 L) of water at 152 °F for 45 minutes. Follow the boiling and fermentation instructions above.

Thanks to Peter Zien of AleSmith for his extensive help in constructing this clone.

Dreadnaught clone (Three Floyd's Brewing Co.)

(5 gallons/19 L, all-grain)
OG = 1.084 FG = 1.021
IBU = 100 SRM = 11 ABV = 8.1%

Ingredients

16.25 lbs. (7.4 kg) American
2-row pale malt
1.25 lbs. (0.57 kg) melanoidin
malt (27 °L)
8.0 AAU Warrior hops (60 mins)
(0.53 oz./15 g of 15% alpha acids)
8.0 AAU Simcoe hops (60 mins)
(0.62 oz./17 g of 13% alpha acids)
8.0 AAU Centennial hops (45 mins)
(0.72 oz./20 g of 11% alpha acids)
8.0 AAU Centennial hops (30 mins)
(0.72 oz./20 g of 11% alpha acids)
8.0 AAU Cascade hops (15 mins)
(1.6 oz./45 g of 5.0% alpha acids)
1.5 oz. Cascade whole hops (dry hops)
1 tsp. Irish moss (15 mins)
Wyeast 1968 (London ESB) or
White Labs WLP002 (English Ale)
0.75 cups corn sugar (for priming)

Step by Step

This is a single infusion mash at 159 °F (71 °C) for 60 minutes. Boil the wort 90 minutes, adding hops at the times indicated in the ingredient list. Ferment at 68 °F (20 °C).

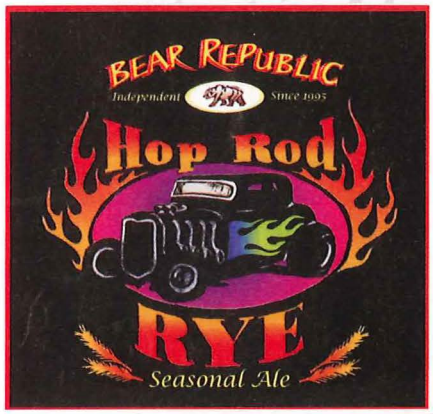
Extract option:

Replace pale malt with 8.0 lbs. (3.6 kg) dried malt extract and 1.33 lbs. (0.6 kg) 2-row pale malt. Steep crushed grains in 103 fl. oz. (3 L) of water at 159 °F (71 °C) for 45 minutes.

Thanks to Nick Floyd of Three Floyd's Brewing Co. for the information used to construct this clone.

Hop Rod Rye clone (Bear Republic Brewing Co.)

(5 gallons/19 L, all-grain)
OG = 1.072 FG = 1.017
IBU = 84 SRM = 17 ABV = 7.2%



Ingredients

8.75 lbs. (4.0 kg) 2-row pale malt
2.5 lbs. (1.1 kg) rye malt
1.25 lbs. (0.57 kg) flaked rye
1.15 lbs. (0.52 kg) Munich malt
0.625 lbs. (0.28 kg) wheat malt
0.625 lbs. (0.28 kg) CaraPils malt
1.75 oz. (49 g) black malt
10.4 AAU Tomahawk hops (60 mins) (0.74 oz./21 g of 14% alpha acids)
4.73 AAU Centennial hops (30 mins) (0.43 oz./12 g of 11% alpha acids)
24.3 AAU Tomahawk hops (0 mins) (1.7 oz./49 g of 14% alpha acids)
0.75 oz. (21 g) Amarillo hops (dry hop)
1.0 oz. (28 g) Centennial hops (dry hop)
1 tsp Irish moss (15 mins)
Wyeast 1272 (American Ale II) or White Labs WLP051 (California V) yeast
0.75 cups corn sugar (for priming)

Step by Step

Mash in at 145 °F (63 °C) then ramp temperature to 152 °F (67 °C) for conversion. Mash out to 170 °F (77 °C). Boil for 90 minutes, adding hops at the times indicated in the ingredient list. Whirlpool the wort and let it sit for 15 minutes prior to cooling. Ferment at 68 °F (20 °C).

Extract option:

Replace the 2-row pale malt with 4.25 lbs. (1.9 kg) dried malt extract and 1.0 lb. (0.45 kg) 2-row pale malt. Steep crushed grains in 2.25 gallons (8.5 L) of water at 152 °F (67 °C) for 45 minutes.

Racer 5 clone (Bear Republic Brewing Co.)

(5 gallons/19 L, all-grain)
OG = 1.071 FG = 1.015
IBU = 60 SRM = 10 ABV = 7.2%

Ingredients

11.25 lbs. (5.1 kg) 2-row pale malt
1.66 lbs. (0.75 kg) wheat malt
0.625 lbs. (0.28 kg) crystal malt (15 °L)
0.42 lbs. (0.19 kg) dextrose (corn sugar)
0.21 lbs. (95 g) CaraPils malt
6.1 AAU Chinook hops (90 mins) (0.51 oz./14 g of 12% alpha acids)
8.7 AAU Cascade hops (60 mins) (1.74 oz./49 g of 5.0% alpha acids)
0.3 oz. Centennial hops (dry hop)
0.3 oz. Amarillo hops (dry hop)
0.2 oz. Cascade hops (dry hop)
0.2 oz. Tomahawk hops (dry hop)
Wyeast 1272 (American Ale II) or White Labs WLP051 (California V) yeast
0.75 cups corn sugar (for priming)

Step by Step

Mash in at 145 °F (63 °C) then ramp temperature to 152 °F (67 °C) for conversion. Mash out to 170 °F (77 °C). Boil for 90 minutes, adding hops at the times indicated in the ingredient list. Ferment at 68 °F (20 °C).

Extract option:

Replace pale malt with 6.0 lbs. (2.7 kg) dried malt extract and 0.33 lbs. (0.15 kg) 2-row pale malt. Steep crushed grains in 1 gallon (3.8 L) of water at 152 °F (67 °C) for 45 minutes.

Thanks to Richard Norgrove of Bear Republic Brewing Co. for his homebrew clones.

Pliny the Elder clone (Russian River Brewing Co.)

(5 gallons/19 L, all-grain)
OG = 1.074 FG = 1.014
IBU = 100+ SRM = 8 ABV = 8–8.5%

Ingredients

12.2 lbs. (5.5 kg) 2-row malt
0.28 lbs. (0.13 kg) crystal malt (45 °L)
0.86 lbs. (0.39 kg) CaraPils malt
1.0 lb. (0.45 kg) dextrose (corn sugar)
19.5 AAU Chinook whole hops (mash hops)

(1.5 oz./43 g of 13% alpha acids)
42.9 AAU Warrior hops (90 mins)
(2.75 oz./78 g of 15.6% alpha acids)
6.1 AAU Chinook hops (90 mins)
(0.5 oz./14 g of 12.2% alpha acids)
12 AAU Simcoe hops (45 mins)
(1.0 oz./28 g of 12% alpha acids)
14.3 AAU Columbus hops (30 mins)
(1.0 oz./28 g of 14.3% alpha acids)
20.5 AAU Centennial hops (0 min)
(2.25 oz./64 g of 9.1% alpha acids)
12 AAU Simcoe hops (0 min)
(1.0 oz./28 g of 12% alpha acids)
3.25 oz. Columbus hop (dry hop)
1.75 oz. Centennial hops (dry hop)
1.75 oz. Simcoe hops (dry hop)
1 tsp. Irish moss (15 mins)
White Labs WLP001 (California Ale) yeast
0.75 cups corn sugar (for priming)

Step by Step

Mash at 150–152 °F (66–67 °C). Boil 90 minutes, adding hops at the time indicated in recipe. Ferment at 68 °F (20 °C). Dry hop two weeks.

Extract option:

Replace 2-row malt with 6.15 lbs. (2.8 kg) dried malt extract and 1.0 lb. (0.45 kg) 2-row malt. Steep crushed grains in 1 gallon (3.8 L) of water at 151 °F (66 °C) for 45 minutes. See remaining instructions above.

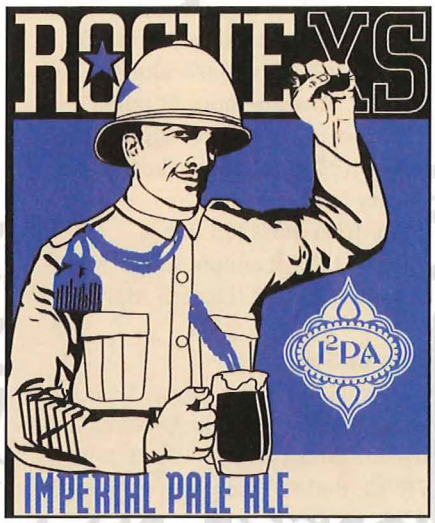
Thanks to Vinnie Cilurzo from Russian River Brewing for his homebrew clone.

Imperial IPA (I²PA) clone (Rogue Brewing)

(5 gallons/19 L, all-grain)
OG = 1.080 FG = 1.020
IBU = 62 SRM = 7 ABV = 7.8%

Ingredients

16.25 lbs. (7.4 kg) British pale malt
13.5 AAU Newport hops (60 min)
(1.0 oz./28 g of 13.5% alpha acids)
5.0 AAU Cascade hops (30 min)
(1.0 oz./28 g of 5.0% alpha acids)
7.0 AAU Sterling hops (15 min)
(1.0 oz./28 g of 7.0% alpha acids)
1.0 oz. (28 g) Amarillo hops (dry hops)



1 pkg Whirfloc (20 min)
White Labs WLP0051 (California V) yeast
4.0 oz. corn sugar (for priming)

Step by Step

Mash at 154 °F (68 °C). Boil for 90 minutes, adding hops at the time indicated in the recipe. Ferment at 68 °F (20 °C).

Extract option:

Replace pale malt with 11.0 lbs. (5.0 kg) English light malt extract and 2.0 lbs. (0.91 kg) 2-row pale malt. Steep crushed pale malt in 80 fl. oz. (2.4 L) of water at 154 °F (68 °C) for 45 minutes.

Thanks to John Maier of Rogue and Jason Petros of Beer, Beer and More Beer for their homebrew clone.

Lagunitas IPA clone (Lagunitas Brewing)

(5 gallons/19 L, all-grain)
OG = 1.059 FG = 1.015
IBU = 67 SRM = 9 ABV = 5.7%

Ingredients

11.33 lbs. (5.1 kg) 2-row pale malt
0.4 lbs. (0.18 kg) dextrine malt
0.3 lbs. (0.14 kg) crystal malt (60 °L)
0.2 lbs. (91 g) light Munich malt (4 °L)
8.25 AAU Horizon hops (60 mins)
(0.75 oz./21 g of 11% alpha acids)
4.5 AAU Cascades hops (30 mins)
(0.90 oz./26 g of 5.0% alpha acids)
1.25 AAU Willamette hops (30 mins)
(0.25 oz./7.1 g of 5.0% alpha acids)
15.75 AAU Cascade hops (0 min)
(3.15 oz./89 g of 5.0% alpha acids)
Wyeast 1056 (American Ale) or White Labs WLP001 (California Ale) yeast

Step by Step

Mash at 154 °F (68 °C). Boil for 90 minutes, adding hops as indicated in the ingredient list. After the boil, let the wort sit for 15 minutes before cooling. Ferment at 70 °F (21 °C).

Extract option:

Replace pale malt with 5 lbs. 9 oz. (2.5 kg) of light dried malt extract and 1.0 lb. (0.45 kg) 2-row pale malt. Steep crushed pale malt and other malts in 76 oz. (2.2 L) of water at 154 °F (68 °C) for 45 minutes.

Thanks to Tony Magee of Lagunitas Brewing for his homebrew clone, upon which this clone is based.

Acme IPA clone (North Coast Brewing)

(5 gallons/19 L, all-grain)
OG = 1.062 FG = 1.011
IBU = 56 SRM = 7 ABV = 6.6%

Ingredients

11.33 lbs. (5.1 kg) Great Western 2-row pale malt
1.0 lb. (0.45 kg) Vienna malt
0.33 lbs. (0.15 kg) Munich malt
0.33 lbs. (0.15 kg) CaraPils malt
3.3 AAU Clusters hops (60 mins)
(0.47 oz./13 g of 7.0% alpha acids)
3.3 AAU Clusters hops (30 mins)
(0.47 oz./13 g of 7.0% alpha acids)

14 AAU Northern Brewer (0 mins)
(1.6 oz./44 g of 9.0% alpha acids)
1 tsp. Irish moss (15 mins)
Wyeast 1056 or White Labs WLP001

Step by Step

Mash at 154 °F (68 °F) for 60 mins. Recirculate for 20 minutes, then collect 7 gallons (26 L) of wort. Boil for 90 minutes, adding Clusters hop charges with 60 minutes and 30 minutes left in boil. At 15 minutes left in the boil, add the Irish moss. At knockout, add the Northern Brewer hops, whirlpool the wort and let it sit for 30 minutes (covered) before you begin cooling. After 30 minutes, chill wort, aerate and pitch yeast. Ferment at 68 °F (20 °C).

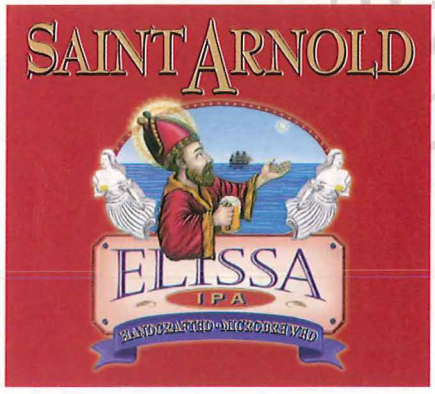
Extract option:

Replace 2-row malt with 5.5 lbs. (2.5 kg) of light dried malt extract and 1.0 lb. (0.45 kg) 2-row malt. Steep crushed 2-row, Vienna, Munich and CaraPils malts in 110 oz. (3.25 L) of water at 154 °F (68 °C) for 45 minutes. Follow all-grain instructions for boiling and fermentation.

Thanks to Mark Ruedrich of North Coast Brewing for information on Acme IPA used to construct this clone.

Elissa IPA clone (St. Arnolds Brewing Co.)

(5 gallons/19 L, all-grain)
OG = 1.061 FG = 1.010
IBU = 60 SRM = 10 ABV = 6.6%



Ingredients

12 lbs. (5.4 kg) Maris Otter pale malt
0.71 lbs. (0.32 kg) Crisp crystal malt (45 °L)
13.5 AAU Cascade hops (60 mins)
(2.7 oz./34 g of 5.0% alpha acids)
6.0 AAU Cascade hops (15 mins)
(1.2 oz./34 g of 5.0% alpha acids)
6.0 AAU Cascade hops (4 mins)
(1.2 oz./34 g of 5.0% alpha acids)
0.8 oz. (23 g) Cascade whole hops (dry hop)
1 tsp. Irish moss (15 mins)
Wyeast 1028 (London Ale) or White Labs WLP013 (London Ale) yeast

Step by Step

Brock Wagner says, "Use water with very low $CaCO_3$. Gypsum is your friend." Mash at 156–158 °F (69–70 °C). Boil 90 minutes. Ferment at 72 °F (22 °C).

Extract option:

Replace pale malt with 5.85 lbs. (2.65 kg) light dried malt extract and 1.0 lb. (0.45 kg) 2-row pale malt. Steep crushed malts in 70 fl. oz. (2.1 L) of water at 156-158 °F (69-70 °C) for 45 minutes.

Clone by Bev D. Blackwood II. Thanks to Brock Wagner of St. Arnold Brewing Company for the recipe.

Celebration Ale clone (Sierra Nevada)

(5 gallons/19 L, all-grain)
OG = 1.064 FG = 1.014
IBU = 60 SRM = 12 ABV = 6.4%

Ingredients

11.5 lbs. (5.2 kg) 2-row pale malt
1.0 lb. (0.45 kg) crystal (35 °L)
0.5 lb. (0.23) CaraPils malt
11 AAU Chinook hops (60 mins)
(1.0 oz./28 g of 11% alpha acids)
8.5 AAU Cascade hops (30 mins)
(1.7 oz./48 g of 5.0% alpha acids)
0.66 oz. (19 g) Cascade hops (dry hop)
0.66 oz. (19 g) Centennial (dry hop)
1 tsp. Irish moss (15 mins)
Wyeast 1056 (American Ale) or White Labs WLP001 (California Ale) yeast
0.75 cups corn sugar (for priming)

Step by Step

Mash at 156 °F (69 °C) for 60 minutes. Boil wort for 90 minutes, adding hops as indicated in the recipe. Ferment at 66 °F (19 °C). Dry hop in secondary for 5 days at 60 °F (16 °C).

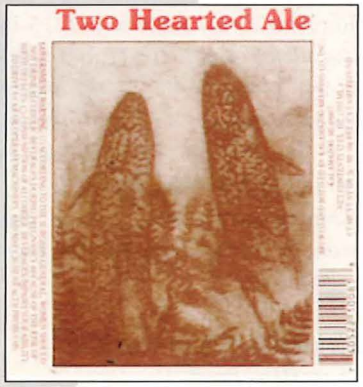
Extract option:

Replace 2-row malt with 5.5 lbs. (2.5 kg) dried malt extract and 1.5 lb. (0.68 kg) 2-row malt. Steep crushed grains in 120 fl. oz. (3.5 L) of water at 156 °F (69 °C) for 45 minutes. Follow all-grain instructions for boiling and fermenting.

Clone modified from a recipe printed in the October 2000 issue of BYO.

Two Hearted Ale clone (Kalamazoo Brewing Company)

(5 gallons/19 L, all-grain)
OG = 1.058 FG = 1.012
IBU = 56 SRM = 8 ABV = 5.9%



Ingredients

9.33 lbs. (4.2 kg) 2-row pale malt
2.0 lbs. (0.91 kg) Vienna malt
0.5 lbs. (0.23 kg) crystal (10 °L)
0.33 lbs. (0.15 kg) CaraPils malt (6 °L)
5.5 AAU Centennial hops (60 mins)
(0.5 oz./14 g of 11% alpha acids)
5.5 AAU Centennial hops (45 mins)
(0.5 oz./14 g of 11% alpha acids)
5.5 AAU Centennial hops (30 mins)
(0.5 oz./14 g of 11% alpha acids)
5.5 AAU Centennial hops (15 mins)
(0.5 oz./14 g of 11% alpha acids)

0.33 oz. (9.4 g) Centennial hops (0 min)
0.33 oz. (9.4 g) Centennial (dry hop)
0.5 tsp. Irish moss (15 mins)
Wyeast 1272 (American Ale II), White Labs WLP051 (California V) or yeast cultured from a bottle of this beer
0.75 cups corn sugar (for priming)

Step by Step

Mash at 152 °F (67 °C) for 1 hour. Boil wort for 75 minutes, adding Centennial hops at the times indicated in the recipe. Ferment at 70 °C (21 °C). Dry hop for 3 days in secondary.

Extract option:

Replace 2-row malt with 4.5 lbs. (2.0 kg) dried malt extract and 1.0 lb. (0.45 kg) 2-row malt. Steep crushed grains in 1.2 gallons (4.6 L) of water at 152 °F (67 °C) for 45 minutes. Boil extract version for only 60 minutes.

Clone modified from a recipe printed in the February 2001 issue of BYO.

Ruination IPA clone (Stone Brewing Company)

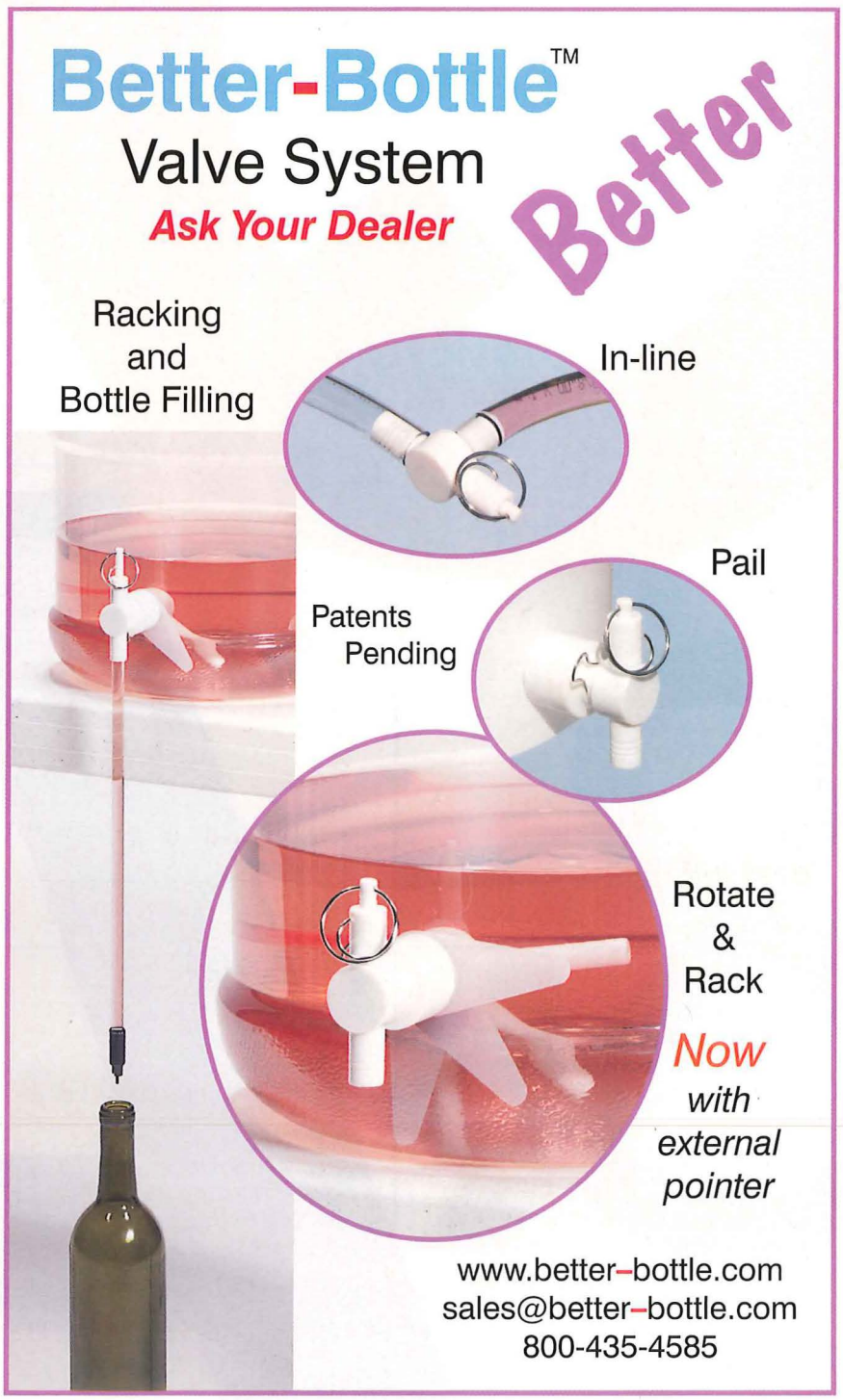
(5 gallons/19 L)
OG = 1.075 FG = 1.010
IBU = 100+ SRM = 6 ABV = 7.7%

See page 11 for Ruination IPA.

cont. from introduction on page 38

A 2-3 quart (~2-3 L) yeast starter is strongly recommended. To make one, boil 0.5-0.75 lbs. (0.22-0.34 kg) of dried malt extract in 2-3 quarts (~2-3 L) of water. Cool, aerate and pitch the yeast 2-3 days before brewday. Don't use stale, leftover hops! Use the freshest hops you can find. Avoid hops that look brown or smell cheesy.

Read the instructions! Some of these beers require you to whirlpool the wort and let it sit for awhile before cooling. Do not skip or shorten this stage as this is needed for the beer to reach its full bitterness. If you are brewing outside in cold weather, insulate your kettle during the whirlpool stage. Extract brewers should follow the directions for steeping carefully. The right temperature and volume of water is given for each recipe. Place your crushed grains in a nylon steeping bag and steep them in a separate pot. Add the "grain tea" to their brewpot when it is ready. Don't try to rinse the grains with additional hot water, just let the bag drip. (These steps help limit astringency, a common problem in extract beers. Also, some grains that need to be mashed are included in the steeping grains. These are added for flavor, but can cause starch haze if you ignore the steeping instructions.) Note that, while you are steeping, you can be heating the water in your brewpot. And finally — don't rush! Let these beers age awhile before enjoying them. When they're ready, you can sit back and enjoy the burn. Happy hopping! ■



a Brewers' ROUNDTABLE

Pull up a Seat and Listen to the Pros Talk Shop About Hops

Q & A

THE BREWERS:

John Harris
Full Sail Brewing Company
Peter Zien
AleSmith Brewing Company
Richard "Ricardo" Norgrove
Bear Republic Brewing Company
Mike Hoops
Minneapolis Town Hall Brewery
Mark Ruedrich
North Coast Brewing Company

Q

How did your beer originate?

A

Peter Zien: "Our (AleSmith) IPA is quite similar to my homebrewed version that I competed with for many years. I was inspired by a Brewing Techniques article in 1996 about American IPAs. We're big believers in the concept that a big IPA needs a big malt background to do its thing. Too many IPAs are one-dimensional, without substantial maltiness to sustain the big hop infusions."

Mike Hoops: "When I started working at the Town Hall there was a solid IPA that was being brewed here, so I had a guideline to work with. In an attempt to make the beer my own I ended up changing the beer into a new beer. I ended up 'tweaking' the beer for nearly three years before really finding the exact profile I wanted for Masala Mamma IPA."

Richard Norgrove: "Hop Rod Rye came to pass as the brewers at Bear Republic were searching for new and exciting malts to showcase. We like our beers big and hoppy, so we just kept pushing the envelope during the development brews for a stronger, hoppier, more balanced rye pale ale. The first batches were done on a three-tier, 15-gallon (57 L) homebrew system built by me, which serves as our pilot plant. After three tries we went big time and it took almost a year with at least six batches on the large scale to get it where we wanted it."

Q

What do you aim for when brewing a hoppy or very hoppy beer?

A

Peter Zien: "The AleSmith way regarding hoppiness is to impart a lot of hop flavor and aroma, but not all that much in-your-face bitterness. This is accomplished by doing most of our hopping on the back-end of the process. We use a large amount of raw hops in the hop back and even more for dry-hopping in the majority of the styles that we brew at AleSmith."

John Harris: "In reference to our pale ale (Full Sail Pale Ale), we strive to taste the character of all the ingredients. The character of the malt should be in concert with the hops. Each one standing out, but none overshadowing the other."

Mike Hoops: "That really depends on the desired effect. Some beers are designed to be hop explosions, while others are more delicate. One of the real benefits in pub brewing is the constant rotation of beers. In that rotation, a brewer gets to highlight different aspects of beers made."

Mark Ruedrich: (On Acme IPA) "We tried to formulate a good session beer — one that was assertively hoppy but wouldn't burn your lips off."

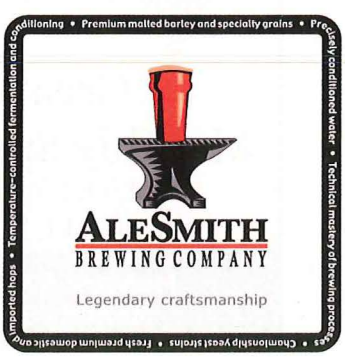
Q

What are the most important factors that come into play when brewing a very hoppy beer?

A

Peter Zien: "Water and proper pH levels certainly play an important part in creating the perception of a hoppy, dry beer. We add calcium sulfate and calcium chloride to filtered San Diego water in various amounts, depending on the style of beer that we're brewing."

Mike Hoops: "Water is very important in any beer and should never be overlooked. That being said, techniques and the brewer's hop blending ability is very important. Hop growers are doing such a fine job today that we



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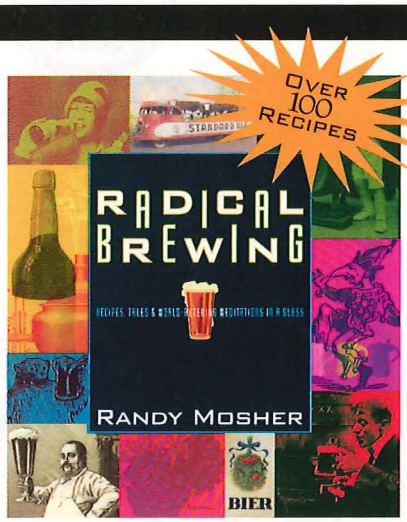

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have many choices available to us as brewers. It is very important that we learn what these varieties have to offer, and to what extent. Try a "hop-tea" with hops that you don't really know, it can really be a great learning tool. Once you know the hops, then experiment with different methods of use. We like first wort hopping, multiple additions, multiple combinations, dry hopping and we would certainly use a hop back if we had one."

Richard Norgrove: "Dry hopping and late kettle additions become key to the aromatic presentation of the beer. If you go overboard, the drinker loses the malt and only remembers the hop aroma."

Mark Ruedrich: "First, you need a beer that's delicious. And, I'm stuck to the idea that balance is very important."

Q

What advice would you give homebrewers about brewing very hoppy beers?

A

Peter Zien: "My advice to the homebrewer making an IPA is that it's not *all* about the hops. Look to build a substantial malt base to hold the high hopping rates. Also, keep the initial hop addition IBUs in check and look to really add hop flavor and hop aroma to your IPA. These are the ones that stand out in my mind when I think of what a world-class IPA should taste like."

Mike Hoops: "Get to know your ingredients first and don't always try to make the biggest or most bitter beer. Low alpha hops can offer fantastic character to beer, play with them."

Richard Norgrove: "Work on balance. There are too many hop bombs out there. It's easy to make a hop tea, but harder to balance the flavors."

Mark Ruedrich: "I was a homebrewer, and from what I remember, homebrewers are an independent lot and don't need much advice."

Q

Do you think the current push towards hoppier and hoppier IPAs will keep going . . . or will "the bubble burst" and many or most of these hop monsters go extinct?

A

Peter Zien: "As far as hoppier and hoppier IPAs go, again I think that some sort of balance must be reached between malt and hop. Raising hop levels while not increasing grain bills can lead to some rather mediocre and one-dimensional IPAs, in my opinion."

Mike Hoops: "I don't like to think of this 'desire for hops' to be a fad. People truly like the flavor that hops offer and I think that will continue. As consumers are introduced to more flavors (from hops or other), they will continue to seek them. Also, a person's palate will adapt to increasingly hoppy beers and ultimately that leads to a desire for even more hops."

Richard Norgrove: "Someone will always push the envelope, but will it turn silly. Oh yeah, it is already getting silly. I have heard of some Southern California pubs actually placing hop pellets or flowers in pints to give that extra turbo boost. Some guys even use synthesized oil extracts to gain that edge. Still, I say go for it. Don't ever stop pushing the envelope. I feel that homebrewing is the laboratory where true advancements of beer styles is coming from."

Mark Ruedrich: "I don't have a clear sense of how popular these are, but I think they may become self-limiting."

Q

What hop varieties do you use in your beer and what is it about these varieties that you like?

A

Peter Zien: "We use Tomahawk (or Columbus), Cascade, Amarillo, Warrior and Simcoe. These are all American varieties that create quite a pleasant hop character for American-style IPAs in virtually any combination. These hops are the gems of the United States hop varieties."

John Harris: "This beer (Full Sail Pale Ale) features two newer varieties, Columbus and Centennial. In our pale we are striving to get a lot of hop flavor. We want to put the character of rubbing fresh hops into each glass. This is a very delicate operation. Using higher alpha hops has required some different approaches to kettle hopping the beer. Remember where there is heat there is isomerization, even if it is not boiling. We like these varieties because we get nice citrus fruit aromas. Grapefruit, lemon and orange."

Richard Norgrove: "Centennial, Chinook, Columbus, Cascade — all the Cs are great."

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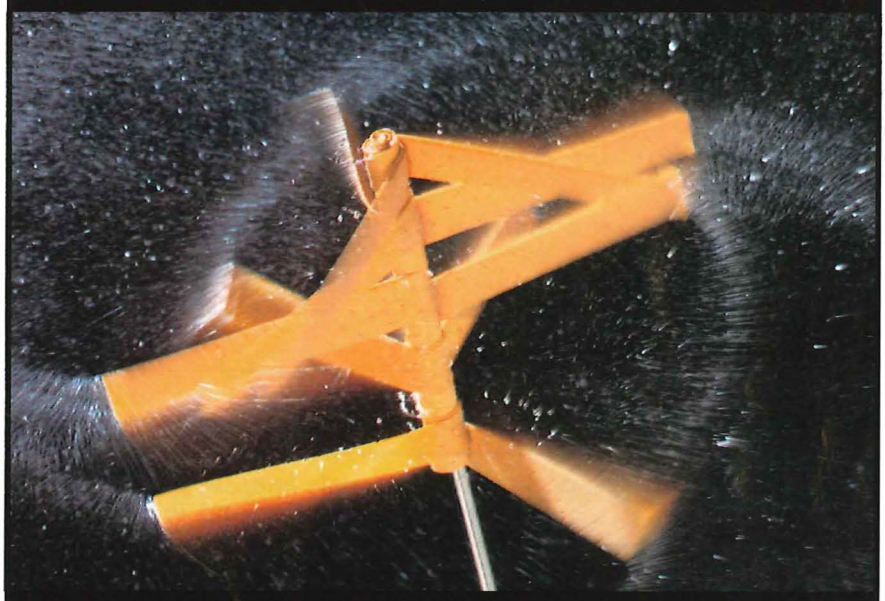

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Mark Ruedrich: "(In Acme IPA) we use Clusters as a bittering hop and Northern Brewer as a finishing hop, which is a little unusual. I think it is deliciously dry and has a great, citrusy, grapefruity character. One thing we don't worry about that other breweries do is cohumulone content. We haven't seen a correlation between cohumulone and harshness, so we're not responding to this in our formulations."

Q

What malts do you use in your hoppy beer?

A

Peter Zien: "Honey malt is incredible in hoppy beers. It imparts a light apricot-like flavor and aroma that plays in perfectly with the American hop varities."

Mike Hoops: "We start with American pale, use various caramel malts, Munich and malted wheat. The Munich gives this beer a lot of its 'backbone'."

Mark Ruedrich: "We use just Vienna, CaraPils and Munich because I believe it's nice not to have a 'muddy' malt profile."

Q

Many hopheads report that, once they began enjoying hops, they wanted to drink increasingly hoppy beers. Do you think hops have an addictive or psychoactive component, such as the addiction some people get to spicy foods?

A

John Harris: "Hops have been considered a sedative for years. I do think people can fall in love with the bitterness. It can be a 'hot food'-type rush."

Mike Hoops: "I have seen some of our customers after they have not had any hops for a few days. One pint can change their whole being. I believe that is due to 'hop-jonesing.' I guess the alcohol also may play a factor."

Richard Norgrove: "Oh yeah. I'm addicted, aren't you? ■

Hops Transducer

From Dogfish Head to your home brewery

story and photos by Thom Cannell

For all the hop-lovers in the world, Dogfish Head has inspired an innovation in hopping and dispensing. (*Enter Randall . . .*)

In a recent *New York Times* article, Sam Calagione, president of Dogfish Head Craft Brewery in Milton, Delaware described a unique addition to brewing apparatus. Dubbed "Randall, the enamel animal AKA an Organoleptic Hops Transducer," the device pushes chilled beer through pounds of fresh hops, adding hop aroma to any brew.

Why an enamel animal? The apparatus is said to leave the enamel of drinker's teeth feeling gritty. This is an exciting addition to brewing, and to home brewing. It's also one of those forehead-slapping "why didn't I think of that" things.

What Sam envisioned, then produced (they are for sale, direct from Dogfish Head), was a large amount of fresh hops placed between keg and tap handle. We won't speak for Sam, but the chosen vessel looks to us like a large water filter that is filled with hops. Beer flows in, ultra-hopped beer flows out. Genius!

Our homage to Randall takes its cues from photographs published, and a bit of intuition. The concept is simple, beer comes into the filter casing where it encounters fresh hops. Filter media prevents chunks of hops from flowing out — brilliant simplicity.

In our attempt to recreate this "hops transducer," we considered that homebrewers typically use 5 gallon Cornelius kegs, so we sized the filter body accordingly selecting a typical "whole-house" filter.

In our first attempt to clone Randall, it took a pound of hops, an afternoon and three gallons of Harper's Grove Street Pale Ale (give or take a pint or two) to discover how to improve our hops transducer clone.

The filter media itself should pass on all of a beer's flavor without removing any hop oils, or aromas (commercial breweries are rumored to filter so finely that flavor molecules are affected) so charcoal filters were ruled out — we will use these for filtering brewing water only. A bit of research with hops producers yielded information suggesting that filters in the 15–30 micron range (i.e "sediment filters") should work perfectly for our version of Randall.

Dogfish Head uses a piece of CPVC pipe with lateral slits cut into it, which is a great idea. As beer enters the filter body from the top, it will migrate through the path of least resistance. With a sediment filter, the entire body is permeable. That means, if the hops are not packed perfectly, beer will flow through any hole or gap without contact with the hops — meaning no direct flavor addition.

In our first pseudo-Randall trial, beer sped through a portion of the hop bed that was void. The result was inevitable: no additional hop flavor. More hops packed into the filter cavity seemed to be an adequate solution — but it wasn't. We needed to ensure that beer had to pass through a majority of the hops before it could exit.

Randall (we think) avoids this problem by slotting its PVC tube "at the bottom." Thus the beer must flow downwards through many inches of packed hops before it has any chance to exit. We emulated this by inserting a tightly-fit tube into the interior of the filter, extending to the half way point of the filter. This meant that any beer dispensed would have to flow down through the hops, picking up flavor, before crossing the filter. The result? Much improved hop aroma and flavor in the beer.

A fellow homebrewer, Jack Adkins, came up with an additional procedure applicable to either device. Pack the bottom half with hops flowers to 1 inch (25 mm) above the filter insert, or slots if using PVC pipe. Fill the remaining cavity with crushed pellet hops. Jack's reasoning is that pellets have crushed lupulin glands; hop flowers' lupulin glands are buried deeply within and not readily exposed to the flow of beer. Hop pellets are readily available and the hop flower bed will provide

Materials and cost

filter body, whole house	$40
filter media, 20-30 micron	$7.50/2
adapters: FIP hex bushing 2 each 3/4" x 1/2"	$6.00/2
adapters: FIP hex bushing 2 each 1/2" x 3/8",	$3.50/2
barbed fittings barb to MIP adapter: 2 each 3/8" x 3/8" hose (or size of your input and output hoses)	$3.50/2
hose, teflon tape, keg output fitting	$5
picnic tap	$3
support base: scrap plywood and metal, paint, sandpaper, nut and bolt, hops	$10

Tools and equipment

wrenches or adjustable wrench
knife or tubing cutter
table saw (or use precut plywood)
hammer and glue

(Top): The clear filter on the left allows you to see the beer run through it. Much cooler! (Bottom): The inlet and outlet configuration.

filtration whether you use a PVC tube or a sediment filter. This should generate maximum flavor and aroma even for low-alcohol beers.

One note, all this messing around with the beer tends to strip much of the CO_2 from the beer, resulting in a very creamy pour.

There you have the basic necessities: a water filter with clear body to impress your friends (and yourself), a filter to keep the beer clean and adapters to connect the keg to filter and the filter to dispensing tap. Total project time may be under one hour and cost you $60–$70, including your first hop charge.

Step by step

Select a filter body. Most home stores carry a variety. Whole-house filters are normally inserted in the main cold water line and have inlets and outlets that are ¾". Be sure you can purchase the correct filter media: 20–30 microns in filter size and the coarser the better. There are "standard" sizes in filters and bodies, so you are free to choose.

Step one: Wrap three turns of Teflon tape around the threads of both a ¾" to ½" and a ½" to ⅜" reducing adapter (sorry, we didn't have a metric-sized filter body or parts to evaluate.) Screw one of each into the inlet and outlet until finger tight. Depending on your keg system, your beer lines are likely ⅜" in internal diameter.

Step two: Wrap the threads of two ⅜" x ⅜" barbed adapters with Teflon tape and screw into the other adapters. If you use a hose with a different internal diameter (i.d.) use the corresponding barbed fitting. Once you're sure you have the correct inlet and outlet configuration, firmly tighten the fittings.

Step three: Measure your filter and cut a length of tubing (PVC or other inert

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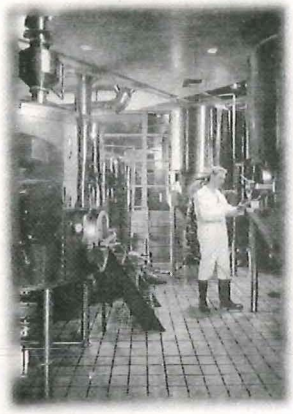
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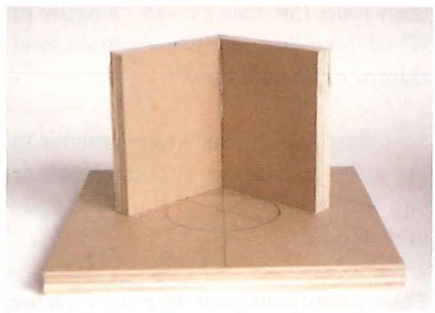
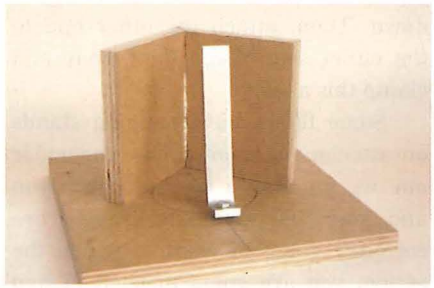
substance) that is ½–¾ of the total length of the filter. The o.d. (outside diameter) of this tube must closely match the i.d. (internal diameter) of the filter. Slip the tube into the filter body until the top of this tube is flush with the filter body. The filter housing top will nudge the tube downwards a bit, so be certain the internal tube is a minimum of 1" from the bottom to allow the beer to flow.

If you decide the Dogfish Head design is for you, cut a length of PVC tube precisely equal to the length of the filter, and with an i.d. the same as a commercial filter's i.d. It must seal top-to-bottom and around the top's penetrating nipple. Cut radial slits into the bottom third of the pipe.

The remaining plumbing consists of attaching inlet and outlet hoses to the barbed fittings. Be sure to use clamps, as it is likely you will be using higher than normal pressures to push the beer through extra length and resistance.





(Left): Here is the keg connector and faucet tap ready to transduce some hops. (Top-right): Here you can see the two small rectangles assembled at the appropriate 90-degree angle and the predrawn circle marking the spot for your filter. (Bottom-right): Here you can see the aluminum bar attached to the base. The idea is that this bar will have a clamping action on the filter and hold it upright.

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Step four: Cut two 24"-48" lengths of ⅜" i.d. beer line. Slip two stainless steel clamps onto each line.

Step five: Attach your keg connector to one hose and clamp. Attach the other end to the inlet side of the filter body and clamp.

Step six: Attach your faucet or picnic tap to the second hose and clamp it down. Then, attach the other end to the outlet side of the filter body and clamp this as well.

Some filters have optional stands or attachment points. The particular one we purchased did not. Since you and your beer-drinking friends are certainly going to want to watch the action, you are going to need to find or construct a support stand of some sort. I had scrap plywood, so quickly made one.

To make a support stand exactly like mine (though I encourage you to be creative and toy around with your own stand-making ideas) start with a rectangle of ¾" plywood.

Step seven: Cut a 10" x 10" rectangle of plywood. Cut two 5" x 5" rectangles of ¾" plywood (miter one edge of each if you have the equipment. It's just for looks.)

Step eight: Draw a filter body-sized circle in the center of the large rectangular piece of plywood.

Step nine: Connect the two small rectangles at a 90-degree angle and place the larger rectangle as shown.

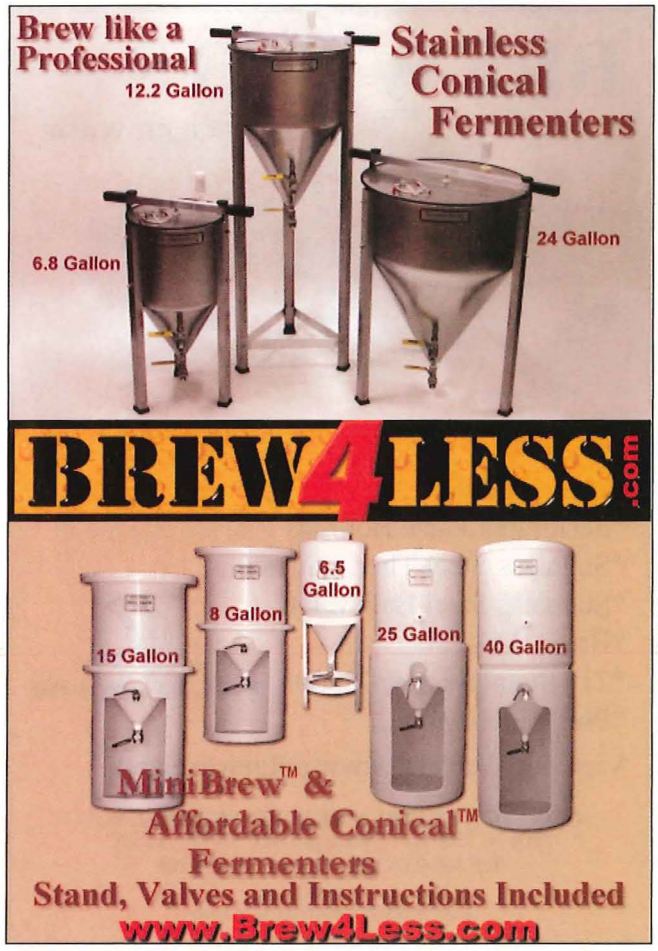
Step ten: From beneath, nail the angle to the base. I used glue and ring nails for all applications and predrilled the nail holes.

Step eleven: Bend a piece of aluminum bar stock to an angle similar to the body of your filter. It will likely not be a perfect cylinder. Drill a hole in the foot of the aluminum bar, place the filter into its corner and fit the bar to provide a clamping action. Mark this location and drill a hole into the support base.

Step twelve: Attach the bar to the base. Make sure that everything is nice and secure; you'd hate to have the support collapse in the midst of a demonstration or party.

If you are so motivated, stain, varnish, or paint the support system. Now comes the fun part — adding hop flavors to your beer. Dogfish Head says that beers with a good alcohol content seem to extract the most flavor from fresh hops, so tap a nice IPA or Pilsner. Fill the ¾" space between filter and wall with fresh hops, add crushed pellet hops up to the top, and let the fun begin! ■

Thom Cannell is a writer in the automotive industry and is Brew Your Own's *regular "Projects" author.*



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RIMS and HERMS

Two, four, six, eight, time now to recirculate

story by Bill Pierce

Because our batch sizes are typically small compared to commercial brews, one problem many all-grain homebrewers have is maintaining their mash temperature. Ideally, mash temperature should remain relatively constant throughout each rest. Maintaining a specific temperature helps to control the fermentability of a beer, which in turn affects such qualities as body, finish and residual sweetness. However, even in a relatively well-insulated mash tun, is not uncommon to experience a drop of 4–5 degrees Fahrenheit (2–3 °C) during the 45–90 minutes of mashing.

One solution to this problem is provided by two types of advanced all-grain systems — RIMS (Recirculating Infusion Mash System) and HERMS (Heat Exchanger Recirculating Mash System). In both systems, mash liquid is drawn off the grain bed, pumped past a heating element or heat exchanger, and returned to the mash.

Other benefits

In addition to maintaining mash temperatures, a RIMS or HERMS can also be employed for raising the temperature of a mash in a step mashing program. Likewise, once starch conversion is complete, a RIMS or HERMS can facilitate the "mashout," in which temperature of the mash is raised to 168–170 °F (75–76 °C) and held for 5–10 minutes before sparging. In both these cases, the temperature is raised without diluting the mash, as when boiling water is added to raise the temperature of the mash.

Recirculating the liquid portion of the mash also helps to minimize the temperature differences during mashing. As the liquid diffuses throughout the grain, it equalizes the temperature. The recirculation and the heating of the mash liquid are therefore the basic principles behind all recirculating mashing systems.

In a RIMS, the heat source is an electric element placed in the recirculation loop to heat the mash liquid. A HERMS uses hot water as the heat source, usually incorporating a copper coil as a heat exchanger. The coil placed in the hot liquor tank (HLT) is used to heat hot water for sparging the mash. Both types of systems require a pump to move and return the mash liquid from the mash tun through the heat source and back again.

RIMS: Electric breweryland

The key to a RIMS is the heating element, which is placed in the recirculation loop. This requires building an enclosed chamber for the element, most commonly from copper or brass pipe and fittings available at hardware stores and home centers. Some plumbing skills are required, but someone who has experience with basic home plumbing projects should be up to the task. The element itself is one used for electric water heating. A variety of replacement water heater elements are available in various lengths, sizes and wattage ratings.

Three factors are important in the selection of the heating element. The element voltage (120 or 240 volts) must be compatible with the electric service and wiring available in the brewing area. The element density (typically expressed in watts per inch or centimeter of length) must not be so high as to easily scorch the mash liquid. And the heat output (expressed in watts) must be sufficient to maintain or raise the temperature of the liquid. Heating elements rated for 240 volts may be used with 120 volts with a 75 percent reduction in output (to calculate the watts at 120 volts, divide the 240 volt rating by four).

To maintain the mash temperature in a RIMS, 1,500 watts is sufficient for 5–10 gallon (19–38 L) batch sizes. For step mashing, more power is required to raise the temperature quickly enough; 4,000–5,000 watts is not unreasonable. This almost certainly requires 240 volt electrical service and the appropriate wiring. A home dryer outlet, for example, is typically rated for 30 amps at 240 volts, for a total capacity of 7,200 watts (actually somewhat less to allow for overload).

Safety is very important when working with electricity in the presence of liquids. The heating element and brewing system must be well grounded to avoid electrical shock and consequences that can be fatal in the wrong circumstances. If you have little experience in this area, I strongly recommend having a professional electrician review the plans and construction.

A potential drawback of a RIMS is scorching of the mash liquid. This occurs at a temperature of about 480 °F (250 °C) as the sugars begin to break down. Caramelization, which darkens the sugars and alters their flavor, occurs at a lower temperature that can be produced rather easily by electric elements. It is important to maintain an adequate flow of liquid past the heating element while it is on, so that scorching and excessive caramelizing do not occur. A little darkening is inevitable, but is not considered a major problem if kept to a minimum.

There is also some concern about denaturing of the mash enzymes. Alpha amylase, the primary enzyme in conversion of the malt starches to sugars, begins to break down at temperatures above about 160 °F (61 °C). However, the evidence is that it takes a considerable period of time before a significant portion of the enzymes are compromised. As a practical matter, the relatively short period of time the liquid is at a high temperature (it is quickly cooled as it is returned to the mash) does not cause a problem.

HERMS: Let water do the work

The possibility of scorching is eliminated in a HERMS because the temperature of the hot water in the hot

liquor tank recirculation coil is far less than that of an electric heating element. There are also no electrical requirements for heating the mash liquid. However, there are other design concerns, such as maintaining efficient heat transfer between the hot water and the coil, and incorporating the coil into the HLT. Many HERMS also use a bypass loop to route the flow of the mash liquid around the coil when it is at or above the desired temperature. This requires a three-way valve, or two valves and plumbing tees so that the flow can be directed either through or around the coil.

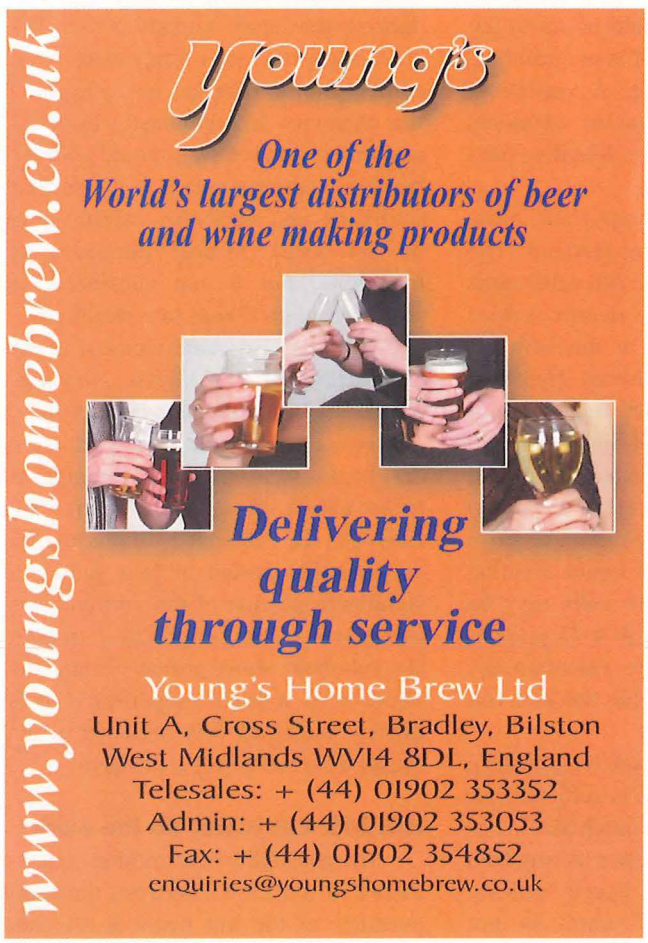
The recirculation coil in a rudimentary HERMS can be merely an immersion chiller lowered into and removed from the HLT as needed. This has the advantage of simplicity; no drilling of the HLT and expensive bulkhead plumbing fittings are required. However, this is less permanent and somewhat less graceful for those who place a priority on elegant design.

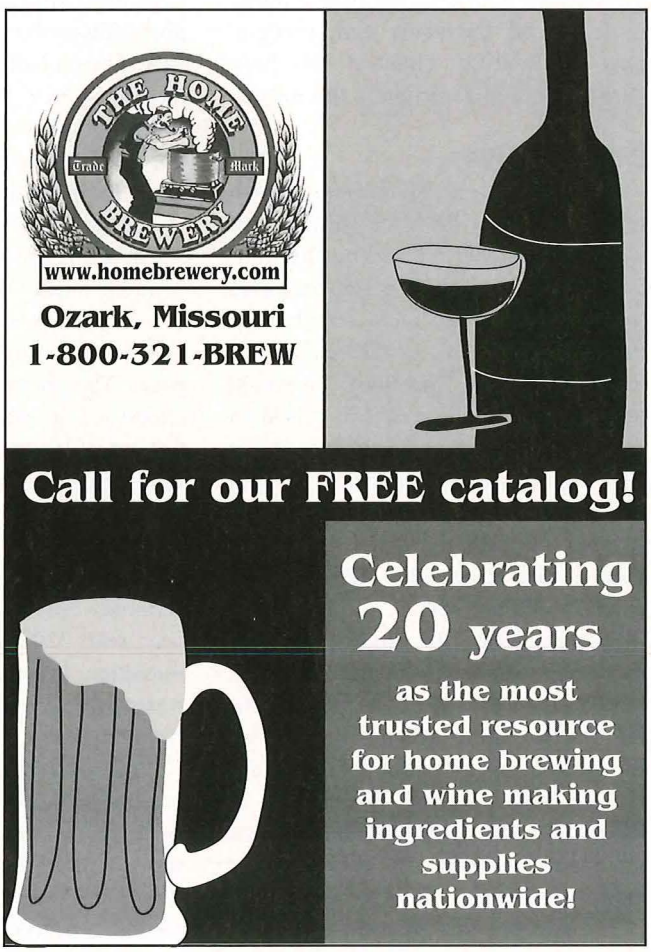
The diameter of the tubing used for the coil is important to maintain an adequate flow rate and not stress the recirculation pump. Typically this requires a tubing diameter of approximately one-half inch (13 mm). As for the length of the coil, most homebrew HERMS use between 25 and 50 feet (7.5–15 meters). Incidentally, it is worth noting that soft copper tubing is usually measured by the outside diameter, as opposed to rigid copper pipe where the nominal size is the inside diameter. The builder needs to keep this in mind when selecting plumbing fittings and adapters.

The temperature of the water in the HLT should be hot enough to transfer heat to the mash liquid in the recirculation coil. Assuming typical heat losses, this is approximately the same as the requirement for the sparge water, about 180 °F (82 °C). Stirring of the water during recirculation greatly increases the efficiency of the heat transfer. A few HERMS incorporate an electric motor and stirrer to accomplish this; other homebrewers stir the water manually with a long spoon or paddle. There is also convoluted copper tubing with interior ridges or fins that increase the turbulence of the mash liquid flow and facilitate the transfer of heat. Recirculation will gradually lower the temperature of the water in the hot liquor tank, very likely making it necessary to apply additional heat to the HLT occasionally during the process.

System design considerations

If a RIMS or HERMS is used for step mashing or mashout, it is important to design the system so that the flow rate and temperature increase are sufficient to accomplish the steps in a reasonable time period. Too slow a temperature rise between steps (less than 2 °F or 1 °C per minute) can adversely affect head retention of the beer, especially over the temperature range of 122–148 °F (50–65 °C).





Avoiding this problem typically requires a flow rate of approximately one gallon (3.8 L) per minute. However, too high a flow rate creates suction on the mash and can compact it, causing a reduction in the flow or even stopping it altogether. This can be minimized by careful mash tun design-whether using a false bottom, manifold or hose braid — as well as by closely regulating the recirculation flow with a valve at the pump outlet. But it can make for problems if not considered and addressed.

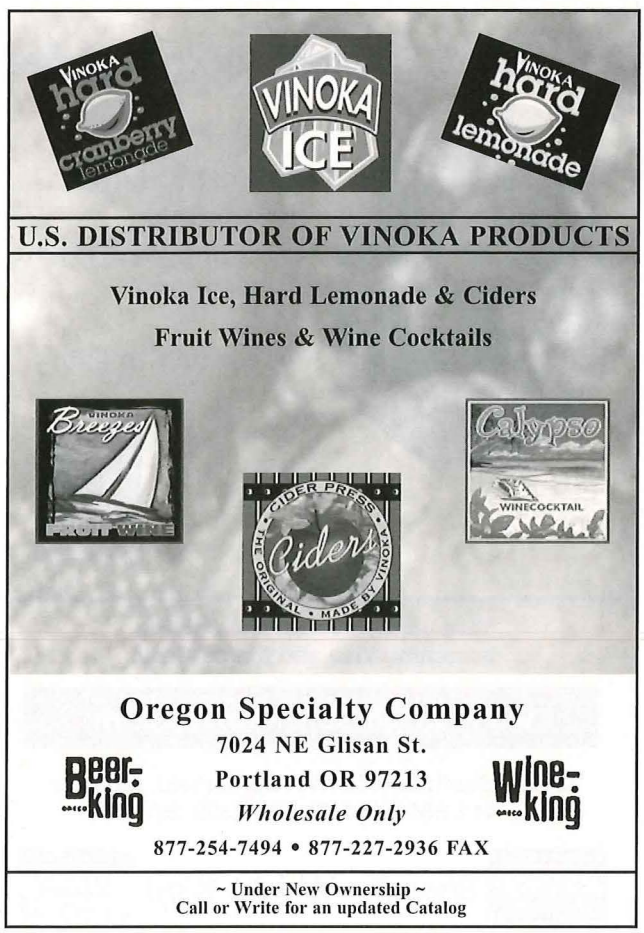
One solution to mash compaction is to use a lauter grant. This is common in commercial brewing systems and consists of a smaller vessel placed below the mash tun outlet and before the recirculation pump. The grant is filled by gravity and the pump creates suction only on the grant rather than on the mash itself. For a 10–15 gallon (38–57 L) homebrew system, the grant can be a 4-quart (4-L) pot with inlet and outlet fittings attached. In automated systems, liquid level switches in the grant turn the pump on and off so that the grant neither overflows nor runs dry; manual systems require adjustment via valves regulating the flow to and from the grant.

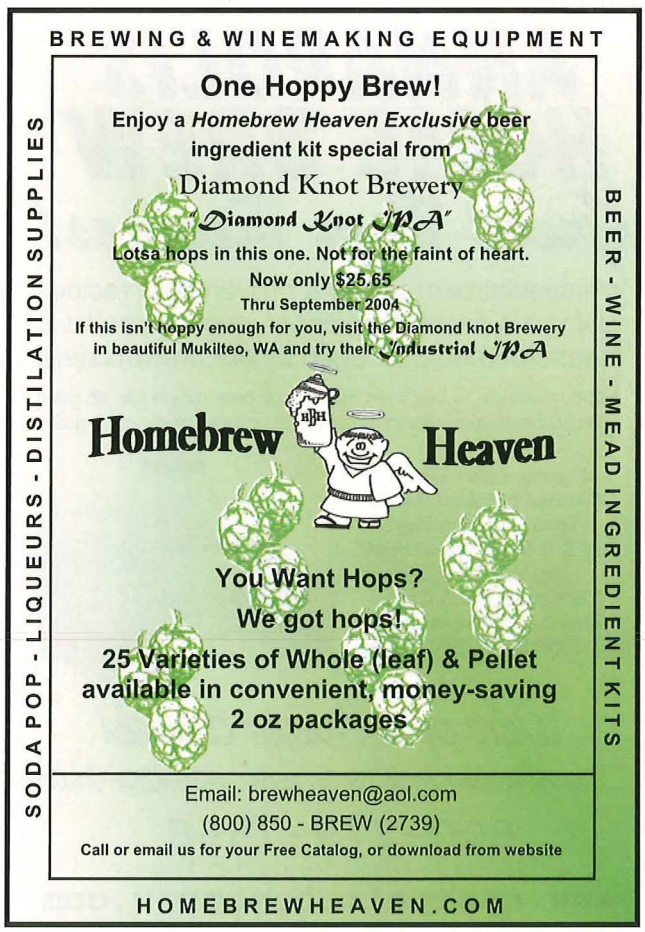
Both RIMS and HERMS lend themselves to automated control systems. The subject of electronic controls is beyond the scope of this article, but see Marlon Lang's article, "Brewing on Autopilot," on programming digital controllers in the November 2003 issue of *BYO*.

Pumping it up

As has been mentioned, both RIMS and HERMS require a pump to recirculate the mash liquid. A variety of pump types can be used (the November 2003 issue of *BYO* also contained an article on pumps, by Thom Cannell); one of the most common for homebrewing applications uses magnetic coupling. In these pumps, the motor shaft is not directly connected to the impeller. Instead, a magnet attached to the motor shaft causes a corresponding magnet on the impeller to rotate as well. The advantage of such a pump is that it does not require a seal on the motor shaft and is relatively easy to keep sanitary. These pumps also are less prone to motor burnout because a disruption of the flow will not cause the motor to seize. Nor is a small amount of grain solids in the mash liquid a problem.

The primary disadvantage of magnetic drive pumps is that they are not self-priming. As a consequence, the pump should be located at the lowest point in the system so that it always has liquid in it and does not draw air. It is strongly recommended to use a pump rated for the temperatures involved, at least 180 °F (82 °C) for the recirculating mash liquid. The cost of such pumps is in the range of $100–$150 and they are available from some of the larger homebrew suppliers.





Other considerations with a RIMS/HERMS include piping, hoses and connectors. Some systems are plumbed with copper, brass or stainless pipe, while others use reinforced food grade vinyl hoses. One is not necessarily better than another: Pipe is rigid and relatively permanent, while hoses allow greater portability and flexibility. In general, a diameter of one-half inch (13 mm) is best for homebrew systems. Plumbing with smaller diameter pipe, tubing or hose can cause flow and pump problems.

Quick disconnects can be used to facilitate frequent attachment and removal of hoses. Food grade plastic disconnects that are rated for the temperatures involved are usually available from larger homebrew suppliers and industrial distributors.

These types of disconnects are somewhat expensive but extremely convenient. I don't recommend cheaper plastic or brass fittings intended for garden hose. These can either cause burns or are not rated for food or beverage applications.

Taking it out for a test drive

Any system as complex as a RIMS or HERMS will likely require some modification for maximum performance. For those who relish such projects, tweaking and fine tuning are part of the challenge and the fun. Build and install the system in place and conduct a test using only water. This will not produce identical conditions to those with a mash (for example, water heats and mixes more evenly and easily), but it will allow you to detect many potential problems and provide a very good idea of what it will be like to brew with the system. Make notes and consider the changes that may be necessary for the sake of both effectiveness and convenience. You should also take detailed notes during your first several brewing sessions. It takes time and experience to achieve a brewing system that accomplishes your desired results.

As you can see, there are a host of design, construction and operational issues to consider and address, as well as a huge variety of means to accomplish them. In most cases there is neither a single right answer nor a single best method. Hundreds of homebrewers have pondered the questions and built their own systems. One of the joys of homebrewing is being able to do it your own way. You may well wish to consult with others who have done this, each of whom has approached the subject in a unique manner. Many of them have shared their thoughts and methods in considerable detail. Browsing the Internet using the search terms "RIMS" and "HERMS" should provide hours of interesting and valuable insights, some of them quite ingenious and specific. ■

Bill Pierce completed Siebel's Craft Brewers Certification program and recently began writing "Advanced Homebrewing," for BYO *magazine.*

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WelshSpirit Malt-infused coffees

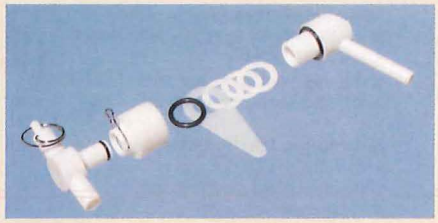
In the fall of 2003, Linda Welsch of Corks & Kegs (an internet based supplier of homebrew and wine products) released WelshSpirit "Premier Release," a coffee that incorporates brewing malt as a major flavor component.

Most recently, WelshSpirit released "Malted Hazelnut Cream" as an addition to its malted coffee line. Brewing experts describe WelshSpirit Coffee as having a "fully rounded mouthfeel with a smooth finish." Coffee drinkers have praised its flavor as well. Both "Premier Release" and "Malted Hazelnut Cream" are available for wholesale buyers through Oregon Coffee Roasters at (800) 526-9940.

Retail purchases can be made directly at www.corkskegs.com or by calling (408) 234-4277.

Better-Bottle introduces Valve System

Last summer, Better-Bottle released an unbreakable and impermeable plastic fermentation bottle as an alternative to glass carboys. Recently, Better-Bottle



has released a new valve system that is designed to make the product more versatile. With the new system, racking and bottling under professional, low-oxygen conditions will be as simple as toggling a valve. The system consists of three components: a specialized valve, an adapter for pails and an adapter for the Better-Bottle itself. The components are made of a unique PET (polyethylene terephthalate) plastic and stainless steel, making them impermeable to oxygen, unaffected by hot liquids, stain-proof and easy to sterilize. The valve system also utilizes a "push-pull" mechanism that makes disassembly without the use of tools simple.

For more information on the Better-Bottle and valve system, visit the company Web Site at www.better-bottle.com.

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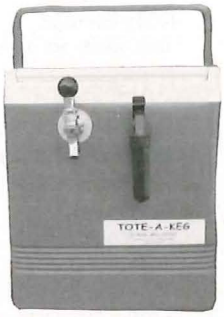

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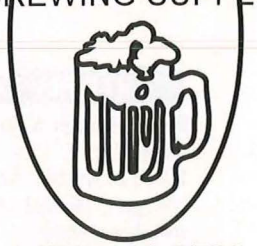

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Brews from Belgium

Let the beer be your tour guide

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Since I started competing in homebrew competitions, I've been drawn to the many unusual styles of Belgian beer. Though Belgian ales do indeed have a typical style and flavor profile, they are truly the renegades of the beer world. Like the fine chef who puts a signature or handle on his own individual sauce, so does the Belgian brewer. On a recent whirlwind beer adventure through Belgium and a bit of the Netherlands, I thoroughly enjoyed tasting beers, exploring brewpubs and visiting some small cottage breweries.

Our flight landed in Brussels, so it was a no brainer to start our adventure there. After finding a cozy hotel in central Brussels near Grande Place that consisted of just eight rooms, we ventured out to find a few traditional Belgian pubs. We didn't have to walk far. The Gothic architecture of this area draws thousands of tourists, so pubs of every shape and size abound. Our goal was to sample as many styles of Belgian ales and lagers as we could fit into our short stay.

The beer style associated with Brussels most certainly would be lambic or gueuze. Sour and refreshing, these beers are made locally and spontaneously fermented in large open fermentation vats. Wort is pumped into a room that is ventilated with open windows, allowing wild yeast to enter, contaminate and ferment the beer. As the owner and brewer of Brussel's Cantillon brewery told me, "We don't use yeast here. The winds blow it through the open windows, there (pointing to vented windows). If it's a lambic or gueuze, (a blend of old and young lambic), it must come from this area (the Senne Valley). Anywhere else, it's not a real gueuze." I soon developed a taste for these refreshingly sour ales. My favorites were Cantillon, Petrus and Rodenbach. There were still tripels, dubbels, saisons, oud bruins and specialty beers to try. Our adventure had just begun.

Open street cafés abound in Brussels. What appears like a leather bound lunch or dinner menu, is actually a beer menu, with a few food items on the back pages. The Belgians seem to have their priorities. I noticed that most patrons had beer, rather than food on their table. This was an opportunity to sample many tripels, dubbels and specialty beers that these cafés had on tap or in bottles. My favorites were Petrus, Chimay and Achel, the newest of the Trappist monastic ales. Though a Belgian dubbel does indeed have a specific flavor profile, individual samples varied considerably. Most pubs would have at least six beers on tap and dozens of bottled versions — all served with their accompanying brewery glasses. A small pub in Bruges advertises that they have three hundred different Belgian ales. Ahh, life is so short . . . if we only had more time. All of the strong ales sampled were full-bodied and quite complex. Signature flavors are the result of varying yeast profiles, and the secrets of the Belgian brewers. Yeast was the predominating feature of all of the Belgian beers I sampled. Some would offer a clove or banana-like aroma, others a dry or malty texture, but all beers had their own distinctive flavor profiles.

During our stop at the lovely village of Bruges, surrounded by canals and windmills. Soft and fruity wit (white) beers dominate here. This small medieval village hosts four small breweries, all making their own versions of this coriander and orange spiced beer. My favorites were Blanche de Bruges and Brugs Blond.

The south of Belgium (Wallonia) is known for its Flemish saison-style beers. These seasonal "farmhouse ales" are refreshing and fruity, and are occasionally doused with spices. Some versions are quite alcoholic, but are soft on the palate. My favorites were Saison Dupont and Fantôme.

Similar to our American Bud and Miller, Jupiler and Stella Artois are two mass-market beers that seemed to be in every pub. Easy drinking and ice cold, these popular lagers seem to be the everyday beer, especially for the younger population. Though this style of lager is very refreshing, I was on the prowl for more distinct Belgian styles like the Trappist and abbey ales that have alcohol content upwards of 10–12% by volume. Descriptions of "peppery, estery and clovelike" are the most common phrases used.

Here are seven Trappist ales from the following monasteries (left to right): Westmalle, Westvleteran, Rochefort, Achel, Chimay, De Schaapskooi (La Trappe) and Orval.

I spent an interesting afternoon touring the La Trappe facility in the Tilburg countryside of the Netherlands. There I sampled their enkel (single), dubbel (double), tripel (triple) and my favorite — the quadrupel! Alcohol and complex malt flavors dominate these distinctive Trappist ales. The Brothers truly have brewing secrets and are quite reluctant to share them. If anyone can duplicate these wonderful ales, it will surely be a homebrewer! ■

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