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OCTOBER 2009, VOL.15, NO.6

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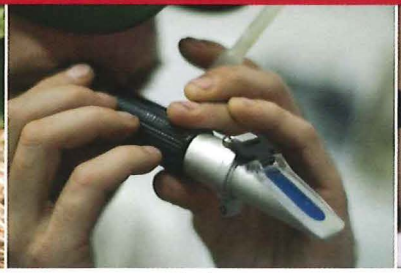

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Partial mashing allows stovetop extract brewers to explore some interesting brewing techniques and ingredients. In this story, we present four unusual partial mash brews. They aren't completely nuts, just partially crazy.

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If we can make imperial stouts and IPAs, why not imperialized versions of German beers? We'll show you how to put a little Kaiser in your Kölsch.

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by Les Howarth
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BYO RECIPE STANDARDIZATION

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

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

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

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

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THE HOW-TO HOMEBREW BEER MAGAZINE

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Cover Photo: **Charles A. Parker**

Microbial Mixup

In Dr. Chris White's "Culturing Yeast" article (September 2009), there are a couple instances where he uses the word "bacteria" when he I think he means "yeast." Maybe I'm just up too late . . .

Alfred H. Raschdorf
via email

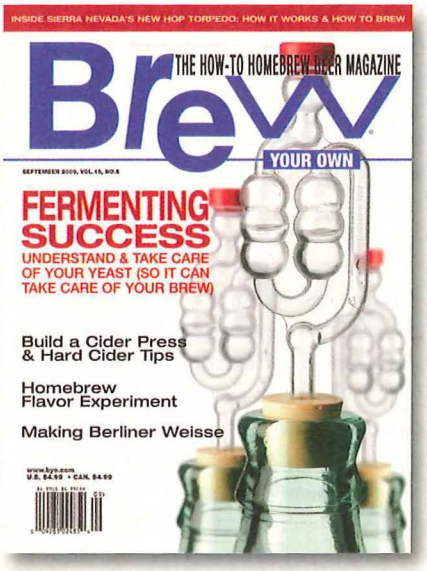
BYO Editor Chris Colby responds: "That's my fault, not Dr. White's. The yeast culturing article was originally much longer and I needed to condense some of the information to get it to fit the space we had available. As a graduate student, I cultured both yeast and bacteria in the way described in the article numerous times. (As a teaching fellow, I even taught these lab skills to hundreds of students.) The technique for plating yeast and bacteria is exactly the same and I slipped up and wrote 'bacteria' a few times when I should have written 'yeast.' I'm sorry for any confusion this caused."

Experimental Excitement

I was very excited to see the yeast cake experiment article in the September 2009 issue of BYO. ("Does Delayed Racking Harm Your Beer?" by James Spencer and Chris Colby.) I understand from the article that more experiments are planned. Is there a list of proposed experiments and when the results will be published? I think that testing homebrew questions at a homebrew scale has the potential to reveal much about our practices.

Mark Belanger
Newburyport, Massachusetts

Chris Colby and James Spencer plan to keep doing experiments in the Brew Your Own/Basic Brewing Radio Collaborative Series as long as there is interest. However, there is no set list of upcoming experiments and publication dates. They are currently performing an experiment on how yeast pitching rates affect your fermentation characteristics and beer. See Chris' blog (at www.byo.com) or Jame's podcasts (at www.basicbrewing.com) for more information. The results of this experiment are tentatively slated for publication in the December issue of BYO. If they are published then, they will also appear on Basic Brewing Radio at around the same time. When each experiment is done, they choose the next one. You can keep up to date on their current plans by reading Chris' blog or listening to James' podcast. Both Chris and James also invite interested homebrewers to join them in performing replicates of their experiments and reporting their results.



Flamed Over Flammability

In the in-line wort aerator article (Projects July-August 2009), the author stated that oxygen is very flammable. Oxygen is not flammable. Check out the MSDS (material safety data sheet) on oxygen.

Rick Hanson
via email

Technically, you're right. Combustion requires a fuel source, an oxidizer and heat. Oxygen is a strong oxidizer, but cannot produce flame if there is no fuel present. We warned homebrewers not to use oxygen around open flames, because pure oxygen will greatly accelerate the combustion of any fuel burning in open air. So yes, oxygen itself is not flammable. It is, however, a safety hazard around open flame.

White Chocolate and Foam Retention

I am an intermediate brewer at best in the sense that I have only ever brewed with cans of malt bought from the store. I have, however, begun incorporating different ingredients and techniques into my brews. I recently decided to venture into brewing a batch of beer with a hint of chocolate. Most things I have read about this suggest to use only cocoa or bakers chocolate. Even chocolate extract is suggested as a flavor enhancement at the end of the fermenting process. I recently stumbled upon a recipe by Scott Russell in

RYAN LOCKARD is a project manager within a large corporation. "About as far from a career in brewing as you can get," says Ryan. He has spent his entire life in the Philadelphia region, and fully appreciates the fantastic local world class beer resources. Ryan developed an appreciation for craft brew right out of college, and this appreciation developed into a passion for seeking out good beer and later homebrewing. He has recently developed a fondness for wild and sour ales. On page 61 of this issue, he describes how to mount a pump in a toolbox for a portable piece of brewing equipment with space for small item storage.

LES JORGENSEN is a 20-year veteran photographer in the advertising and editorial worlds. His exterior work has included several 360° VR Tours of "Major" golf courses for the PGA and USGA, syndication of VR Tours to The Golf Channel, PGA.com and SI.com. An early adopter of the digital work flow, he has been a beta testing site for Nikon and Phase One camera companies and led the pack towards 360° Virtual Reality photography in the 90's.

On page 48 of this issue, he created the composite image of bottles coming up from the ground in front of a tombstone for our "Zombie Clones" story.

HORST DORNBUSCH is a long-time contributor to *Brew Your Own* magazine. Born in Germany, but now based in Massachusetts, he is an international brew industry consultant, an award-winning brewer, and a frequent contributor to European and North American brew publications.

Horst was the author for BYO's "Style Profile" column from 2002 until 2006 and has written several "stylish" features since then. In this issue, on page 30, he examines German beer styles and how they can be "imperialized" by bumping up and exaggerating certain qualities.

your May 2001 issue and noticed that it calls for white chocolate chips. Would these not be fairly high in cocoa butter content? Would that not infringe on the foam retention?

Jonathan Bolton
via email

Cocoa and baker's chocolate are made from roasted cacao nibs that have had most of the cocoa butter pressed out of them. Likewise, chocolate extract is an alcohol extract that does not have any appreciable fat in it. Any of these work well in getting the flavor of roasted cacao nibs into your beer. And obviously, chocolate malt lends a chocolate-like flavor to beer.

White chocolate, in contrast, is a mixture of cocoa butter, sugar and milk. As such, it is likely that it would negatively impact head retention. For more on brewing with chocolate, see the November 2004 *issue of* BYO. *This article is also available on-line. (Go to www.byo.com and type "chocobrau" into the site's search engine.)*

A Scary Question

I have roughly 10 lbs. of candy corn left over from Halloween last year. I want to brew with it but am unsure how to properly mash out the sugars from the gelatin that holds it together. Do I just heat it in water until dissolved or go straight to boil? Please help me to create my monster mash!

Shane Hartley
via email

The short answer (that may not be what you want to hear) is "never make from beer from ingredients that are left over from something else and are not fresh." Even stored under good conditions, your candy corn likely does not taste very good anymore. (We found one source that listed the shelf life of candy corn as 3 to 9 months.) And, you cannot make good beer from old ingredients.

We haven't used candy corn in brewing, but if you had fresh candy corn, your best bet would probably be to add it during the boil. Candy corn is made from sugar, corn syrup and honey, with gelatin as a binder. The sugars would simply dissolve in the hot wort. Gelatin is flavorless and would likely form a gummy gel upon cooling the wort. How much volume the gel would occupy and how hard it would be to clean up is an open question. You might try boiling some candy corn in an old, expendable kitchen pot and seeing the results before risking a big mess in your brewpot.

You could also try to add the candy corn to your mash. The heat of the mash would be sufficient to melt the gelatin and the sugars would simply dissolve into the wort, but it's possible that you would encounter problems with lautering due to the gelatin if you used a lot of the candy.

Questions, concerns, comments?

Contact us!

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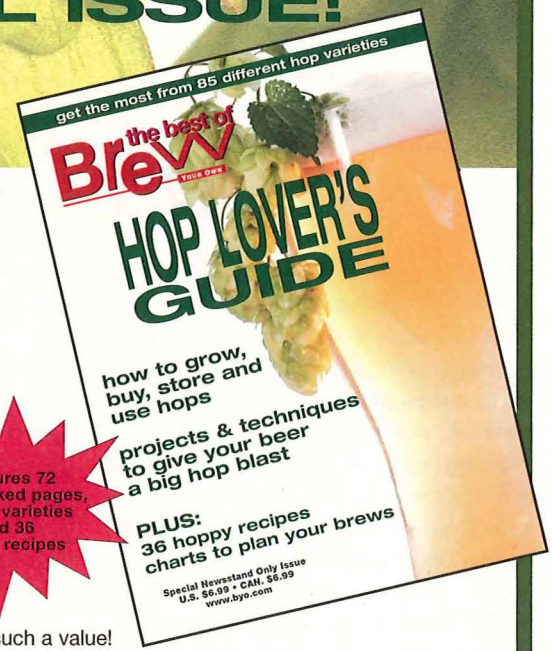

We've collected and updated the best hops information from the past 12 years of BYO and included updated charts with the specs for 85 hop varieties including new varieties and suggested substitutions for hard-to-find hops. We've also detailed different hopping methods, hop growing info, hop-related build-it projects and 36 hoppy recipes. A few of the reasons you will love this new reference...

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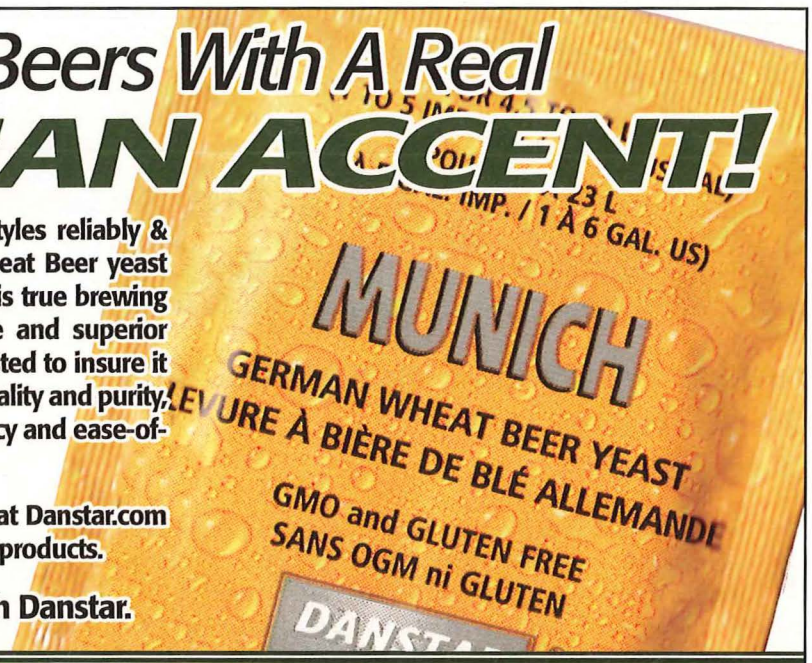

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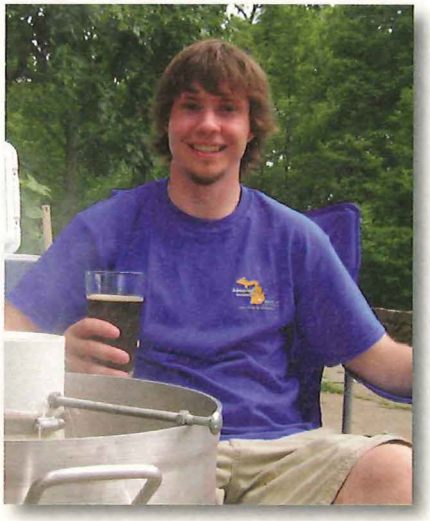
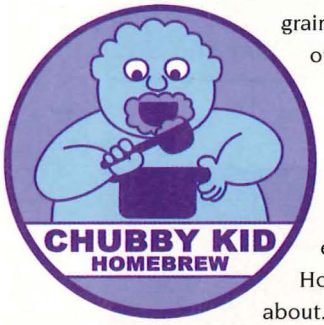


I started homebrewing while I was attending the University of Virginia. I lived in a big house with a bunch of guys. My friend, Brian, and I would often brew up batches of homebrew to the great enjoyment of everyone else in the house. We started brewing extract and eventually ended up with a setup where we could brew two 5-gallon (19-L) all-grain batches simultaneously.



It was during this time of living the bachelor lifestyle that the name for our brewery, Chubby Kid Homebrew, came about. It all started with my housemate, Matt, saying to me one day "What a chubby kid! Eating straight from the pot!" when I was sitting on the couch, watching TV, with a pot of prepared boxed macaroni in my lap, devouring the feast with a serving spoon. Soon the phrase "chubby kid" stuck. It referred to anyone who decided it was necessary to pick up several burritos at 2 a.m., have a cheeseburger eating contest or have their spaghetti dinner straight from the pot. The brewery slogan, "Everyone's a chubby kid at heart," refers to the fact that everyone feels the need to indulge once in a while, whether it be with too many cheeseburgers or another pint of delicious homebrew.

Now, a few years later, most of the guys that I lived with in college are no longer living the bachelor lifestyle. But when I brew today, "Chubby Kid Homebrew" is a fond reminder of the great times we had living the college life, making and drinking great homebrew, and from time to time being chubby kids.

The Imposter! Pumpkin Ale (5 gallons/19 L, partial mash)

OG = 1.063 FG = 1.014

Ingredients:

For the mash:

8.0 oz. (227 g) rice hulls
2.0 lbs. (0.9 kg) US 2-row pale malt (2.0 SRM)
12.0 oz. (340 g) Carapils®/dextrine (2.0 SRM)
12.0 oz. (340 g) Victory® malt (25.0 SRM)
8.0 oz. (227 g) caramel/crystal malt (60 °L, 60.0 SRM)
5.0 lb. (2.27 kg) butternut squash

For the Boil:

1 lbs 8.0 oz. (0.68 kg) extra light dried malt extract (3.0 SRM)
2 lbs. (0.9 kg) amber liquid extract (12.5 SRM)
2 lbs. (0.9 kg) pale liquid extract (8.0 SRM)
0.5 oz. (14 g) Fuggles hops (60 min.)
0.75 oz. (21 g) Cascade hops (60 min.)
0.5 oz. (14 g) Fuggles hops (15 min.)
0.38 oz. (11 g) ginger root
½ tsp. allspice
½ each cinnamon stick
½ tsp. cloves
½ tsp. nutmeg

Note: Grate the fresh ginger. Coarsely grind the whole spices (except for cinnamon stick).
1 Pkg. Safale American (DCL Yeast #S-05) yeast
4.75 oz. (135 g) corn sugar (for priming)

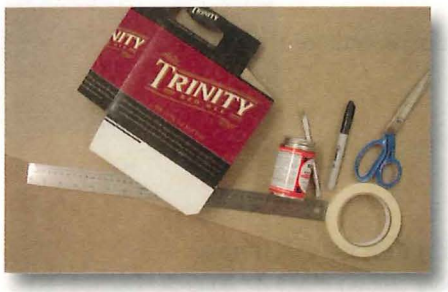
Step by Step

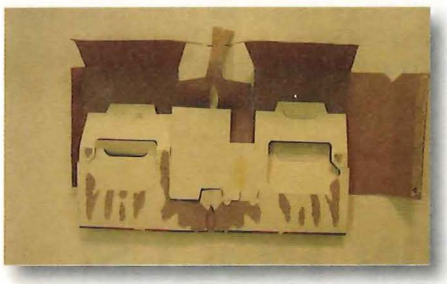
Prepare 6.79 gallons (26 L) of water for brewing. Cut squash in half, remove seeds, bake at 350 °F (177 °C) for one hour, or until squash is fork tender. Remove skin from squash, cut into approximately 1-inch cubes, and add to mash. Mash In: Add 5.63 quarts (5.33 L) of water at 174.5 °F (79 °C). Hold mash at 156 °F (69 °C) for 60 minutes. Mash Out: Add 2.25 quarts (2.1 L) of water at 205.4 °F (96 °C). Hold mash at 168 °F (75.5 °C) for 10 minutes. Sparge with 4.82 gallons (18.2 L) of 168 °F (75.5 °C) water. Add water to achieve boil volume of 6 gallons (23 L). Add the malt extracts and bring to a boil. Add the hops according to the schedule in the ingredients list. Steep all spices in small hop bag at knockout. Let spices steep 10-15 minutes. Rapidly chill the wort to 70 °F (21 °C). Remove spices once the wort has reached yeast pitching temperatures. Boil for 60 minutes, siphon to a sanitized primary fermenter, aerate well and pitch the yeast. Ferment for seven days at 70 °F (21 °C). Transfer to a secondary fermenter and ferment at 70 °F (21 °C) for fourteen days. Prime with corn sugar and bottle. Age for three weeks at 70 °F (21 °C) and enjoy!

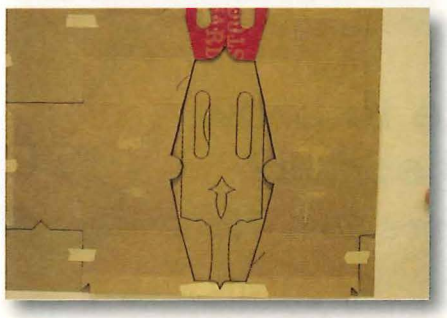
reader PROJECT: Make your own six-pack holder

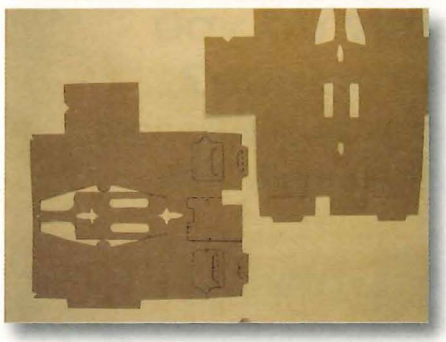
Zach Neuman
Cary, North Carolina

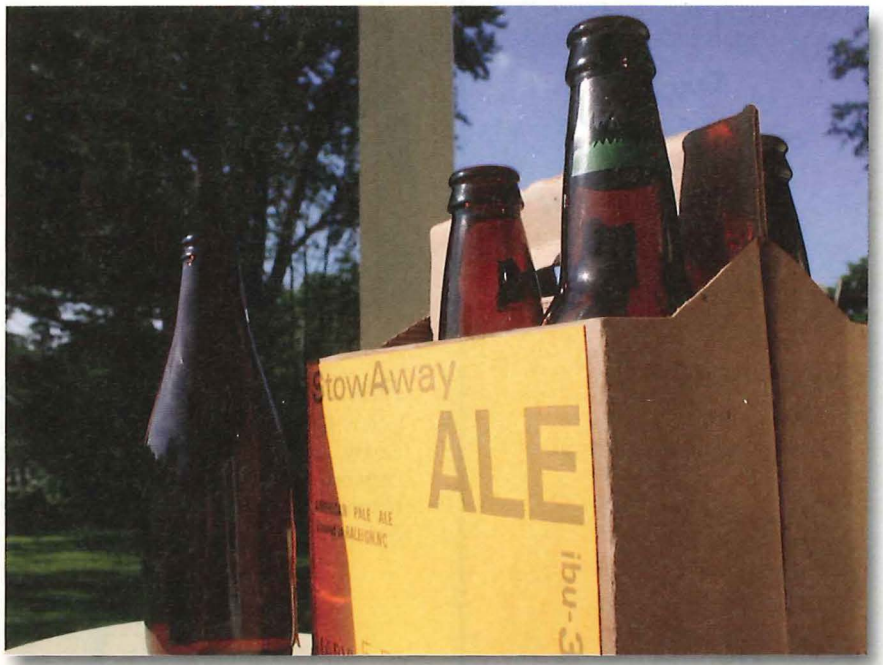
So you've just finished bottling your best beer yet, or not; either way you want to show it off to your friends and make it look stylish when you give it as gifts. That's at least what I was thinking when I made this project. The lack of a six-pack holder finally got to me when the local store didn't have pre-made, white six pack holders and I was tired of fishing the closest PBR sixer out of the recycling to load my brews in to bring to parties so I made my own. Here are my directions for making an awesome custom six-pack beer box at home.











MATERIALS:

- Chipboard or single-sided corrugated cardboard — 1/32 in. is about as thick as you can get away with.
- Metal ruler
- Marker or pen
- X-acto knife
- Scissors
- Masking tape
- Rubber cement or basic white glue
- A store-bought six pack to make the template

1. Pick a commercial six-pack box to make your template with. You can use this as the template or customize the look. Draw what changes you want to make to the box. For parts you're changing with more than one layer (like the handle area) go ahead and trim what you want it to look like. Wait for the other parts; this will be easier when the box is deconstructed.

2. Take the box apart. Be careful and try not to rip anything, these boxes really are not meant to be taken apart. Mark which areas were glued together (this will help later). Fold and unfold the box so you know what folds go where. And if there are any more cut-outs to customize the look make those now.

3. Tape down the template to your cardboard/chip board. If using the single sided corrugated cardboard or a material with color on one side tape the template face down onto the material with whatever side you want to become the outside of your box face down.

4. Trace the design onto your box material choice. I can fit two box designs on one 30" x 40" piece of material.

5. Cut the template out. Use the metal ruler for long straight parts so if you slip you won't cut into the box.

6. Remember where you marked the glue spots on the template? Use that starting from the last fold and glue on the template to mark the first fold and glue on your box. Work counting down on the template from there. Also, mark where the folds are and score them to make it easier to fold the cardboard.

7. Make sure you have the fold order correct. When you've got it, go ahead and start gluing. Glue one fold at a time and place some kind of weight on it as it's drying because the thick cardboard will want to unfold. A stack of books or case of beer should work fine.

8. If you've followed along up until now, not overused your glue and waited for it all to dry, you should be able to open the flat box into a beautiful beer holding container. Now go show off your homebrew!

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Copious clones

We've cloned many commercial beers in BYO over the years. Take a look at our recipe directory and find some of your favorites:
http://www.byo.com/stories/recipes

byo.com BREW POLLS

Do you like to brew imperial styles?

Yes 56% Sometimes 25% No 19%

How frequently do you brew clone recipes?

From time to time 47% Regularly 22%
Never 18% Very frequently 13%

Check out the latest poll question and vote today at byo.com

replicator
by **Marc Martin**

Dear Replicator,

I was curious if there is any information that can be gathered for replicating the Black Radish Schwartzbier from the Weeping Radish Brewery in Jarvisburg, North Carolina? My family was in the Outer Banks on vacation recently and my wife and I took a trip out to the Weeping Radish for a tour and sampling. The signature brew offered year round was the delicious Black Radish listed as a commercial example on the BJCP style guidelines. I bought two cases but would love to be able to brew this beer at home since the brewery is seven to eight hours from me and there is no distribution.

Ryan Lockard
Aston, Pennsylvania

Sometimes it takes one of our readers to introduce me to a brewery and this was definitely one of those cases. I really didn't know what to expect when calling an establishment called a "farm brewery," but I must say I encountered several pleasant surprises while researching this beer.

The first surprise came when I was told that the man I needed was "out on the tractor." My call was quickly returned by Uli Bennewitz, the owner and founder, who was more than happy to discuss his unique brewery.

The second surprise came when I discovered that this is one of the oldest microbreweries in the country and the first in North Carolina. This is due to an incredible amount of legal wrangling by Uli.

In 1980 Uli emigrated from Germany to the US. He was disappointed to discover that the vast majority of beers were light lagers with very little flavor. His brother in Bavaria suggested that a restaurant that brewed its own beer might be a profitable venture. Brewing equipment was located and on the way before he discovered that brewpubs were illegal in North Carolina. He worked with the state legislature to get a legalization bill passed, and in 1986 the Weeping Radish was established.

This restaurant brewpub had only an electric 3-barrel system but the beers soon became popular. His real dream came true two years ago when he was able to move to a 24-acre farm, 14 of which supply the restaurant with vegetables, herbs and eggs. A butcher shop was also added and the brewhouse now features a 15-barrel JV Northwest system.

All beers are produced under the strict guidelines of the German Reinheitsgebot and distribution is limited to just North Carolina, Virginia and Washington D.C. They now produce a Kölsch with malt from Cologne and a pumpkin ale with their own pumpkins. A Rauchbier is also in the works that will feature their own smoke house producing the malt. Uli reports that Black Radish continues to be their best seller.

This black lager replicates German Schwartzbier, a style that almost became extinct in this country. Only a few of American microbreweries continue to brew this style. Schwartzbier was originally a regional specialty from southern Thuringen and northern Franconia in Germany. It was thought to be a variant of the Munich Dunkel style. The word schwartz means "black" in German.

Weeping Radish's version of this style has a solid malt base provided by a generous amount of Munich malt. This helps to create a semi-bitter chocolate palate with hints of molasses. The highly attenuative German lager yeast produces a well balanced beer with a somewhat dry finish that accentuates the noble hop profile. Obviously a classic example of the style as indicated by the endorsement of the BJCP. This brew is also featured as one of the "50 beers to drink before you die" on The Brew Site (www.thebrewsite.com) and is listed as "highly recommended" by Beer Advocate (beeradvocate.com).

Now Ryan, armed with the recipe for Black Radish you can help perpetuate this style and "Brew Your Own".

For further information about the brewery and their other fine beers visit the website www.weepingradish.com or call them at 252-491-5205.

Weeping Radish Farm Brewery Black Radish Lager

(5 Gallons/ 19 L, extract with grain)

OG = 1.048 FG = 1.012
IBUs = 29 SRM = 23 BV = 4.7 %

Ingredients

3.3 lbs. (1.5 kg) Muntons light, unhopped, liquid malt extract
1.4 lbs. (0.63 kg) light dried malt extract
2 lbs. (0.9 kg) Munich malt
10 oz. (0.28 kg) chocolate malt (375 °L)
6.5 AAU Mt. Hood pellet hops (60 min.) (1.0 oz./28 g of 6.5% alpha acid)
3.25 AAU Mt. Hood pellet hops (20 min.) (0.5 oz./14 g of 6.5% alpha acid)
½ Tsp. Irish moss (last 15 minutes of the boil)
White Labs WLP830 (German lager) or Wyeast 2308 (Munich lager) yeast
0.75 cup (150 g) of corn sugar for priming (if bottling)

Step by Step

Steep the crushed grain in 1.5 gallons (5.7 L) of water at 154 °F (68 °C) for 30 minutes. Remove grains from the wort and rinse with 2 quarts (1.8 L) of hot water. Add the malt extracts and bring to a boil. Add the hops and Irish moss as per the schedule. Add the wort to 2 gallons (7.6 L) of cold water in the sanitized fermenter and top off with cold water up to 5 gallons (19 L).

Cool the wort to 75 °F (24 °C). Pitch the yeast and aerate heavily. Let the beer cool over a few hours to 65 °F (19 °C). When evidence of fermentation is apparent drop the temperature to 52 °F (11 °C). Hold at 52 °F (11 °C) until fermentation is complete. Transfer to a carboy, avoiding any splashing. Condition for two weeks at 42 °F (5 °C) and bottle or keg. Allow to carbonate, age for four weeks and enjoy.

All-grain option:

This is a single step infusion mash. Replace the liquid malt extract with 7.5 lbs. (3.4 kg) of 2-row pale malt. Mix the crushed grains with 3.5 gallons (13 L) of 172 °F (78 °C) water to stabilize at 154 °F (68 °C) for 60 minutes. Sparge slowly with 175 °F (79 °C) water. Collect approximately 6 gallons (23 L) of wort to boil for 60 minutes. Reduce the 60-minute hop additions to 0.75 oz. (21g) of Mt. Hood pellets to allow for the higher utilization factor of a full wort boil. Follow the remainder of extract with grain recipe.

Homebrew CALENDAR

October 3-4
Dunedin, Florida
Suncoast Animal League OctoBrewFest Homebrew Competition
The Suncoast Animal League, as part of their Oktoberfest event, is sponsoring a BJCP-sanctioned homebrew competition to raise money for animal rescue efforts. Best Of Show will be brewed commercially by Master Brewer Franz Rothschald at The LAGERHAUS Brewery & Grill in Palm Harbor, Florida. Entry deadline is October 1. More information is available at http://www.profittoolbelt.com/homebrewcompetition/.

October 16-17
Houston, Texas
Dixie Cup XXVI
One of the nation's oldest homebrewing competitions, organized by the Foam Rangers homebrew club. This year's theme is "Hoptoberfest," and features a special hybrid beer style called Frankenbier (a classic German beer style with "American" parts). Deadline is September 25. For more information, visit http://dixiecup.crunchyfrog.net/.

October 24
Philadelphia, Pennsylvania
Best of Philly Homebrew Competition
The Homebrewers of Philadelphia and Suburbs club (HOPS) present their 25th annual event. Judging will take place at the Nodding Head Brewery & Restaurant. Entries will be accepted from October 3 through 18. More information and dropoff locations are available at http://hopsclub.org/HOPS-BOPS_2009/details.html.

November 13-14
Orlando, Florida
Sunshine Challenge
Registration for The Central Florida Home Brewers homebrew competition starts October 5 and ends November 2. Judging takes place November 6–8. This year's two-day event will also include dinner, music and a beer festival. More information is available at http://www.cfhb.org/.

BEGINNER'S block

Clone Success

by Betsy Parks

When you first begin to homebrew, you will most likely follow recipes and use beer kits before formulating recipes. Among those recipes are a great many replications of commercial beers known as clones. When it comes to brewing clones, however, the recipe is a bit more of a starting off point than recipes for unknown brews as there is an expectation for brewing something that you can taste against the actual commercial beer. Follow some basic practices and you will have more success when brewing clones.

> "THE GOAL OF CLONING IS TO DO AS THE ORIGINAL BREWER DID . . ."

Choose recipes well

Either the brewer who originally developed the beer or someone who contacted the brewer write most clone recipes. Homebrewers willing to experiment with malts, yeasts and techniques to find a similar finished beer formulate other clone recipes. For the best success, try to find recipes written by someone who has contacted the brewer as they will provide the most accurate list of malts, yeasts and adjuncts, which will more closely replicate the brewing conditions of the original beer. These brewer-sanctioned recipes are also more likely to include information that is critical to successfully duplicating the beer, including mash and fermentation temperatures, hopping schedules and conditioning times.

Ingredients

The goal of cloning is to do as the original brewer did, so you need to find ingredients that match the original recipe as closely as possible. For example, a clone recipe may call for domestic 2-row malt, but malts can vary from maltster to maltster and make a very different beer than the commercial example.

This is also true for yeast. A pale ale recipe calling for generic ale yeast can leave you in the lurch as strains behave differently depending on fermentation temperatures, alcohol levels and fermentable sugars. If your recipe doesn't specifically list the yeast or malt, try getting in touch with the brewery for more details. Many commercial brewers are willing to share brewing information. While they may not share all their secrets, they can often at least point you in the right direction or make an educated suggestion.

Also keep in mind the water profile of the beer. Your water chemistry may be drastically different from a brewery across the state — or even across the country. Try and get as much information as you can about the water the original beer is brewed with so that you can try and replicate that chemistry at home. Most public water information is available (often for free) by contacting the town or city public works departments in charge of the municipal water supply.

Taste and experiment

The beauty (and bane) of a clone recipe is that you can taste your beer with the original (unless the beer is discontinued). Even with the most detailed list of ingredients and procedures sometimes a commercial-sized recipe just doesn't translate down to a 5-gallon (19 L) batch of beer and you may need to make adjustments with malts and hops as well as fermentation temperatures, conditioning periods and more. Use the commercial beer as your control as you experiment and tweak each batch of the clone until you get as close as you can in taste.

Brewing Big Beers

The ins and outs of imperial styles

by Betsy Parks

Sometimes when you're brewing you can get the urge to go big. Really big. Imperial-style big. Brewing an imperial takes a little more advance planning than just buying more hops and malt, however. This issue we found three imperial-brewing pros with advice to share about successfully brewing something big.

DENISE JONES, Brewmaster at Moylan's Brewery and Restaurant in Novato, California. Denise was the first female graduate of the American Brewer's Guild in 1995. She apprenticed at Great Basin Brewing Company in Sparks, Nevada and was the brewmaster at the Third Street Ale Works in Santa Rosa, California for eight years.

We brew a couple of imperial styles at Moylans, including an imperial stout and two imperial IPAs as well as some specialty beers such as our double-strength Scotch ale, Double Kilt Lifter.

As a professional brewer, I think balance is something that is paramount to brewing an imperial. As a homebrewer, it's not as much of a concern. Drinkability is obviously what you want to have in any beer, whether you're professional or brewing at home, be it an imperial or a small beer. But balance is subjective. A lot of people don't think balance is required in imperials. I've always tried to keep balance in my beers but there are times when you brew something that goes off the chart.

Some of the mistakes I think brewers make with these kinds of beers include thinking that the flavor of the alcohol is what you should taste. If there's too much alcohol or if the beer is too sweet it won't be drinkable. Other big mistakes include underpitching the yeast so the fermentation can't finish out and the beer comes out sweet and cloying. People also sometimes try to ferment a little bit warmer to try and get it to finish, which will create fusel alcohols and change the entire brew. Think for a moment about not just doubling up the hops and malt but of how the beer will ferment, what strain of yeast you should use and how much.

One problem homebrewers can run into with imperials is that they can't always brew what a commercial brewery can. For instance, we make a triple IPA called Hopsicle. I get emails just about every day asking how to brew it, but a lot of the homebrew equipment won't allow you to process those ingredients the way that we can with hopbacks, whirlpools and straining mechanisms as well as the means to maintain fermentation temperatures. In the case of Hopsicle, I don't think you can get that much hop material in your beer at home — you can definitely try and get close, but it is an expensive experiment trying to get 15–20 pounds of hops in a 15-gallon batch.

Also, these beers take longer to ferment and longer to condition. Like some wines, imperials need time to go through their awkward changes. If the finished beer tastes hot, put some of it aside for later. Over time it will come into its own, smooth itself out and not be so alcohol-forward.

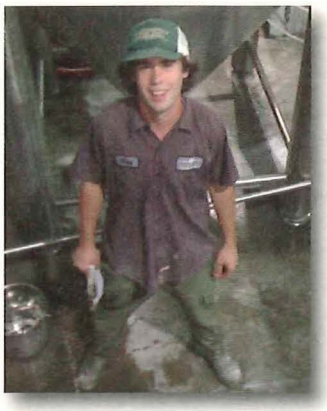
STEVE BREEZLEY, Production Manager at Avery Brewing Company in Boulder, Colorado. Steve started homebrewing while earning a bachelor's degree in geology from the University of Montana. He graduated from the Master Brewers program at UC-Davis in 1996 and earned his associate membership to the Institute of Brewing in London.

At Avery Brewing we brew three imperial style beers: The Maharaja Imperial IPA, The Kaiser Imperial Oktoberfest and the Czar Imperial Stout. Our Hog Heaven Barleywine (called a barleywine because when we first brewed it there was no such thing as an imperial red ale or imperial IPA) has won a medal in imperial red ales so we could also claim it's an imperial beer as well.

Brewing imperials is a chance to push style guidelines and sometimes leave them miles behind. We can take a style like Oktoberfest, for example, and do something with it that honors the original style while at the same time opens up new interpretations and makes a beer that doesn't exist "style-wise."

I think one of the hardest things to do is make any beer at a higher alcohol content while retaining the beer flavors you want. Careful control of the fermentation can be the best way to avoid any problems. Take great care of your yeast. Propagation, proper aeration, proper pitch rate, fermentation temperature, etc. are all extremely important. It would be a shame to work doubly hard to imperialize that beer and have a failed or flawed fermentation.

One of the best parts of brewing imperial styles is saying, "the hell with drinkability and balance." I laugh when someone says our Maharaja is balanced. No it's not — it's a hop bomb and that's why we brewed an Imperial IPA in the first place! I think imperials are the time to leave boundaries like balance and drinkability behind and have some fun. Small scale brewing can be the best time to try out something new and different. Why not try brewing an imperial Dortmunder? Ingredients and yeast strains are usually the only limiting factors to trying something different and your local homebrew shop can hopefully help you out.



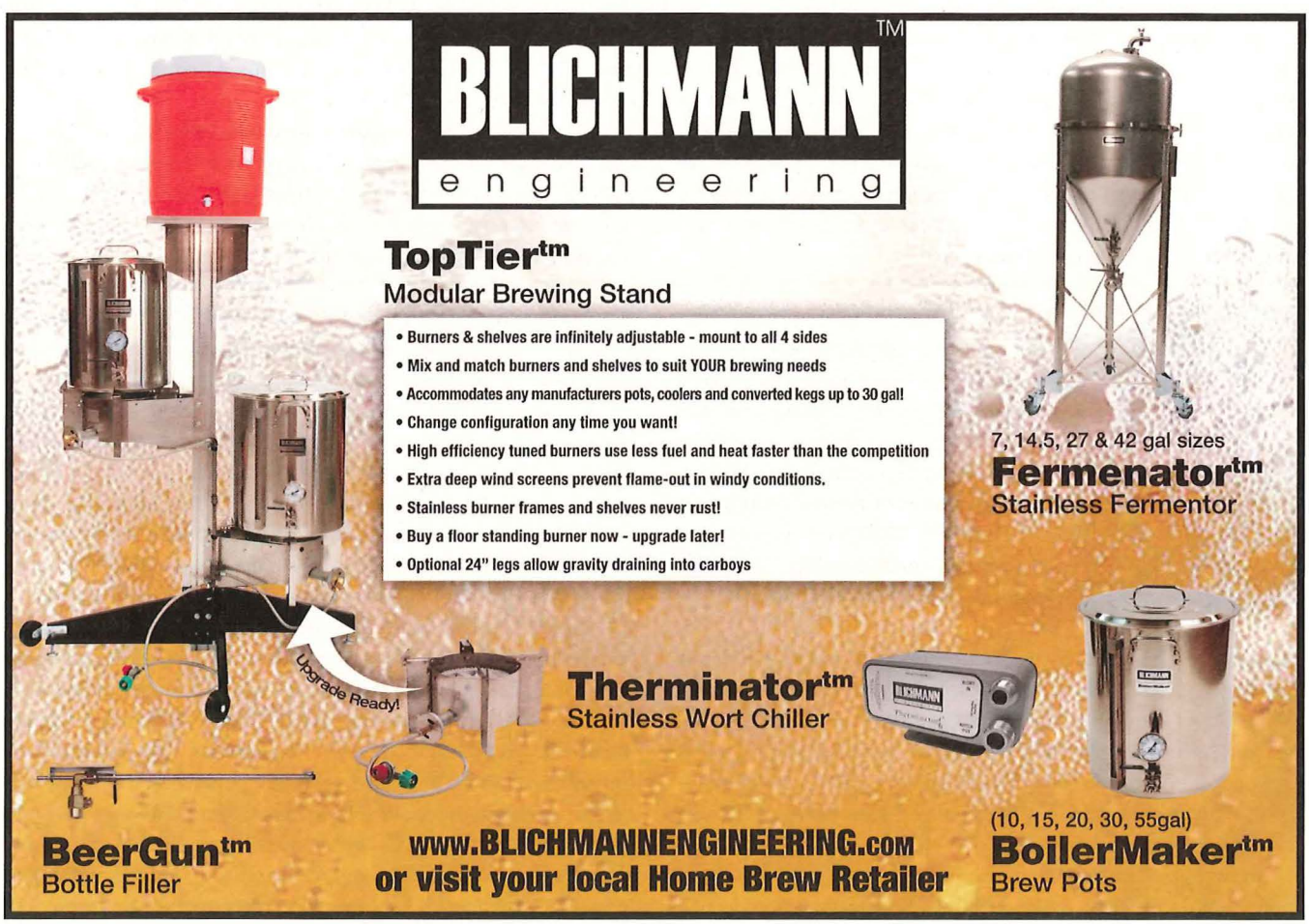
PAUL CAIN, Director of Brewing Operations at Southern Tier Brewing Company in Lakewood, New York. Paul has worked at Southern Tier for a little over five years. He started out on the packaging line and worked his way through the ranks where he is now in charge of their 25-barrel brewhouse and 2,000-barrel cellar.

We specialize in a line of imperial stout at Southern Tier and imperial stout is one of my favorite styles to brew. Other imperial styles that appeal to me are some that other people maybe wouldn't think of as imperials — like a saison. We like to take a beer style that you wouldn't normally see over maybe 5 or 6% ABV and take it up to 10%, which is a challenge, although it can be pretty rewarding. People often have their minds made up about certain styles and I think it's fun to kick the door down.

Making a balanced imperial is a challenge most of the time. Brewing is all relative depending on the taste of the brewer, but I feel that when you're making an imperial that balance is pretty critical, especially when you are brewing really hoppy beers. Some people just want to go over the top with an imperial or like to consume something that is really outrageous. It may be that they don't understand how those flavors need a balance of others to be appreciated, or they may also prefer the intensity of that one flavor and want to be blown away one-dimensionally.

The most common mistakes I think brewers make when they make an imperial is that they don't focus enough on how they want the finished product to taste. But again, what kind of beer you want in the end is all relative, especially the kind of beer that we brew. When you're brewing at home, I think homebrewers have the advantage in some ways because you can brew whatever tastes good to you. On a commercial scale we have to brew what we think our customers will enjoy.

As far as making mistakes in brewing techniques, however, it is common to lose sight of how yeast works in high alcohol beer, as well as remembering how enzymes work in the mash. One little misstep can lead to something you didn't expect to see in the finished beer. You can end up with an under attenuated beer if the mash is wrong. Brewers who make imperials really need to focus on the early stages in the brewing process — watch the mash temperatures and keep in mind how much residual sugar you are shooting for. Then be sure to use the right yeast that can produce enough alcohol as well as keep active in a higher alcohol environment. Also, take a lot of yeast counts during the first 48 hours to see how the yeast is reproducing.



The Best Equipment

"Help Me, Mr. Wizard"

Open fermentation at home, lambics

by Ashton Lewis

Brewery investments

I want to spend some money on my homebrewing set. What is the most important piece of brewing equipment for a homebrewer?

Justin Wallace
Springfield, Missouri

The first item I would invest money in is a properly sized kettle. Many homebrew kettles are poorly sized and prevent a full-volume wort boil. A kettle should be big enough to boil the entire volume of wort collected from the mash, or to boil the equivalent volume from an extract batch.

In order to yield 5 gallons (19 L) of beer you typically must begin with about 6 gallons (23 L) of wort prior to boiling to allow for evaporative losses, trub loss, fermentation losses and packaging losses. In addition to the 6 gallons (23 L) or so of pre-boil wort volume, a properly designed kettle will have sufficient "free-board" to allow for foam formation during boiling. While boil-overs can and do occur with properly sized kettles, smaller kettles make this problem more common. I suggest an additional 25% of free-board to accommodate wort foam during the boil and this pushes the kettle volume to 7.25 gallons (27 L). Add a valve to this vessel and you have just now purchased the most important piece of brewing equipment in the homebrewery.

Open at home?

On page 42 In the March-April 2009 issue of *BYO* there is an old picture of an open wood fermenter at Coopers. Can an open fermenter be used in homebrewing in either bucket or carboy-style fermenters? What does an open fermenter do to the taste and speed of fermentation? Could you use any yeast, etc.? Is it at all advisable to try this as a homebrewer?

Matthew Kaminskis
Brookfield, Connecticut

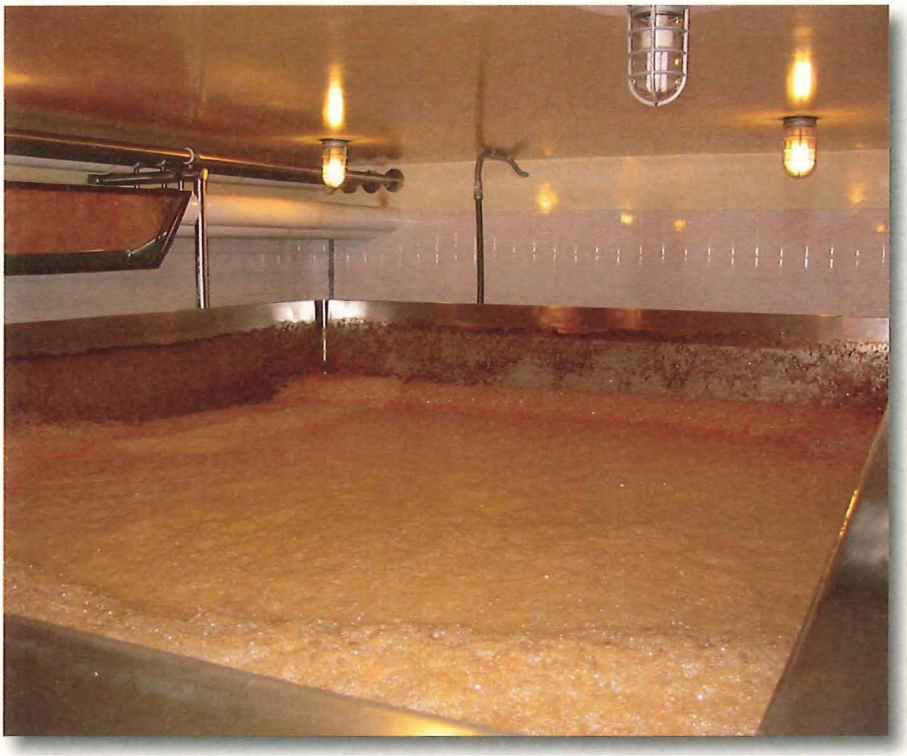


Photo courtesy of Ommegang Brewery

Open fermentations like this one at Brewery Ommegang in Cooperstown, New York can produce exceptional beers under the watchful eye of careful brewers. Open fermentations are prone to failure at home if the brewer is not meticulous about sanitation and contamination.

Open fermenters have been used for more than 98% of the history of beer brewing and I would be silly to proclaim their use either not practical or antiquated. There are many beers available that are fermented in open vessels. To my knowledge, Anchor Brewing continues to use open fermentation for their beers. I have no knowledge of Coopers' fermentation methods and can't offer specific information about their process.

I can tell you that I worked at a brewery in Davis, California while in graduate school and we produced excellent German-style lager and weizen beers in open fermenters. The worse thing that ever happened to an open fermentation when I was working at this brewery was when some stupid, and likely drunk, college kid snuck into our cellar and used one of the fermenting lager fermenters as a "hot" tub . . . it was a maintained at a muscle soothing temperature of 10 °C (50 °F)! Luckily, this moron left with his health intact; fermenting beer produces carbon dioxide and open fermenters have a blanket hovering above the top of the vessel, right at nose level when one is bobbing around in one.

Open fermentation actually has several brewing merits. The shallow depth of the vessel makes for a fruitier beer since hydrostatic pressure, encountered in taller tanks, reduces ester formation during fermentation. At home, you are not going to notice this since when I mention "tall tanks" I am speaking of vessels that are at least 20 feet (6 m) tall. Open fermenters can also be skimmed of that brown yeast-trub stuff that rises to the top of fermenting beer. Many brewers remove this layer, often called *braun hefe*, in order to improve finished beer flavor. So skimming is good. Yeast can also be cropped from open fermenters and many brewers proclaim that yeast cropped from open fermentation tanks is superior to yeast harvested from conical fermenters.

But brewers who use open fermenters realize that there are real sanitation con-

cerns with these vessels and keep them in special rooms that are designed to guard against contamination from the environment. Marketing types like to show images that make their consumers think, "Wow!" Open fermenters are one such image, but it is important to consider that these vessels are not simply parked out behind the brewhouse. There is nothing romantic or remarkable about contaminated beer and brewers who use open vessels for fermentation are not as carefree as marketing photographs depict.

Unless you are a very seasoned brewer with everything, I mean everything, under control I do not recommend the use of open fermentation at home or in a commercial brewery. To me the goal of homebrewing is the production of a pleasant and rewarding beer and the use of open fermentation vessels can easily end in frustration unless very special considerations about sanitation and prevention of contamination are made. Other than those concerns, I am totally in favor of this method of fermentation.

Lambic lessons

I'm getting ready to brew my first pseudo-lambic. I opened two ounces of 1.9% AA Styrian Goldings pellets and stored them in a 100 °F (38 °C) greenhouse for the last two months so that they got good and stale. If the only reason we're adding these hops is for the antimicrobial behavior, how long is enough and how long is too long? In fact, is there any reason to boil the wort past the hot break?

Bruce Bowman
via email

I don't think there is a real science to producing old hops for the use in lambics. Your hops sound like they have been thoroughly abused and are probably in good shape for your intended use. If they don't smell like fresh hops, don't have the nice oil rub of fresh hops and are a tanner shade of brown, then your hops are probably not fresh hops. The hops are probably the least of the challenges most homebrewers face when they decide to embark on the pseudo-lambic voyage.

For the sake of this answer I will assume that you intend on purchasing a liquid yeast and bacteria blend from a yeast lab. Wyeast and White Labs both sell lambic cultures. The idea here is to inoculate sterile wort with a specially blended culture. This principle is no different than when you brew a "normal" beer and inoculate the wort with a single yeast strain.

A brewer draws a sample of lambic beer from a barrel at the Boon Brewery in Lembeek, Belgium. Homebrewers can try their hand at making lambic styles at home by "abusing" fresh hops and inoculating the wort with specially blended, commercially available yeast strains.

"There is nothing romantic or remarkable about contaminated beer and brewers who use open vessels for fermentation are not as carefree as marketing photographs depict."

Lambics, truly among the funkiest cats in the beer world, are not the products of total neglect. While the methods used to brew lambics in Belgium are (to say the least) odd when compared to brewing an über clean helles, one must remember that the native organisms required for lambic production are indigenous to the specific locale around this small grouping of breweries. Exposing unpitched wort to other environments will probably result in a much different beer. And if I were a gambling man would wager that the end result would probably not be at all enjoyable. This means that when you boil your wort you also want to kill the usual suspects, mainly *Lactobacilli*.

The next challenge when brewing these types of beers is to simply leave them alone. Articles published about lambics often have graphs showing how

"Carbonation using carbon dioxide is extremely easy at home if you follow a few very basic rules and invest in some useful tools that will make packaging and dispense much, much easier than bottling."

microbial populations wax and wane during the course of lambic maturation. As populations come and go they leave behind key flavor components and set the stage for other populations to take over, often times the next population gets nutrients required for growth from the dead cells of the previous dominant organism. After considerable time the beer will become sour from the growth of certain bacteria. In addition to sourness, lambics have a complex aroma that is largely due to the growth of *Brettanomyces* species. *Brett* is known for its contribution of a variety of aromas including 4-ethyl phenol (classic phenolic aromas, such as medicinal), 4-ethyl guaiacol (smoked bacon, spicy, clove) and isovaleric acid (sweat, dirty sock, cheesy). *Brett* is also known to contribute aromas such as wet dog, creosote, plastic, horse-blanket and vinegar. Mmmmm — wet dog!

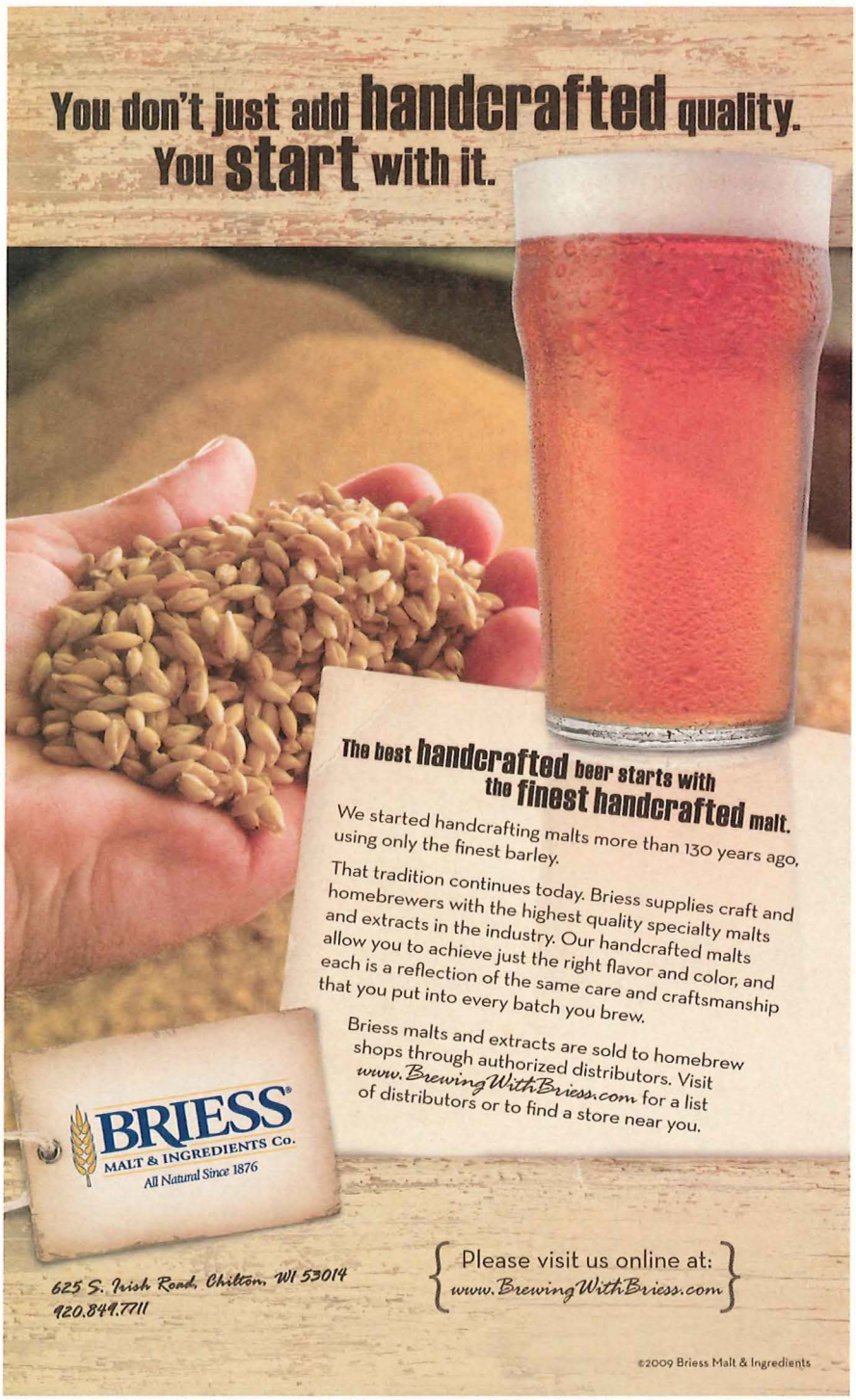
My advice is to keep in mind that what makes a lambic is the fermentation and aging process. You should aim to produce clean wort with the ingredients you have chosen, including your old hops, and exercise patience while your lambic culture goes through the various phases of this interesting process. Sampling is of course required, but I would wait at least 9 months if not longer to take the first sample. Continuous sampling does not speed things along and with these types of beers it is often best to stick them in the corner and forget them for a while.

Keg carbonation

Would it be possible for me to artificially carbonate homemade lager at home? If so how would I do this? What equipment would I need? I have made homemade lager using natural carbonation on a few occasions, it always has nice flavor but the gas is too smooth, I'm looking to make lager that is more fizzy and crisp like lager sold in shops and bars.

Luke Moon
Tilbury, Essex (UK)

Carbonation using carbon dioxide is extremely easy at home if you follow a few very basic rules and invest in some useful tools that

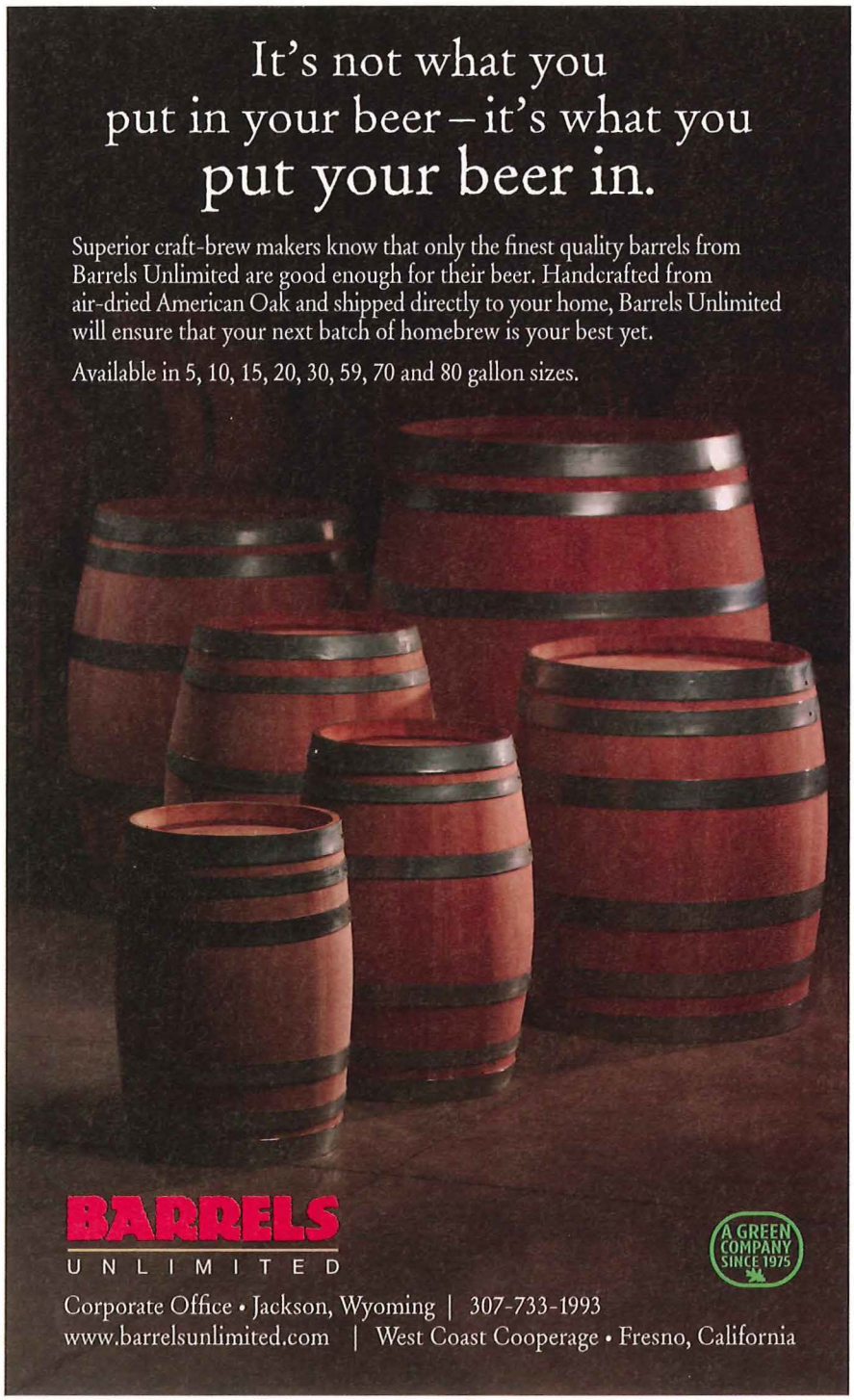


will make packaging and dispense much, much easier than bottling. The equipment required is a pressure vessel to put your beer into, a carbon dioxide cylinder and gas regulator to attach to the cylinder.

In the US, soda syrups once were delivered to restaurant accounts in 5-gallon (19-L) stainless steel canisters. These tanks were made by the Cornelius Company and are called "Corny kegs" by many homebrewers. Today, soda syrups are packaged using bag-in-box technology and there are many, many Corny Kegs hanging about waiting to be adopted by homebrewers. The only thing required is replacing the gaskets and O-rings as these soft elastomers pick up aromas from soda and can contaminate beer.

Once you have a keg, a regulator and a tap to get the beer out of the keg (simple "cobra head" taps are the cheapest and simplest taps) you are ready to go. Begin by cleaning your keg, purging it of air and transferring the beer into it through what is labeled as the "out" tube. As the keg fills you need to vent the keg through the poppet fitting on the top. The next step is to put the keg into a cold and controlled environment; in other words toss it into your keg refrigerator (not required, but handy if you keep food in your primary refrigerator). You should adjust the temperature of the refrigerator so that it is around 38 °F (3 °C). Attach the carbon dioxide tank to the gas fitting on the Corny keg, adjust the pressure to around 12 psi and wait. The beer will be fully equilibrated with the carbon dioxide pressure above the beer level in about 3–5 days.

You can speed the carbonation process up by periodically shaking your keg, using a higher pressure and/or introducing the gas through the "out" tube on the keg. Personally, I do not like the last two shortcuts for several reasons and suggest simply waiting. Even with the wait this is far quicker than bottle conditioning. After the beer is carbonated you should maintain the same temperature and pressure conditions until the keg is empty. If you want more carbonation, you can simply increase the head pressure slightly.



Brew Your Own Technical Editor Ashton Lewis has been answering homebrew questions as his alter ego Mr. Wizard since 1995. A selection of his Wizard columns have been collected in "The Homebrewer's Answer Book," available online at brewyourownstore.com.

Do you have a homebrewing question for Ashton? Send inquiries to *Brew Your Own*, 5515 Main Street, Manchester Center, VT 05255 or send your e-mail to wiz@byo.com. If you submit your question by e-mail, please include your full name and hometown. In every issue, the Wizard will select a few questions for publication. Unfortunately, he can't respond personally. Sorry!

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American Brown

An English style with a US feel

by Jamil Zainasheff

It is said that the first American brown ale was a creation of homebrewers in and around Texas many years ago. Perhaps it started as an attempt to brew an "Americanized" version of an English brown ale, but it quickly became much more than that — more of a style of its own. American brown ale is not just bigger, hoppier, and roastier than an English brown ale. The choices for hopping, malt and fermentation create a beer with a different overall character from the English brown ales.

It may seem obvious to some, but an American brown should always be brown. It can range from light to very dark brown, but it shouldn't be black and it shouldn't be amber, which are the odd mistakes you sometimes see in recipes. The overall balance can seem a little on the sweet side up front, but it should never finish sweet. It can have a medium to fairly dry finish and a medium to medium-full body. Fruity esters are generally no more than a gentle presence and in many examples very low or none at all.

All good examples should have some level of chocolate, toasty caramel flavors and aromas. While there should be some chocolate malt character and maybe even a tiny touch of coffee, it is important to note that this should stop short of being too much like a robust porter. How bold those flavors are in each beer and the amount of residual malt sweetness as compared to the hopping, makes up the wide range of interpretations of this style.

American brown ales vary from being very hoppy, very bitter beers to beers with a more restrained hop bitterness and character. Some examples have a little sweetness up front and a rich background malt flavor that balance the hops, while others are drier, letting the hops come straight through and poke you in the tastebuds. Being an American style, you'd think that a citrusy character is a requirement, but not necessarily. Almost any hop character is fine, from restrained to bold, but the bittering should always be firm.

You have some flexibility in choosing base malt for American brown. Using domestic two-row will give the beer a clean, subtle background malt character common to many fine American craft beers. Using domestic pale ale malt adds a slightly richer background malt character, somewhat of a light bready note. Again, this is the type of malt character you'll find in many fine domestic craft brews. Less common is the use of British pale ale malt. British pale ale malt, provides an even greater depth of malt character to the beer, mainly a biscuit-like taste and aroma common in many British beers. Some folks feel British pale ale

Continued on page 21

AMERICAN BROWN by the numbers

OG:	1.045–1.060 (11.2–14.7 °P)
FG:	1.010–1.016 (2.6–4.1°P)
SRM:	18–35
IBU:	20–40
ABV:	4.3–6.2%

RECIPE

American Brown

Janet's Brown Ale
(5 gallons/19 L, all-grain)
OG = 1.066 (16.2 °P)
FG = 1.016 (4.2 °P)
IBU = 63 SRM = 23 ABV = 6.6%

This is a recipe from my good friend Mike McDole. It is a little bit outside the style guidelines, but not so much so that you'd call it out of style, especially on the west coast. Mike has won many awards with this beer, but the most important critique he ever received was from his late wife Janet. She really loved this brown ale. Brew this beer and every time you have a pint, make a toast to the memory of a fine lady with great taste. Mike always does.

Ingredients

10.75 lbs. (4.87 kg) Great Western North American two-row malt (2 °L) or similar substitute
18 oz. (510 g) Great Western Crystal malt (40 °L)
18 oz. (510 g) Briess CaraPils® malt (1 °L)
14 oz. (397 g) Great Western Wheat malt (2 °L)
8 oz. (227 g) Chocolate malt (420 °L)
5.4 AAU Northern Brewer hops (0.83 oz./24 g at 6.5% alpha acid) (mash hop)
6.76 AAU Northern Brewer hops (1.04 oz./29 g at 6.5% alpha acid) (60 min.)
5.4 AAU Northern Brewer hops (0.83 oz./24 g at 6.5% alpha acid) (15 min.)
7.5 AAU Cascade hops (1.25 oz./35 g at 6% alpha acid) (10 min.)
7.5 AAU Cascade hops (1.25 oz./35 g at 6% alpha acid) (0 min.)
15 AAU Centennial hops (1.67 oz./47 g at 9% alpha acid) (dry hop)
Wyeast 1056 (American Ale), White Labs WLP001 (California Ale) or Fermentis Safale US-05 yeast

Step by Step

Mill the grains and dough-in targeting a mash of around 1.5 quarts of water to 1 pound of grain (a liquor-to-grist ratio of about 3:1 by weight) and a temperature of 154 °F (68 °C). Mix the first hop addition with the mash. Hold the mash

at 154 °F (68 °C) until enzymatic conversion is complete. Infuse the mash with near boiling water while stirring or with a recirculating mash system raise the temperature to mash out at 168 °F (76 °C). Sparge slowly with 170 °F (77 °C) water, collecting wort until the pre-boil kettle volume is around 6.5 gallons (25 L) and the gravity is 1.051 (12.7 °P).

The total wort boil time is 90 minutes. Add the bittering hops with 60 minutes remaining in the boil. Add Irish moss or other kettle finings along with the third hop addition with 15 minutes left in the boil. Add other hop additions at 10 minutes remaining and flame out. Chill the wort to 67 °F (19 °C) and aerate thoroughly. The proper pitch rate is 11 grams of properly rehydrated dry yeast, two packages of liquid yeast or 1 package of liquid yeast in a 2.5-liter starter.

Ferment at 67 °F (19 °C) until the yeast drops clear. At this temperature and with healthy yeast, fermentation should be complete in about one week. Allow the lees to settle and the brew to mature without pressure for another two days after fermentation appears finished. At this point add your dry hop addition. Keep the beer on the dry hops for approximately seven days. Rack to a keg and force carbonate or rack to a bottling bucket, add priming sugar, and bottle. Target a carbonation level of 2 to 2.5 volumes.

Dirty Water Brown

(5 gallons/19 L, all-grain)

OG = 1.048 FG = 1.011
IBU = 34 SRM = 21 ABV = 4.9%

This recipe makes an American brown on the lower side of the style; hoppy, but lower in alcohol and bittering, for those times when you want to have a couple of pints.

Ingredients

9 lbs. (4.1 kg) Great Western pale malt (2-row) (2 °L) or similar substitute
7 oz. (200 g) Great Western crystal malt (40 °L) or similar substitute
7 oz. (200 g) Great Western chocolate malt (420 °L) or similar substitute
4 oz. (113 g) Great Western crystal malt (60 °L) or similar substitute
4 oz. (113 g) Briess Victory® malt (28 °L)
4.94 AAU Horizon hops (0.38 oz./11 g at 13% alpha acid) (60 min)
7.47 AAU Amarillo hops (0.83 oz./24 g at 9% alpha acid) (15 min)
13.14 AAU Amarillo hops (1.46 oz./41 g at 9% alpha acid) (0 min)
Wyeast 1056 American Ale, White Labs WLP001 California Ale or Fermentis Safale US-05 yeast

Step by Step

Mill the grains and dough-in targeting a mash of around 1.5 quarts of water to 1 pound of grain (a liquor-to-grist ratio of about 3:1 by weight) and a temperature of 152 °F (67 °C). Hold at 152 °F (67 °C) until enzymatic conversion is complete. Infuse the mash with near boiling water while stirring or with a recirculating mash system raise the temperature to mash out at 168 °F (76 °C). Sparge slowly with 170 °F (77 °C) water, collecting wort until the pre-boil kettle volume is around 6.5 gallons (25 L) and the gravity is 1.037 (9.3 °P).

The total wort boil time is 90 minutes. Add the bittering hops with 60 minutes remaining in the boil. Add Irish moss or other kettle finings and second hop addition with 15 minutes left in the boil. Add the last hop addition at flame out. Chill the wort to 67 °F (19 °C) and aerate thoroughly. The proper pitch rate is 9 grams of properly rehydrated dry yeast, two packages of liquid yeast or one package of liquid yeast in a 1.5-liter starter.

Ferment at 67 °F (19 °C) until the yeast drops clear. At this temperature and with healthy yeast, fermentation should be complete in about one week. Allow the lees to settle and the brew to mature without pressure for another two days after fermentation appears finished. Rack to a keg and force carbonate or rack to a bottling bucket, add priming sugar, and bottle. Target a carbonation level of 2 to 2.5 volumes.

Extract with Grains Option

Replace the domestic pale malt with 5.7 lbs. (2.6 kg) light liquid malt extract. I use an ultra-light extract made from Great Western two-row malt by Alexander's (California Concentrate Company), but any fresh, high quality light color extract made from domestic two-row malt will work well. If you can't get fresh liquid malt extract, use dried malt extract (DME). (Use 20% less dry extract by weight.) When the amount of liquid extract called for in the recipe is not easy to measure, use the most convenient liquid measure and you can make up the rest of the malt sugars with dry extract. Always choose the freshest extract that fits the beer style.

Mill or coarsely crack the specialty malts. Mix them well and place loosely in a grain bag. Avoid packing the grains too tightly in the bag, using more bags if needed. Steep the bag in about 1 gallon (~4 L) of water at roughly 170 °F (77 °C) for about 30 minutes. Lift the grain bag out of the steeping liquid and rinse with warm water. Allow the bags to drip into the kettle for a few minutes while you add the malt extract. Do not squeeze the bags.

Add enough water to the steeping liquor and malt extract to make a pre-boil volume of 5.9 gallons (22.3 L) and a gravity of 1.041 (10.2 °P). Stir thoroughly to help dissolve the extract and bring to a boil. Boil time is 60 minutes. Get the wort boiling, add your first addition of hops, then follow the boil, fermentation and packaging instructions for the all-grain version.

Big Sky Brewing Moose Drool clone

(5 gallons/19 L, all-grain)

OG = 1.052 FG = 1.013
IBU = 30 SRM = 22 ABV = 5.1%

Big Sky Brewing Moose Drool is a great commercial example of American brown ale. It is such a popular beer that it was one of the most requested for the *Jamil Show: Can You Brew It*. Matt Long at Big Sky Brewing helped us out with the clone recipe. You can hear the interview with Matt along with more tips to brew this classic example at www.thebrewingnetwork.com/shows/The-Jamil-Show.

Ingredients

9.7 lbs. (4.4 kg) Great Western pale malt (2 °L) or similar substitute
18 oz. (510 g) Great Western crystal malt (75 °L) or similar substitute
5 oz. (142 g) Great Western chocolate malt (450 °L) or similar substitute
0.5 oz. (14 g) Great Western black patent malt 550 °L or similar substitute
5.6 AAU Kent Golding hops (1.17 oz./33 g at 4.75% alpha acid) (60 min)
2.5 AAU Willamette hops (0.5 oz./14 g at 5% alpha acid) (10 min)
2 AAU Liberty hops (0.5 oz./14 g at 4% alpha acid) (0 min)
Wyeast 1968 (London ESB), White Labs WLP002 (English Ale) or Fermentis Safale S-04 yeast

Step by Step

When I brew this beer all of my grain is from Great Western Malting Co. Feel free to substitute any quality malt of the same type and color from a different supplier.

Mill the grains and dough-in targeting a mash of around 1.5 quarts of water to 1 pound of grain (a liquor-to-grist ratio of about 3:1 by weight) and a temperature of 154 °F (68 °C). Hold the mash at 154 °F (68 °C) until enzymatic conversion is complete. Infuse the mash with near boiling water while stirring or with a recirculating mash system raise the temperature to mash out at 168 °F (76 °C). Sparge slowly with 170 °F (77 °C) water, collecting wort

until the pre-boil kettle volume is around 6.1 gallons (23 L) and the gravity is 1.043 (10.6 °P).

The total wort boil time is 70 minutes. Add the bittering hops with 60 minutes remaining in the boil. Add Irish moss or other kettle finings with 15 minutes left in the boil. Add other hop additions at 10 minutes remaining and flame out. Chill the wort to 67 °F (19 °C) and aerate thoroughly. The proper pitch rate is 12 grams of properly rehydrated dry yeast, two packages of liquid yeast or one package of liquid yeast in a 2.5-liter starter.

Ferment at 67 °F (19 °C) until the yeast drops clear. At this temperature and with healthy yeast, fermentation should be complete in about a week. Allow the lees to settle and the brew to mature without pressure for another two days after fermentation appears finished. Rack to a keg and force carbonate or rack to a bottling bucket, add priming sugar, and bottle. Target a carbonation level of 2.5 volumes.

Extract with Grains Option

Replace the domestic pale malt with 6.2 lbs. (2.8 kg) light liquid malt extract. I use an ultra-light extract made from Great Western two-row malt by Alexander's (California Concentrate Company), but any fresh, high quality light color extract made from domestic two-row malt will work well. If you can't get fresh liquid malt extract, use dried malt extract (DME) instead. (Use 20% less dry extract by weight.) When the amount of liquid extract called for in the recipe is not easy to measure, use the most convenient liquid measure and you can make up the rest of the malt sugars with dried extract. Always choose the freshest extract that fits the beer style.

Mill or coarsely crack the specialty malts. Mix them well and place loosely in a grain bag. Avoid packing the grains too tightly in the bag, using more bags if needed. Steep the bag in about 1-gallon (~4 L) of water at roughly 170 °F (77 °C) for about 30 minutes. Lift the grain bag out of the steeping liquid and rinse with warm water. Allow the bags to drip into the kettle for a few minutes while you add the malt extract. Do not squeeze the bags.

Add enough water to the steeping liquor and malt extract to make a pre-boil volume of 6.1 gallons (23 L) and a gravity of 1.043 (10.7 °P). Stir thoroughly to help dissolve the extract and bring to a boil. Follow the boil, fermentation and packaging instructions for the all-grain version.

malt can be too much for American styles, so if you prefer a more subtle, restrained malt background, go with domestic two-row or pale ale malt. Extract brewers can use an English pale ale extract if they want a richer malt background or a light color domestic malt extract if they want a more subtle taste. All-grain brewers can use a single infusion mash and should target a mash that will leave enough long chain sugars in the beer to help fill out the body. A temperature around 152 to 154 °F (67 to 68 °C) creates wort with a nice balance between fermentable and non-fermentable sugars.

The majority of the character that defines an American brown comes from specialty malts and this is one area ripe for creativity. Every American brown needs both some chocolately dark malt notes and some caramel notes. Experimenting with the amounts and colors of crystal and roasted malts is a great way to change the character of your beer. I like to use mid-color crystal (40–60 °L), darker crystal (80–150 °L) or a combination of colors. The mid-color crystal malts add more caramel flavors, while the darker crystal malts add progressively more plum, raisin and burnt caramel notes as they get darker. The darker crystal malts also tend to be less sweet than the lighter crystal malts. Even though you have a lot of leeway, you don't want to add a lot of low color crystal malt (< 30 °L), as it adds sweetness without much caramel character. Also watch the total amount of crystal malt being added. If the total amount exceeds 10% of the grist, it can result in an overly sweet and heavy beer.

It is important to not leave too much residual sweetness in the beer. Even with a high level of bitterness, there is a limit to how much sweetness is acceptable. While there is some truth to the adage that you can balance hop bitterness with malt sweetness, that is true only to a point and it doesn't take much before the drinkability of the beer suffers. One of the other benefits of the darkest crystal malts is that they add a little dryness to the finish. Any dark roasted malt can enhance the perception of dryness, but each malt or grain has its own character. Some can be harsh and acrid if used in more than the smallest amount. Generally speaking, the darker the malt the less you'll need to use in an American brown. Keep in mind that you only want some restrained flavors and aromas, since you're not trying to make a robust porter or a stout of any kind. About 5% is the limit on the amount of the darker roasted malts and that should be in the 300 to 500 °L range. Much, much less if you're going darker.

If you're looking for more complexity or head retention or some other flavor in your brown it is possible to add other malts as well. CaraPils®, wheat malt, Victory® and Munich are common additions to many American brown recipes. Just use restraint so the beer doesn't become saturated with unfermentable dextrins or cloying flavors. Target between 0 and 5% for these additional specialty grains.

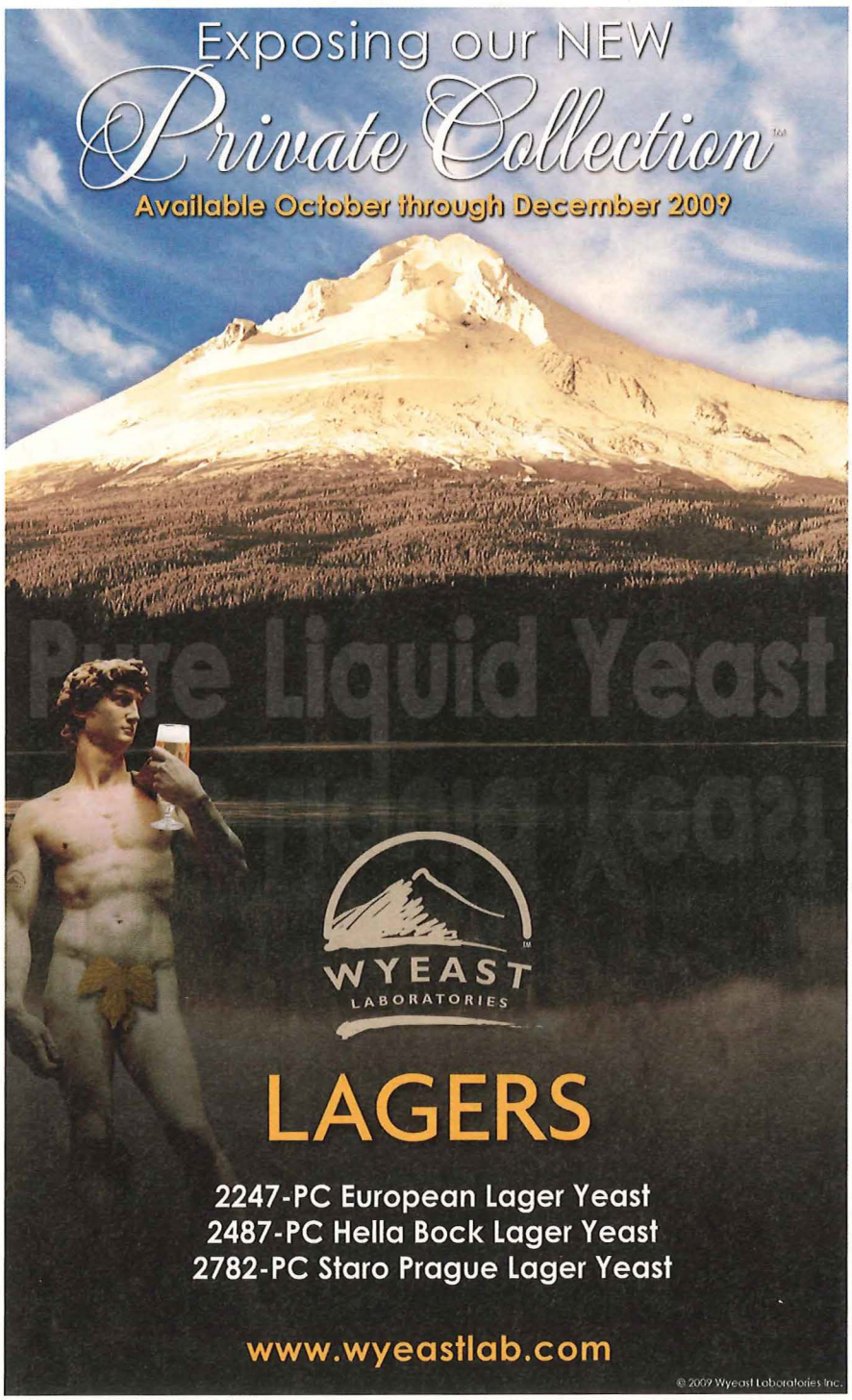
"It is important to not leave too much residual sweetness in the beer. Even with a high level of bitterness, there is a limit to how much sweetness is acceptable."

You have quite a bit of flexibility in hopping American brown ales. The balance of bittering versus malt sweetness can range anywhere from slightly sweet to boldly bitter. Target a bitterness to starting gravity ratio (IBU divided by OG) of 0.5 to 0.7 for a more balanced beer or 0.7 to 1.0 for a bold American brown. The BJCP guide suggests that IPA strength examples are really specialty beers, so you might want to stop short of turning your beer into a brown IPA. However, here on the west coast of the United States, IPA-strength beers in both alcohol and

hops is a fairly common occurrence and nobody blinks an eye at a bold brown ale.

Hop flavor and aroma also varies from minimal to bold. I really like using citrusy or piney American variety hops such as Cascade, Centennial, Columbus, Simcoe and Amarillo for flavor and aroma, but there are plenty of great examples out there that use a wide variety of hops from around the world. You can use almost any hop you feel has a pleasant character as it is the overall impression that matters. You can bitter with almost any hop as well, but clean, neutral hops are most common. You want some hop character and a firm bitterness, but both should complement your malt and yeast choices.

Fermentation for American brown is straightforward. Like the majority of American ales, this style most often has a clean profile, with very low to no fruity esters. A slight fruitiness can be welcome,



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Healdsburg, California 95448
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as long as it isn't excessive. If you do want some esters, an English-style yeast at a lower temperature is a common technique. But keep in mind those yeasts often attenuate a little lower than most American-style yeasts, so you'll need to account for that in your recipe formulation. I prefer to use a clean, moderately attenuating yeast, such as Wyeast 1056 American Ale or White Labs WLP001 California Ale. Make certain that you oxygenate the wort and pitch an appropriate amount of clean, healthy yeast for the batch you are brewing. This will help create that clean American pub-style profile in the beer. Ferment at around 67 °F (19 °C), holding the temperature steady throughout fermentation. Holding the temperature steady is important to getting a proper level of attenuation and avoiding off-flavors, especially if you're making a bigger beer. Letting the beer go through large temperature swings can result in the yeast flocculating early or producing solventy and/or estery beers. If you wish, you can raise the temperature a few degrees near the end of fermentation to help the yeast clean up some of the intermediate compounds produced during fermentation, but with an appropriate pitch and proper temperature control, it shouldn't be necessary.

"Make certain that you oxygenate the wort and pitch an appropriate amount of clean, healthy yeast for the batch you are brewing. This will help create that clean American pub-style profile in the beer."

For more information about the history of English brown ale, read Terry Foster's story on page 26 in the September 2007 issue of *Brew Your Own*.

Jamil Zainasheff is host of "Can You Brew It," a show about cloning commercial beers and "Brew Strong," a show that answers technical brewing questions. Both shows can be found on the Brewing Network (www.thebrewingnetwork.com). He writes "Style Profile" in every issue of Brew Your Own *and co-authored* Brewing Classic Styles (*Brewer's Publications* 2008).

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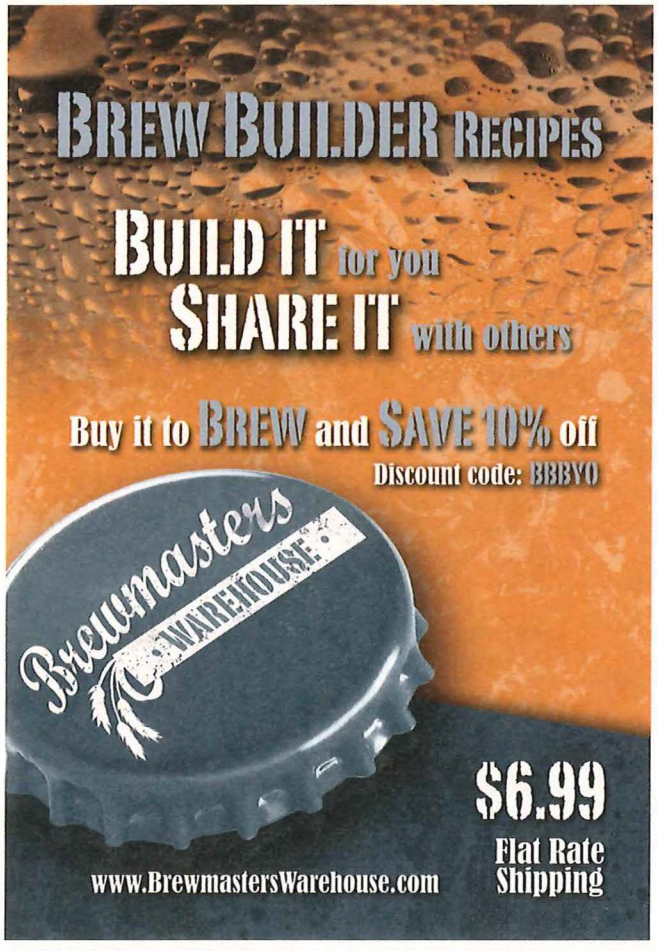

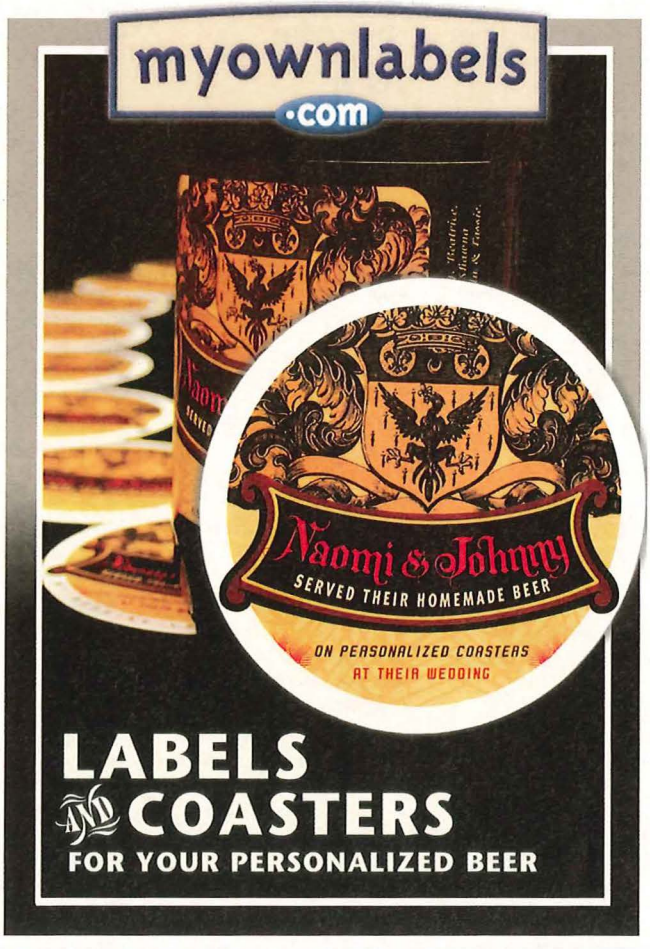

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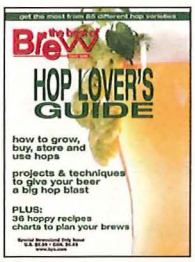

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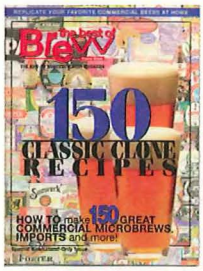

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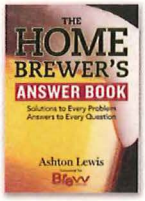

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Story by **CHRIS COLBY**

Partial mashing combines the convenience of brewing with malt extract and the flexibility of all-grain brewing. It lets extract brewers employ any malt that requires mashing. It is also possible to introduce extract brewers to different mashing techniques via partial mashing. In fact, previous partial mash recipe collections gave instructions on how to do a step mash and a single decoction mash. For all-grain brewers, partial mashing is a stovetop technique to consider when the weather outside isn't inviting — for example, winter in Minnesota or summer in Texas.

There are many ways to perform a partial mash and these 5-gallon (19-L) recipes will work with any of them. However, they are formulated especially to be used with the technique I call countertop partial mashing. Basically, countertop partial mashing involves mashing 4.0 lbs. (1.8 kg) of grains in a 2.0-gallon (7.6-L) beverage cooler. The roughly 2.0 gallons (7.6-L) of wort produced from this mash is boiled, often along with a small amount of malt extract. Roughly half of the extract weight (the total amount of "stuff" in the beer) of the brew is added via malt extract late in the boil. This thick wort is then diluted to working strength at 5 gallons (19 L). The combination of making part of the wort from a mash and adding much of the extract late in the boil allows stovetop brewers to produce lighter-colored beers with better hop utilization compared to usual extract brewing techniques. All an extract brewer needs to do this is his usual brewing equipment, a 2.0-gallon (7.6-L) beverage cooler and a large steeping bag.

Partial mash brewing can let extract brewers flex their brewing muscles and try some unusual beers. In this recipe collection, we'll look at four recipes that couldn't be made with the usual extract and steeped grains method. These recipes produce beers that are a bit out of the ordinary, but not unheard of. They're not totally nuts, just partially crazy.

PARTIALLY CRAZY

Partial Mash Recipes on the Wild Side

Sweet Potato ESB

(5 gallons/19 L, partial mash)

OG = 1.059 FG = 1.011
IBU = 26 SRM = 10 ABV = 6.1%

The sweet potato in this recipe only contributes extract and an interesting orange color. There is no sweet potato flavor. With the mashed starchy adjunct and the sugar added to the kettle, this beer starts in the gravity range of an old ale, but finishes in the range of a normal pale ale.

Ingredients

1.75 lbs. (0.79 kg) British pale ale malt (3 °L)
1.25 lb. (0.57 kg) US 2-row pale malt (1.8 °L)
0.50 lb. (0.23 kg) crystal malt (60 °L)
2.0 lbs. (0.91 kg) sweet potatoes
0.75 lbs. (0.34 kg) Muntons Light dried malt extract
3.3 lbs. (1.5 kg) Muntons Light liquid malt extract (late addition)
1.0 lb. (0.45 kg) cane sugar (late addition)
1.0 tsp Irish moss (15 mins)
0.5 tsp. yeast nutrients (15 mins)
6 AAU Northern Brewer hops (60 mins) (0.75 oz./21 g of 8% alpha acids)
0.5 oz. (14 g) of First Gold hops (15 mins)
0.5 oz. (14 g) of First Gold hops (0 mins)
Wyeast 1968 (London ESB) or White Labs WLP002 (English Ale) yeast (1.5-qt./1.5-L yeast starter)
1 cup corn sugar (for priming)

Step by Step

Buy your sweet potatoes within a few

days of brewing this beer. Do not store them in the refrigerator. Peel the sweet potatoes and cut them into roughly 1-inch (2.5-cm) cubes. Boil the cubes for 10 minutes, pour off the excess liquid and then mash them with a potato masher. (Alternately, rice them with a potato ricer.) In a large soup pot, work the crushed grains into the mashed sweet potatoes. Put the grain bag in your mashing cooler and scoop this mix into it. Heat roughly 5 quarts (~5 L) of water to 163 °F (73 °C). Stir this hot water into the mix until the cooler is just about full. As you near the final volume, check the temperature and add cool water, if needed, to hit a mash temperature of 152 °F (67 °C). Let the mash rest for 1 hour. Recirculate the wort by drawing off 1 cup of wort and returning it to the top of the mash. Repeat this step about 15 times. Run off the wort 1 or 2 cups at a time and place in your kettle. Then, replace the lost volume by adding 190 °F (87 °C) water to the top of the grain bed. (Do not stir the water into the grains, just pour it gently on top.) Repeat this until you have collected 2.0 gallons (7.6 L) of wort in your brewpot. (You will need about 6 qts./6 L of sparge water at 190°F/87 °C. If the temperature of the grain bed reaches 170 °F/77 °C while rinsing the grain bed (sparging), drop the temperature of this sparge water to 170 °F/77 °C by adding cool water.)

Add water and dried malt extract to make 3.0 gallons (11 L) of wort. Boil for 60 minutes, adding hops at times indicated. With 15 minutes left in the boil, stir in liquid malt extract, sugar, Irish moss and yeast nutrients. Cool wort to 68 °F (20 °C) and transfer to fermenter. Top up to 5.0 gallons (19 L) with cool water. Aerate well and pitch yeast from starter. (If you don't make the starter, pitch two packets of yeast.) Ferment at 68 °F (20 °C). Once yeast has settled, let sit for one or two days at fermentation temperature, then rack directly from primary to a keg or bottling bucket.

Bärbecüebräu

(5 gallons/19 L, partial mash)

OG = 1.052 FG = 1.013

IBU = 18 SRM = 17 ABV = 5.0%

Do you like barbecue? Do you like beer? Why not combine the two? This smoked beer gets its bacon-like smoked flavor from rauchmalz (smoked malt). It tastes great on its own or doubly great served with barbecue. You can substitute lager yeast and make this as a classic rauchbier. However, as in this recipe, I've made versions of this brew as a smoked beer that is similar to a German altbier and people have loved it.

Ingredients

4.0 lbs. (1.8 kg) Weyermann rauchmalz (mashed)
6.0 oz. (0.17 kg) CaraMunich® III malt (50 °L) (steeped)
2.0 oz. (57 g) chocolate malt (steeped)
4.75 lbs. (2.2 kg) Weyermann Bavarian Pilsener liquid malt extract (mostly late addition)
5 AAU Magnum hops (60 mins) (0.33 oz./9.4 g of 15% alpha acids)
1 tsp Irish moss (15 mins)
Wyeast 1084 (Irish Ale) or White Labs WLP004 (Irish Ale) yeast (1.5-qt./1.5-L yeast starter)
1 cup corn sugar (for priming)

Step by Step

Heat 5.5 qts. (5.2 L) of water to 163 °F (73 °C). Place crushed rauchmalz in grain bag inside cooler and stir in water to hit mash temperature of 152 °F (67 °C). Let mash rest for 45 minutes. While mash is resting, steep crushed specialty grains in your brewpot. Use 2.0 qts. (~2 L) of water and hold steep temperature around 152 °F (67 °C). Recirculate and run off wort until you have roughly 2.25 gallons (8.5 L) of wort in your brewpot. (See the first recipe for the recirculation and run off procedure.) Add water and roughly a third of the liquid malt extract to your brewpot to make 3.0 gallons (11 L) of wort. Boil for 60 minutes, adding hops at times indicated. With 15 minutes left in the boil, stir in the remaining liquid malt extract and Irish moss. Cool wort to 68 °F (20 °C) and transfer to fermenter. Top up to 5.0 gallons (19 L) with cool water. Aerate well and pitch yeast. Ferment at 68 °F (20 °C). Once primary fermentation has finished, let beer sit on yeast, at fermentation temperature, for 2 or 3 days. Then, rack to secondary and condition for 1 to 2 weeks. Serve with barbecued chicken.

Bastroper Weisse (Sour Mash Beer)

(5 gallons/19 L, partial mash)

OG = 1.041 FG = 1.009

IBU = 15 SRM = 6 ABV = 4.2%

This is a tart, refreshing beer, styled after a Berliner weisse. However, the sourness comes from the mash, not from bacterial action in the fermenter, so it is ready to drink in a few weeks. Also, since bacterial action is stopped during the boil, this beer does not dry out completely and get stingingly sour. It retains a nice sweet/sour balance and a fair amount of body. Bastroper weisse is a great beer after a long run or bike ride.

"Partial mash brewing can let extract brewers flex their brewing muscles and try some unusual beers."

Ingredients

1.75 lbs. (0.79 kg) domestic 2-row pale malt (1.8 °L)
0.75 lb. (0.34 kg) Vienna malt (3.5 °L)
1.5 lbs. (0.68 kg) wheat malt
1.0 lb. (0.45 kg) Briess Golden Light dried malt extract
2.0 lbs. (0.91 kg) Briess Golden Light liquid malt extract (late addition)
4 AAU Vanguard hops (60 mins) (0.80 oz./23 g of 5% alpha acids)
1 tsp Irish moss (15 mins)
Wyeast 1272 (American II Ale) or White Labs WLP051 (California V Ale) yeast (2-qt./2-L starter)
Wyeast 5335 (*Lactobacillus*) or White Labs WLP677 (*Lactobacillus*) bacteria (for mash)
1.75 cups corn sugar (for priming)

Step by Step

Take your package of bacteria out of the refrigerator and let it sit somewhere warm while you make the sour mash. Heat 4.5 qts. (4.25 L) of water to 163 °F (73 °C). Place roughly 3 of the 4.0 lbs. (1.8 kg) of crushed grains in grain bag inside cooler and stir in water to hit mash temperature of 152 °F (67 °C). Let mash rest for 30 minutes. In a soup pot, mix remaining grains with 1 qt. (~1 L) of water at room temperature. Stir this mix into your main mash, which should come to a temperature around 120 °F (49 °C). If you are over this temperature, add ice cold water to lower temperature. If you are under, remove a portion of the mash and bring it to boil, then stir it back into the mash. Place the unopened package of bacteria on top of the mash for 20 minutes to acclimate the bacteria. Then, stir the bacteria into your mash and let the cooler sit for 2 days. Keep it as insulated as possible and in a warm area.

Once the mash has soured, run off 4.5 qts. (~4.5 L) to your brewpot, leaving the last bit of wort in the cooler. (Do not recirculate prior to running off the wort. The idea here is to leave the top layer of liquid — the portion most likely to be contaminated with unnwanted organisms, such as the aerobic bacteria, *Acetobacter* — out of your wort.)

Add water and dried malt extract to your brewpot to make 3.0 gallons (11 L) of wort. Boil for 60 minutes, adding hops at times indicated. With 15 minutes left in the boil, stir in the remaining liquid malt extract and Irish moss. Cool wort to 66 °F (19 °C) and transfer to fermenter. Top up to 5.0 gallons (19 L) with cool water. Aerate well and pitch ale yeast. Ferment at 66 °F (19 °C), then rack to secondary and let condition for 2 weeks. Bottle with 1.75 cups of corn sugar or force carbonate to around 3 volumes of CO_2.

1850 Compromise Bock

(5 gallons/19 L, partial mash)

OG = 1.044 FG = 1.011

IBU = 17 SRM = 15 ABV = 4.3%

In 1850, Congress enacted a series of laws meant to resolve territorial (and other) issues left over from the Mexican-American War. Texas-style bock — as exemplified by Shiner Bock — can be viewed as a compromise between, or at least a blending of, Old-World and New-World techniques and ingredients. And of course, partial mashing is a compromise between all-grain and extract brewing.

This brew can introduce you to cereal mashing, a technique for using starchy adjuncts in your beer. If you choose the corn grits option, do not use prepared grit. Purchase plain, unprocessed corn grits or polenta. If you can find degerminated grits, use those.

Ingredients

1 lb. 3 oz. (1.2 kg) 6-row brewers malt
1 lb. 5 oz. (1.3 kg) Vienna malt
0.50 lb. (0.23 kg) crystal malt (60 °L)
0.75 oz. (21 g) black malt (500 °L)
1.0 lb. (0.45 kg) corn grits or rice
1.0 lb. (0.45 kg) cane sugar
1.5 lbs. (0.68 kg) Briess Golden Light dried malt extract

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1.0 lb. (0.45 kg) Briess Munich liquid malt extract (late addition)
1 tsp. Irish moss (15 mins)
0.5 tsp yeast nutrients (15 mins)
4.6 AAU Brewer's Gold hops (60 mins)
Wyeast 2112 (California Lager) or White Labs WLP810 (San Francisco Lager) yeast (3-qt./3-L yeast starter)
1 cup corn sugar (for priming)

Step by Step

Heat 4.8 qts. (4.5 L) of water to 151 °F (66 °C). Place crushed grains in the grain bag, put the grain bag inside cooler and stir in water to hit initial mash temperature of 140 °F (60 °C). After 15 minutes of mashing, scoop out about a cup (240 mL) of the mash and combine it with 1.0 quart (~1 L) of water and the corn grits or rice in a soup pot. Heat the cereal mash slowly to a boil, stirring constantly. As an option, you can let the cereal mash rest at 158 °F (70 °C) for 5 minutes when heating. Boil cereal mash for 15 minutes, continuing to stir constantly, then quickly transfer to main mash. Stir thoroughly so main mash stabilizes at 152 °F (67 °C). Let this rest for 20 minutes. Recirculate and run off wort until you have roughly 2.25 gallons (8.5 L) of wort in your brewpot. Recirculate the wort by drawing off 1 cup of wort and returning it to the top of the mash. Repeat this step about 15 times. Run off the wort 1 or 2 cups at a time and place the wort in your kettle. (You can start heating the wort as soon as it is in the brewpot.) Then, replace the lost volume in the mash by adding 190 °F (87 °C) water to the top of the grain bed. (Do not stir the water into the grains, just pour it gently on top.) Add water and the dried malt extract to your brewpot to make 3.0 gallons (11 L) of wort. Boil for 60 minutes, adding hops at times indicated. With 15 minutes left in the boil, stir in the liquid malt extract, sugar, Irish moss and yeast nutrients. After boil, cool wort to 60 °F (16 °C) and transfer to fermenter. Top up to 5.0 gallons (19 L) with cold water. Aerate well and pitch yeast. Ferment at 60 °F (16 °C). Once primary fermentation has finished, let the beer sit on the yeast at fermentation temperature (or slightly higher), for 2 days. Then, rack to secondary and condition for 3 to 4 weeks at 40 °F (4.4 °C). Carbonate to 2.5 volumes of CO_2.

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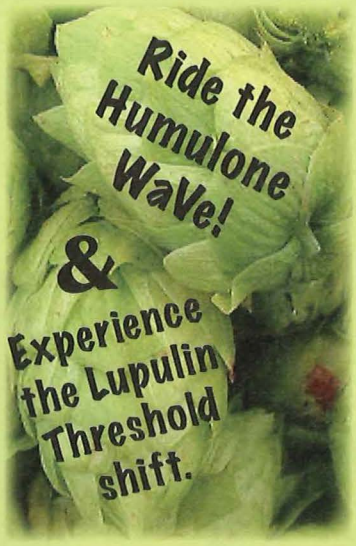

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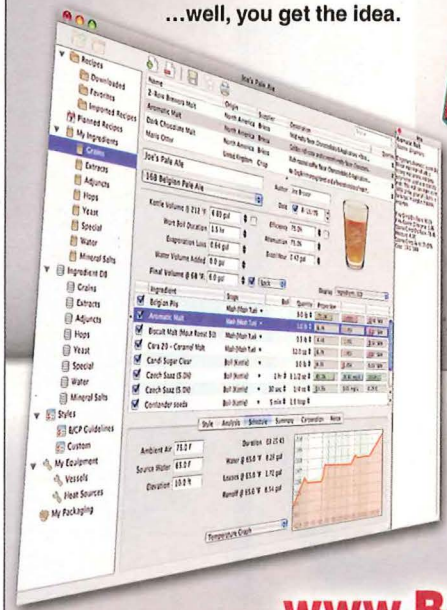

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"GIVE ME A WOMAN WHO LOVES BEER AND I WILL CONQUER THE WORLD"

— KAISER WILHELM II

IMPERIAL GERMAN BEERS

Russian Imperial Stout . . . that's what started it! In the late 18th and throughout the 19th Centuries, the Brits sent a dark and hefty brew of as much as OG 1.100 (25 °P) to the Czar of Russia and traded it mostly for fur. A Czar was, of course, a divine-right, absolute ruler, and, as stated in his official title, the "Emperor and Autocrat of All the Russias." If you send a beer to a person of such lofty rank, you'd better name it "imperial" and make it at once rich, opaque, and nourishing — and as dark and mysterious as the Russian soul itself.

Transportation, too, shaped the composition of the stouts (and porters, too) that were used in the Baltic trade. They had to be strong in alcohol, robust in bittering and high in gravity, because of the conditions they had to survive in merchant ships on their way to the frigid docks of St. Petersburg, at the mouth of the Neva River. On route, the waters were especially choppy through the Skagerrak, the Kattegat and Oresund Strait, three narrows between Denmark, Norway and Sweden that connect the North to the Baltic seas. There, storms are very common and temperatures are well below freezing much of the year . . . and the store houses of St. Petersburg were not known for their balmy conditions either.

The last of the Czars, Nicholas II, found his end at the hands of Bolshevik revolutionaries in 1917. However, the end of imperial rule did not spell the end of imperials brews. The Russian imperial stout from the Baltic trading days has emerged as a distinct, potent beer style that is still being lovingly replicated today as a winter brew by craft brewers throughout the world.

The Imperialization of Ales

If you can "imperialize" stouts, why not other ales, too? Leave it to democratic Americans to "monarchize" the world's traditional ales with a vengeance. Now we have imperial IPAs, imperial porters, imperial Scotch ales, imperial brown ales, and even the strangely contradictory-sounding imperial mild ales. These imperials tend to be extreme beers in just about any respect. More often than not, they are of wine-like alcoholic strength with a powerful, citrus-spicy hop-bitterness from American Northwest hop varieties. Bitterness in these brews is sometimes pushed to the limits. Designed as aggressive, IBU-strutting macho-suds, these modern American imperials seem to be born and raised at the frontier of brewhouse innovation. Frequently, they are capable of challenging the taste-bud tolerance of even the hardiest of drinkers.

In line with the tradition that got the imperial ball rolling in the first place, virtually all American high-gravity bombs of bitterness and ethanol are, stylistically, adaptations of the British ale heritage — slightly reminiscent of such partigyle, first-running creations as stock ales, old ales or barleywines. There are fewer German beer styles that American brewers have "imperialized." And, in general, European — and especially German — brewers have been much slower than their North American counterparts in catching the imperial wave.

Imperialized European Styles

Imperialization is the art of essentially exaggerating whatever characteristic is most defining of a style. So there ought to be no reason why styles other than Anglo-Saxon could not be imperialized. It seems that going for imperial German beers should be the obvious next step.

The Boston Beer Company figured this out a while back when it came out with its "Imperial Series." The series includes not only, as expected, a 9.2%-ABV Samuel Adams Imperial Stout, but also a 9%-ABV Samuel Adams Imperial White, an 8.8%-ABV Samuel Adams Hallertau Imperial Pilsner and a 9.5%-ABV Samuel Adams Double Bock. The Imperial White is an amped up version of a Belgian witbier and the Imperial Pilsner is heavily hopped with Hallertau. Though the Samuel Adams imperials rely on European rather than Northwest hops, they still try to emulate the extreme direction of hop character.

Rogue's Morimoto Imperial Pilsner clocks in at 18 °Plato (SG 1.074) and has 74 IBUs, all from Sterling hops. Sterling is an American-grown aroma hop variety that is similar in character to Saaz.

Pilsner isn't the only lager style that American brewers have imperialized. Avery Brewing has brewed The Kaiser Imperial Oktoberfest every year on August 1st since 2004. This amber lager is not highly hopped, but ranges from 9 to 10% alcohol by volume (ABV). (See the BYO clone of The Kaiser in the December 2006 issue. There's also a recipe for Odell's Double Pilsner in the same issue.)

Germans also brew a few ale styles, and these can be kicked up a notch, too. German hefeweizens typically weigh in at around 5% ABV, but Garrett Oliver of Brooklyn Brewery and Hans-Peter Drexler of G. Schneider and Sohn Brauerei collaborated to produce Hopfen Weisse. The different versions of this beer have hovered around 8% ABV and are dry hopped — either with a variety of American hops or German Saphir.

Universal Imperialization

Imperialization may not be subtle or balanced, but the result must still taste

Continued on page 35

KAISER BEER RECIPES

Pickelhaube KaiserKölsch

(5 gallons/19 L, all-grain)
OG = 1.074 FG = 1.014
SRM = 3.8 IBU = 50 ABV = 7.8%

Ingredients

15 lbs. (6.8 kg) Weyermann Bavarian Pilsner malt (1.7 °L)
11 AAU Tettnanger hops (75 mins) (2.75 oz./78 g of 4% alpha acid) (alternately, use 0.8 oz/23 g of Magnum hops at 13.5% alpha acids)
3.0 oz. (85 g) Tettnanger (5 mins)
1 tsp. Irish moss (15 mins)
White Labs WLP029 (Kölsch) or Wyeast 2565 (Kölsch) yeast (6-qt./6-L yeast starter)
1 cup corn sugar (for priming)

Step by Step

Continuous infusion is a very efficient mashing process for obtaining optimum extract results, particularly with a very large grist bill. Start with a very thick dough-in at approximately 100 °F (38 °C), followed by a hydration rest of about an hour or longer. In Germany, brewers sometimes even let the mash sit overnight to hydrate.

Once the grain is thoroughly hydrated, increase the mash temperature continually and gradually, at a rate of no more than 1 °F (½ °C) per minute, by infusing it very slowly with near-boiling water, while stirring slowly and frequently throughout.

Apply gentle heat to the mash, stir it frequently to avoid hot spots, and infuse it at a trickle with near-boiling water. Adjust the flow rate of the water so that you reach a thin mash at about 170–172 °F (77–78 °C) within about 90 minutes (longer is OK, too). Expect to use about two-thirds or more of your total brewing liquor. Before lautering and sparging, recirculate the wort until it runs clear. Sparge for about 90 minutes (again, longer is OK), while maintaining the mash-out temperature.

Boil the heavy wort for about 90 minutes. Add the bittering hops about 15 minutes into the boil, the Irish moss about an hour into the boil and the final hop addition five minutes before shut-down. After shut-down, let the wort rest for about 30 minutes for improved trub sedimentation. Then rack the wort off the trub and heat-exchange it to 60 °F (16 °C). Because of the high gravity, pitch three packages of yeast, or make the 6-qt. (6-L) yeast starter and aerate twice as long as you normally would. Aerate again the following day. Proper aeration is crucial to give the yeast a healthy and vigorous start. Primary fermentation (at 60 °F/16 °C) is complete when the brew reaches final gravity. This may take as much as two weeks.

Once the brew is still, allow the sediment to settle for a few days. It is important for the clean taste of the finished beer to allow all spent yeast and debris to settle out. Then rack the brew and reduce the temperature by 2–3 °F (1–1.5 °C) a day to as low a temperature as your equipment allows, preferably all the way to the freezing point. A lagering refrigerator is, of course, ideal for this phase, however, if you do not have the equipment to control the temperature reduction, wait another two weeks and then crash the temperature, if you can. Let the brew mature at the lager temperature for at least three weeks, but preferably two months. Then rack it again and prime it for packing or condition it with CO_2 in a keg. If the beer is to be bottled, it may aid in priming the brew if you add about 2 qts. (2 L) of fresh pale wort with some active yeast as a Speise and then let the bottles condition at room temperature for about two weeks.

Pickelhaube KaiserKölsch

(5 gallons/19 L, extract)
OG = 1.074 FG = 1.014
SRM = 5–6 IBU = 50 ABV = 7.8%

Ingredients

11.5 lbs. (5.2 kg) Weyermann Bavarian Pilsner liquid malt extract
12 AAU Tettnanger hops (60 mins) (3.0 oz./85 g of 4% alpha acid) (alternately, use 0.89 oz/25 g of Magnum hops at 13.5% alpha acids)
3.0 oz. (85 g) Tettnanger (5 mins)
1 tsp. Irish moss (15 mins)
White Labs WLP029 (Kölsch) or Wyeast 2565 (Kölsch) yeast (6-qt./6-L yeast starter)
1 cup corn sugar (for priming)

Step by Step

Mix approximately half of the liquid malt extract with 3.0 gallons (11 L) of brewing water in the kettle. Boil the wort for 60 minutes. Add hops and Irish moss at times indicated. At shut down, stir in the remaining malt extract and let the brewpot sit, with the cover on, for 15 minutes before cooling the wort. Transfer the chilled wort to your fermenter and top up with cool water to 5.0 gallons (19 L). For the details regarding fermentation and conditioning, follow the remaining instructions in the all-grain recipe.

Hohenzollern Kaiser-Pils

(5 gallons/19 L, all-grain)
OG = 1.078 FG = 1.012–1.014
SRM = 4.6 IBU = 75 ABV = 8.4%

Ingredients

15 lbs. 14 oz. (7.2 kg) Weyermann Bavarian Pilsner malt (1.7 °L)
15 AAU Tettnanger hops (60 mins) (3.75 oz./106 g of 4% alpha acid) (alternately, use 1.1 oz./31 g of Magnum hops at 13.5% alpha acids)
2.0 oz. (56 g) Tettnanger hops (20 mins)
2.0 oz. (56 g) Hallertauer Mittelfrüh hops (5 mins)
1 tsp. Irish moss (15 mins)
0.5 tsp yeast nutrients (15 mins)
Wyeast 2042 (Danish Lager) yeast (10-qt./10-L yeast starter)
1 cup corn sugar (for priming)

Step by Step

Start with a very thick dough-in at approximately 100 °F (38 °C), followed by a hydration rest of about an hour or longer. In Germany, brewers sometimes let the mash sit overnight to hydrate.

Once the grain is thoroughly hydrated, increase the mash temperature continually and gradually, at a rate of no more than 1 °F (½ °C) per minute, by infusing it very slowly with near-boiling water, while stirring slowly and frequently throughout.

Apply gentle heat to the mash, stir it frequently to avoid hot spots, and infuse it at a trickle with near-boiling water. Adjust the flow rate of the water so that you reach a thin mash at about 170–172 °F (77–78 °C) within about 90 minutes (longer is OK, too). Expect to use about two-thirds or more of your total brewing liquor. Before lautering and sparging, recirculate the wort until it runs clear. Sparge for about 90 minutes (again, longer is OK), while maintaining the mash-out temperature.

Boil the heavy wort for about 90 minutes. Add the bittering hops about 30 minutes into the boil and the second hop addition of flavor hops about 20 minutes before shut down. Add Irish moss and yeast nutrients with 15 minutes left in the boil and the final hop addition five minutes before shut-down. After shut-down, let the wort rest for about 30 minutes for improved trub sedimentation. Then rack the wort off the trub and heat-exchange it to 50 °F

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(10 °C). Because of the high gravity, pitch five packages of yeast, or make the 10-qt. (10-L) yeast starter, and aerate twice as long as you normally would. Aerate again the following day. Proper aeration is crucial to give the yeast a healthy and vigorous start. Ferment at 50 °F (10 °C) until fermentation is complete. Once the brew is still, allow the lees to settle for a few days. Then rack the brew and give it a diacetyl rest at 65 °F (18 °C) for about two to three days, after which you should reduce the temperature by 2–3 °F (1–1.5 °C) a day to as low a temperature as your equipment allows, preferably all the way to the freezing point. Let the brew mature at the lager temperature for at least four weeks, but preferably two to three months. Rack it again and prime it for packing or condition it with CO_2 in a keg. If the beer is to be bottled, it may aid in priming the brew if you add about half a gallon or two liters of fresh pale wort with some active yeast as a Speise and then let the bottles condition at around room temperature for about two weeks.

Hohenzollern Kaiser-Pils

(5 gallons/19 L, extract)
OG = 1.078 FG = 1.012–1.014
SRM = 6 IBU = 75 ABV = 8.4%

Ingredients

11 lb. 12 oz. (5.3 kg) Weyermann Bavarian Pilsner liquid malt extract
15 AAU Tettnanger hops (60 mins) (3.75 oz./106 g of 4% alpha acid) (alternately, use 1.1 oz./ 31 g of Magnum hops at 13.5% alpha acids)
2.0 oz. (56 g) Tettnanger hops (20 mins)
2.0 oz. (56 g) Hallertauer Mittelfrüh hops (5 mins)
1 tsp. Irish moss (15 mins)
0.5 tsp yeast nutrients (15 mins)
Wyeast 2042 (Danish Lager) yeast (10-qt./10-L yeast starter)
1 cup corn sugar (for priming)

Step by Step

Mix approximately half of the liquid malt extract with 3.0 gallons (11 L) of brewing water in the kettle. Boil the wort for 60 minutes. Add hops, Irish moss and yeast nutrients at times indicated. At shut down, stir in the remaining malt extract and let the brewpot sit, with the cover on, for 15 minutes before cooling the wort. Transfer the chilled wort to

Continued on page 36

appealing. Cascade, Cascade and more Cascade is clearly one way of imperializing any brew, apart from the high ethanol levels, of course. But there are other ways of doing it. If you imperialize a Bohemian Pilsner, clearly "over-Saazing" is the way to go. Likewise, an imperial Helles would best be a brew with very strong malt and hop aromas in the finish . . . actually, in my book, doppelbock is already a traditional form of imperializing a Bavarian quaffing brew. A fruity Kölsch or an edgy, crisp, clean Pils, on the other hand, should probably be extremely noble-citrusy upfront. By the same logic, an extreme altbier would be more like a clean ale version of a doppelbock, but with a bit more hops. If Northwest hops is the main weapon of the American imperializing brewer, noble hops would be the weapon of choice of the German imperializer.

Imperializing German Styles

With these precepts in mind, let's explore a few German styles and figure out how we can imperialize them. But first some terminology: If the Czar is the "Emperor and Autocrat of All the Russias" and thus deserving of having a brew named after his rank, any German imperial brew ought to be called, well . . . KaiserBier, because "Kaiser" is the German word for emperor. The last of the German Kaisers was crusty old Wilhelm II of the Hohenzollern dynasty, most famous for wearing a Pickelhaube, a German pointy military helmet, to formal occasions, and, of course, for losing World War I. He abdicated in disgrace in 1918. So I call my imperial German pale ale Pickelhaube KaiserKölsch, my hop-accented imperial German pale lager Hohenzollern KaiserPils for the Prussian dynasty Wilhelm II came from, and my imperial German amber lager simply KaiserBock.

The Pickelhaube KaiserKölsch is basically a "double" kölsch, but heavy on noble German, instead of Northwest American, hops; the Hohenzollern KaiserPils is an edgy "double" northern German Pils; and the KaiserBock an aroma-hopped "double" strong amber lager. These brews, unlike conventional (if that's the right word) American imperials, stress not only up-front bitterness, but also "imperial" aroma in the finish.

Brewing Considerations

If you are formulating an imperial German style yourself, start with the grain bill. Adding Pilsner malt, while leaving the amounts of specialty malts (or Vienna, Munich or rauchmalz) untouched will increase your original gravity. It will also increase your final gravity (FG) and add a bit of color.

There's no rule regarding how much you need to boost the starting gravity. Sometimes imperial beers are called "double" their base style — for example, double IPA — but they are rarely actually twice as strong. For good measure, you'll probably want to go at least a couple of degrees Plato over the top end of the style guidelines for the type of beer.

With the slight bit of added color and higher FG from the extra Pilsner malt, you may want to consider decreasing the amount of specialty malt so the beer

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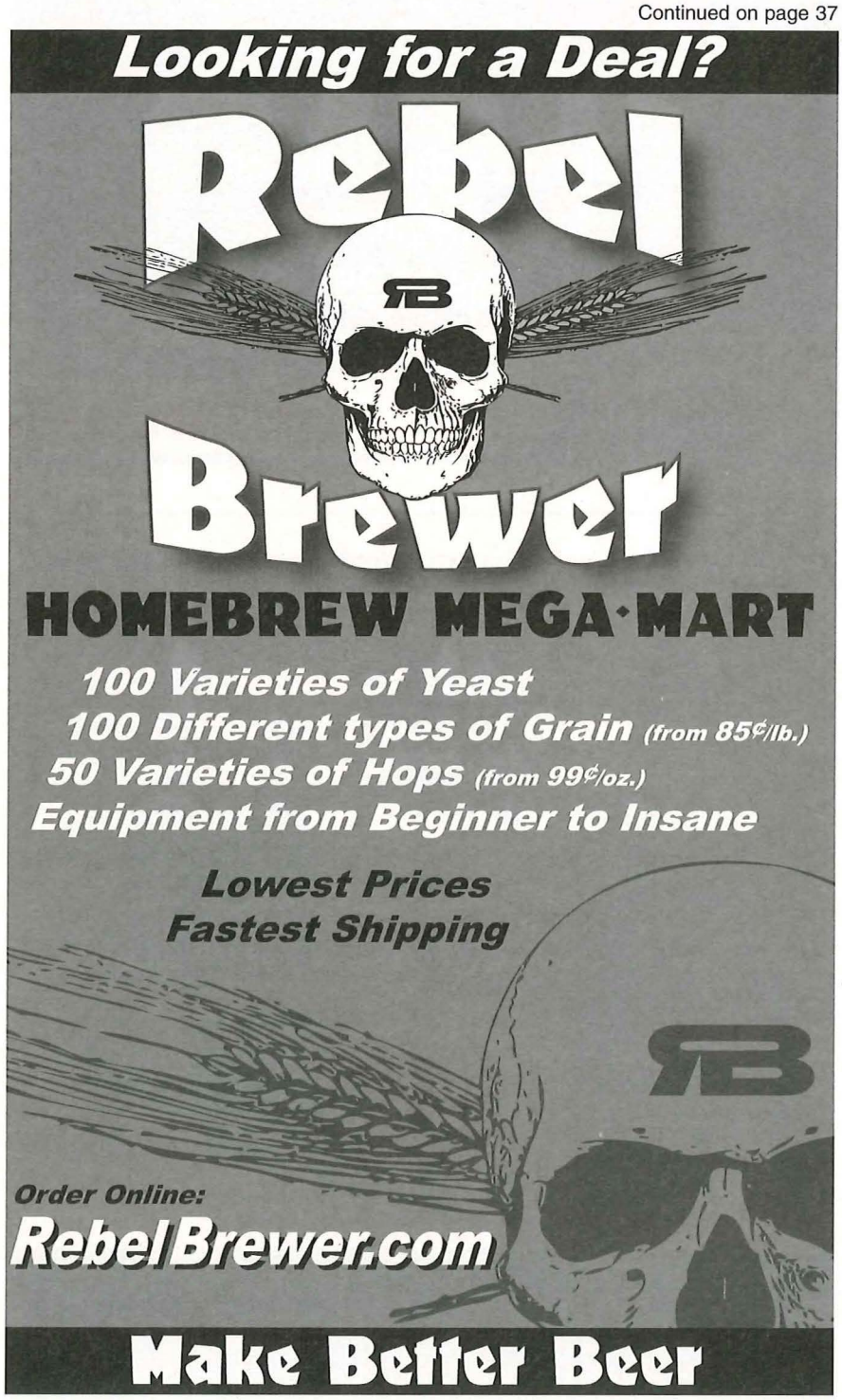

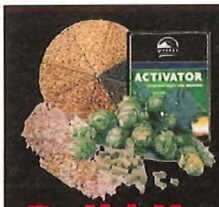

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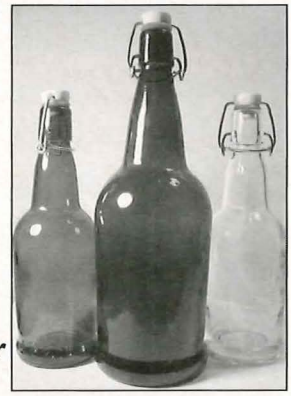

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your fermenter and top up with cool water to 5.0 gallons (19 L). For fermentation and lagering instructions, follow the remaining portion of the all-grain recipe on page 33.

KaiserBock

(5 gallons/19 L, all-grain)
OG = 1.068 FG = 1.018
IBU = 40 SRM = 26 ABV = 6.4%

Ingredients

8 lb. 10 oz. (3.9 kg) Weyermann Bavarian Pilsner malt (1.7 °L)
2 lb. 5 oz. (1.1 kg) Carafoam® malt (2 °L)
1 lb. 12 oz. (0.79 kg) Weyermann Munich I malt (6 °L)
1 lb. 8 oz. (0.69 kg) Carared® malt (20 °L)
3.7 oz. (104 g) de-husked Carafa® Special Type I malt (320 °L)
1 AAU Hallertauer Mittelfrüh, Hersbrucker or Mt. Hood hops (75 mins)
(0.25 oz./7.1 g of 4% alpha acid)
5.0 oz. (142 g) Hallertauer Mittelfrüh, Hersbrucker or Mt. Hood hops (20 mins)
1 tsp. Irish moss (15 mins)
White Labs WLP820 (Oktoberfest), White Labs WLP 920 (Old Bavarian), or Wyeast 2206 (Bavarian) yeast
(8-qt./8-L yeast starter)
1 cup corn sugar (for priming)

Step by Step

Start with a very thick dough-in at approximately 100°F (38°C), followed by a hydration rest of about an hour or longer. Once the grain is thoroughly hydrated, increase the mash temperature continually and gradually, at a rate of no more than 1 °F (½ °C) per minute, by infusing it very slowly with near-boiling water, while stirring slowly and frequently throughout. Apply gentle heat to the mash, stir it frequently to avoid hot spots, and infuse it at a trickle with near-boiling water. Adjust the flow rate of the water so that you reach a thin mash at about 170 –172 °F (77–78 °C) within about 90 minutes. Before lautering and sparging, recirculate the wort until it runs clear. Sparge for about 90 minutes, while maintaining the mash-out temperature.

Boil the wort for about 90 minutes. Add the bittering hops about 15 minutes into the boil and the flavor hops and Irish moss about 20 minutes before shut down. After shutdown, let the wort rest for about 30 minutes for improved trub sedimentation. Then rack the wort off the trub and heat-exchange it to 55 °F (13 °C). Because of the high gravity,

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doesn't get too chewy. On the other hand, more body and color isn't always a bad thing in a strong beer.

If you want the beer to start at a higher gravity, but finish at a gravity in the ballpark of the base beer style, you may want to consider adding some adjunct — either flaked maize in the mash or sugar in the kettle. This is definitely a non-traditional, non-Reinheitsgebot compliant option, but worth considering if you like your beers on the drier side.

When formulating your recipe, keep in mind that it will take about a gallon of mash tun space for every 2.5 lbs. of grain (3.5 L/kg), given a thick mash. For thinner mashes, or step mashes that use boiling water to raise the temperature, you'll need more space. If your grain bill exceeds the ability of your mash tun to hold it, scale back and supplement your wort with malt extract.

If you are making your wort mostly or entirely from malt extract, keep in mind that a very thick wort will darken considerably during the boil. Likewise, your hop utilization will suffer increasingly as wort density increases. The closer you can come to a full-wort boil, the better off you will be. Consider also withholding some of your malt extract until near the end of the boil. This will make for a lighter beer and ensure better utilization of your hops.

Obviously, the better extract efficiency you achieve, the better off you will be when brewing extremely big beers. If you can run off wort at a very high gravity, you will not have to boil excessively to reduce the wort to its target volume and gravity. To increase your extract efficiency, consider crushing your malt more finely, stirring the mash during your saccharification rest and sparging more slowly.

The mash program you choose will affect the fermentability of your wort. For big beers, choosing a mash that produces very fermentable wort will keep the beer from being too sweet. At a minimum, mash on the low end of the saccharification range (148–150 °F/64–66 °C). Better yet, perform a step mash with a rest in the 140–145 °F (60–63 °C) range. For the recipes that accompany the article, I've chosen a continuous infusion mash, in which the temperature of the mash is raised slowly from 100 to 170 °F (38 to 77 °C). This should result in high extract efficiency and a highly fermentable wort.

An imperialized German beer would best be hopped with traditional noble hops, such as Hallertau, Tettnanger or Saaz. However, the average alpha acid rating of these hops is fairly low, usually in the neighborhood of 3– 5% alpha acids. So, although these noble hops can be used for late addition hops, you may want to consider using higher-alpha hops for bittering. This will minimize the amount of wort lost to absorption by the hops. Perle is a German hop variety with typical alpha acid levels from 6–8%. Magnum is a high-alpha variety with alpha acid levels in the 12–15% range. Either of these would be great for bittering.

As for yeasts in imperialized brews, there appears to be no reason to make a change from the base style: a Bohemian yeast for an imperial Bohemian; a crisp-fermenting lager yeast for an imperial Pils;

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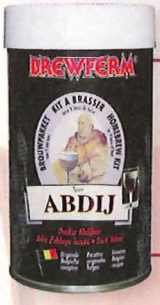

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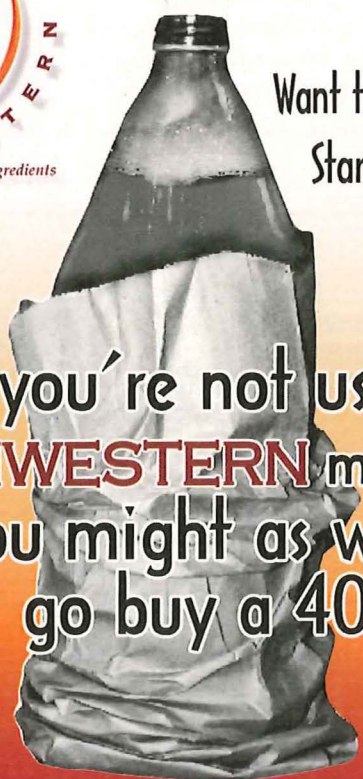

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pitch three packages of yeast, or make the 8-qt. (8-L) yeast starter, and aerate twice as long as you normally would. Aerate again the following day. Proper aeration is crucial to give the yeast a healthy and vigorous start. Primary fermentation is complete when the brew has reached final gravity. Once the brew is still, allow the lees to settle for a few days. Then rack the brew and give it a diacetyl rest at room temperature for about two to three days, after which you should reduce the temperature by 2–3 °F (1–1.5 °C) a day to as low a temperature as your equipment allows, preferably all the way to the freezing point. Let the brew mature at the lager temperature for at least three weeks, but preferably two months. Then rack it again and prime it for packing or condition it with CO_2 in a keg. If the beer is to be bottled, it may aid in priming the brew if you add about half a gallon or two liters of fresh pale wort with some active yeast as a Speise and then let the bottles condition at room temperature for about two weeks.

KaiserBock

(5 gallons/19 L, extract)
OG = 1.068 FG = 1.018
IBU = 40 SRM = 26 ABV = 6.4%

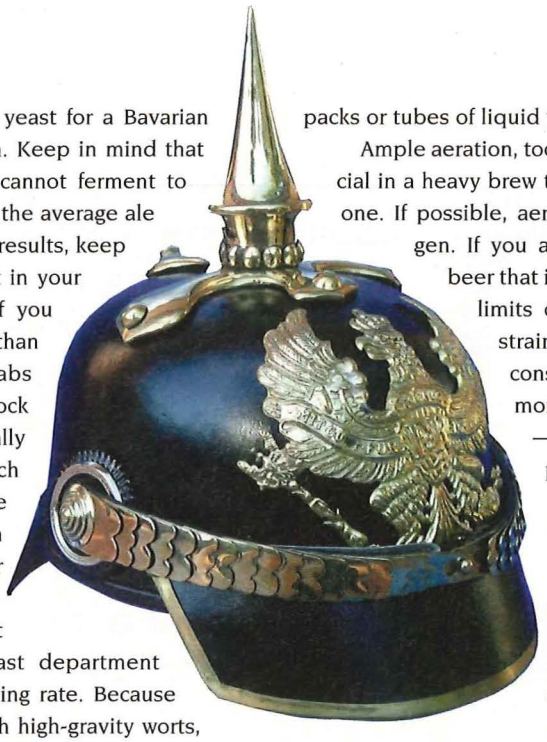
Ingredients

10 lb. 4 oz. (4.7 kg) Weyermann Munich Amber liquid malt extract
2.4 fl. oz. (72 mL) SINAMAR® liquid malt color
1 AAU Hallertauer Mittelfrüh, Hersbrucker or Mt. Hood hops (60 mins)
(0.25 oz./7.1 g of 4% alpha acid)
5.0 oz. (142 g) Hallertauer Mittelfrüh, Hersbrucker or Mt. Hood hops (20 mins)
1 tsp. Irish moss (15 mins)
White Labs WLP820 (Oktoberfest), White Labs WLP 920 (Old Bavarian), or Wyeast 2206 (Bavarian) yeast
(8-qt./8-L yeast starter)
1 cup corn sugar (for priming)

Step by Step

Mix approximately half of the liquid malt extract with 3.0 gallons (11 L) of brewing water in the kettle. Boil the wort for 60 minutes. Add hops, Irish moss and yeast nutrients at times indicated. At shut down, stir in the remaining malt extract and let the brewpot sit, with the cover on, for 15 minutes before cooling the wort. Transfer the chilled wort to your fermenter and top up with cool water to 5.0 gallons (19 L). See all-grain recipe for fermentation instructions.

a healthy Bavarian yeast for a Bavarian imperial; and so on. Keep in mind that most lager strains cannot ferment to the ABV levels that the average ale yeast can. For best results, keep the alcohol content in your lagers under 9%. If you plan to go bigger than this, White Labs WLP833 (German Bock Lager) and especially WLP885 (Zurich Lager) can produce more alcohol than most typical lager strains.



The biggest change in the yeast department would be the pitching rate. Because you are dealing with high-gravity worts, always be generous with your yeast cell count to ensure an early and vigorous start of fermentation. For a lager with an expected 7 to 8% ABV, you'll need the yeast from at least 2.0 gallons (~8 L) of well-aerated starter wort or four smack packs or tubes of liquid yeast.

Ample aeration, too, is more crucial in a heavy brew than in a light one. If possible, aerate with oxygen. If you are brewing a beer that is pushing the limits of your yeast strain, you might consider aerating more than once — right before pitching your yeast and a few hours later. Do not aerate once fermentation has started.

A few hours prior to pitching, acclimate your yeast to the fermentation temperature it will encounter. Don't take the time to make a big starter, only to have a large portion of the yeast shocked or killed by pitching room temperature yeast into 50 °F (10 °C) wort. On brewday, place the yeast starter in your fermentation chamber, or outside if ambient temperatures are in the low 50s °F (10–12 °C). Pitch only the slurry from the starter, so you don't dilute your imperialized wort with humble, low-gravity starter beer.

As with any beer that may tax the yeast, adding some yeast nutrient will help the yeast complete their task. Adding a half teaspoon of Wyeast Yeast Nutrient or a capsule of White Labs Servomyces to a 5-gallon (19-L) batch will give your yeast the zinc and other nutrients they need to ferment the wort in a timely manner and reach a reasonable finishing gravity. Yeast nutrient is not, however, a substitute for pitching the proper amount of yeast. Finally, dosing your nearly finished beer with actively fermenting kräusen beer can help finish the fermentation and will also help clean up any residual diacetyl.

Horst Dornbusch is a frequent contributor to Brew Your Own *magazine.*

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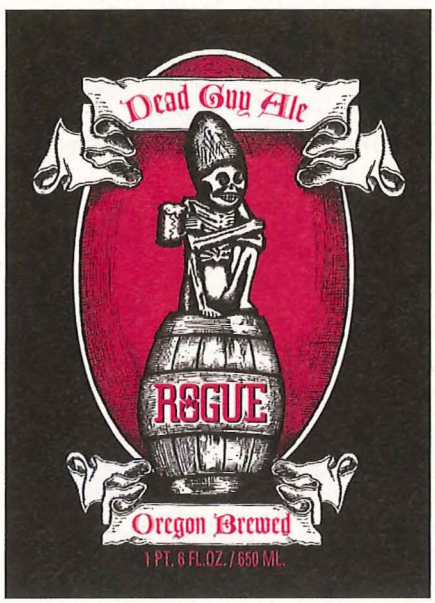
Story by **STEVE BADER**

SEND IN THE CLONES

AS HOMEBREWERS, WE ARE ALWAYS LOOKING FOR NEW RECIPES. AS A HOMEBREW SHOP OWNER, MY STAFF AND I GET MANY REQUESTS EACH WEEK FOR RECIPES OF LOCAL PORTLAND OR SEATTLE AREA BEERS THAT PEOPLE LOVE. SO, OVER THE LAST 18 YEARS, WE HAVE WRITTEN MANY RECIPES FOR CUSTOMERS TO REPLICATE THEIR FAVORITE LOCAL BEER. HERE IS HOW WE DO IT.

"WITH ALL THE INFORMATION AND TOOLS AT OUR DISPOSAL, FORMULATING CLONE RECIPES IS EASIER THAN EVER"



Initially, my recipes were written more by "feel" than any basis in deep homebrewing knowledge. Back in 1992, there was very little homebrewing literature to help us to understand the various components in beer. While there were a few books in print, none were geared toward recipe formulation.

Over the years, through experience, trial and error — and reading everything I could on the subject — I learned more on how to formulate recipes. And of course, I got some practice while I served as *Brew Your Own*'s "Replicator" from 2001 to 2006.

While this article focuses on recipe formulation, I would like to point out that recipes themselves do not make great beer — they need to be brewed well. This is no different than food recipes. Skilled cooks make great food and skilled brewers make great beer!

For some commercial beers, there are variables you cannot replicate at home. For example, the brewery may ferment with a proprietary yeast strain or use a piece of equipment you don't have (such as a hopback). However, with some good information and attention paid to detail during brewing, homebrewers have found out that they can make clone brews that are very respectable facsimilies of their commercial counterparts.

Today, we have many tools to use to produce recipes. Brewery web sites are a great starting point, and for most kinds of beer there are a variety of published recipes for that style. Brewing software like Promash, BeerTools, BeerSmith and others make recipe formulation easier than ever. These software tools are excellent at calculating beginning wort specific gravities and estimated hop bitterness in the beer we are making. They also give you an estimated color. With all the information and tools at our disposal, formulating clone recipes is easier than ever.

LET'S GET STARTED!

Once you have decided what beer you want to brew, the first step in replicating a beer at home is to gather as much information about the beer as possible. Today we are lucky that most breweries have websites to promote their beer. Some websites are more homebrewer friendly than others. The best ones for homebrewers not only give you the marketing descriptions that make you drool, but also give you some of the factual information to help you formulate the recipe.

If you can, talk directly to the brewer — this is the best source of information for you. Since most craft brewers started as homebrewers, many of them are often willing to talk to you about their beers and are flattered that you like it so well you are interested in brewing a batch. Having dinner and a few pints of beer at their brewpub is a nice show of support for their business and may make them more interested in visiting with you and sharing information.

The primary information you are after is the original and final specific gravities (sometimes given in degrees Plato), the IBU rating of the beer, hop varieties and their usage, types of malt and the percentage of the grist each represents and finally the suggested yeast strain to use. You should also try to find out the key details of the brewing process — mash temperature, boil length and fermentation temperature. If you can get this information, you are in great shape.

Secondary information that is helpful is any unusual brewing methods that are used in brewing these beers or additional ingredients used. It could be mash regimes, mash thicknesses, pitching rates, additional lagering time, dry hopping or any of a variety of other

THE ANATOMY OF FORMULATING A CLONE RECIPE

Images Courtesy of Rogue Brewery

brewing techniques. Finally, of course, repeated evaluation of the beer in question helps you to pick out the flavors you love in the beer, and what you want to replicate.

Let's Formulate a Clone Recipe

In the Pacific Northwest, Rogue Brewery is a popular brewery. Let's use their Dead Guy Ale as an example of how to clone a beer. Rogue has a great website that is useful for gathering information on their beers. For the sake of this article, we'll rely solely on information from the website, which can be found at www.rogue.com. (Normally, for a clone recipe published in *Brew Your Own*, we ask the brewer for help.) Click on the "Dead Guy Ale" link for the information pertinent to our clone.

No matter what type of brewer you are — extract or all-grain — the process begins with formulating an all-grain recipe. If you're an extract brewer, you will later convert the all-grain recipe to its extract equivalent.

Let's start with the malt. The website lists the original gravity as 16 °Plato. The Plato scale is another way of describing wort density, just like the specific gravity scale that homebrewers are familiar with. To get an approximate conversion between the two, multiply the value in degrees Plato by 4. This number then becomes the last two digits in the specific gravity, when expressed in the usual four digit manner. For example, 16 times 4 equals 64, or a specific gravity of 1.064. For a more accurate conversion, many homebrewing texts have a conversion table. If you

ROGUE DEAD GUY ALE CLONE (5 gallons/19 L, extract with grains)

OG = 1.065 FG = 1.015 IBU = 40 SRM = 16 ABV = 6.6%

Ingredients

3.3 lbs. (1.5 kg) light malt extract syrup
2.25 lbs. (1.0 kg) light dried malt extract
2.5 lbs. (1.1 kg) Munich liquid malt extract
1.25 lbs. (0.57 kg) Carastan malt
11 AAU Perle Hops (60 mins)
(1.6 oz./45 g of 7% alpha acids)
1.0 oz. (28 g) Saaz hops (0 mins)
1 tsp. Irish moss (15 mins)
0.5 tsp. yeast nutrient (15 mins)
Wyeast 1764 (Rogue Pacman Ale) yeast
(2.5-qt./2.5-L yeast starter)
1.0 cup corn sugar (for priming)

Step-by-step

Steep crushed grain in 1.0 gallon (3.8 L) of 152 °F (67 °C) water for 30 minutes. Remove the grain from the wort, then add the dried malt extract and Munich malt extract. Add water to make 3.0 gallons (11 L) and bring to a boil. Add Perle boiling hops and boil for 60 minutes. Add light liquid malt extract, yeast nutrient and Irish moss with 15 minutes left in the boil. Add Saaz aroma hops at the end of the boil. Cool your wort and transfer to fermenter. Top off to 5.0 gallons (19 L) with cool water. Aerate well and pitch your yeast. Ferment at 60 °F (16 °C). Bottle with corn sugar.

All-grain version:

Treat 10 gallons (38 L) of soft water (carbonates < 25 ppm) with 2 tsp. calcium chloride. Substitute 8.75 lbs. (4.0 kg) of pale malt and 4.0 lbs. (1.8 kg) of Munich malt (10 °L) for the malt extracts. Mash the grains for 60 minutes at 152 °F (67 °C) in 18 qts. (17 L) of water. Collect approximately 7.0 gallons (26.5 L) of wort and boil 90 minutes, adding hops at times indicated. Ferment at 60 °F (16 °C).

do, you'll see that 16 °Plato converts to 1.065. The "4X" approximation gives an exact result when the beer is at 10 °Plato (SG 1.040), but gets progressively worse as wort density increases.

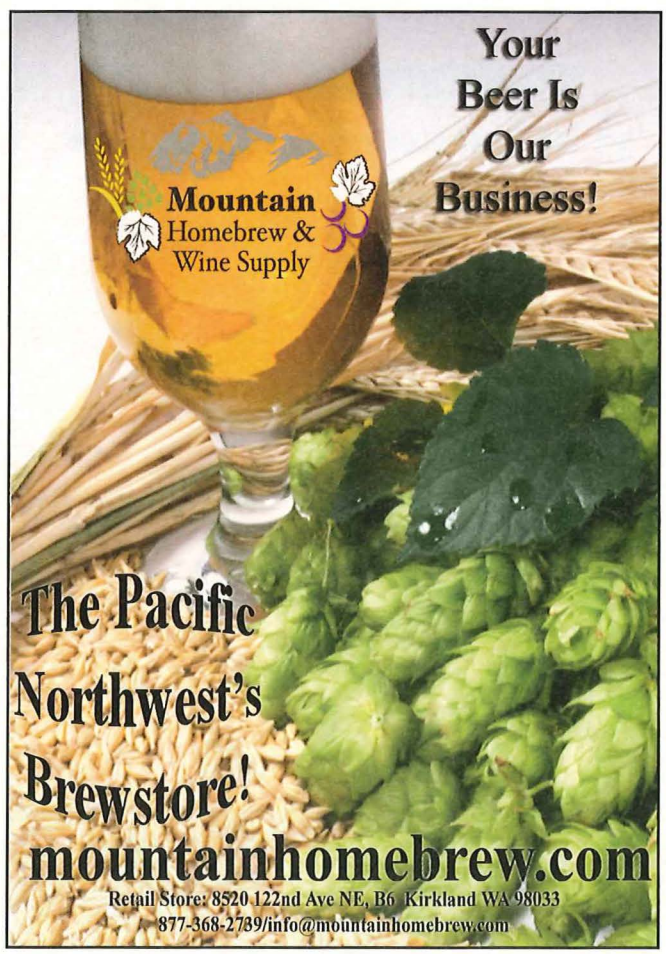
The Rogue website lists Klages, Harrington, Munich and Carastan as the malts used. Klages and Harrington are varieties of barley. When a barley variety is mentioned, this indicates a pale malt. Carastan is a type of crystal malt, whose color is usually around 30 °L. It would be great to know how much of each grain, but this isn't indicated. Not to worry. Virtually all beers use around 80% to 100% base malts, with the remaining specialty malts rounding out the grain bill. The base malt is usually a pale malt, but can also be a slightly darker malt such as Vienna or Munich. From the website, we also know that the color of Dead Guy Ale is 16 °Lovibond (roughly 16 SRM) and the beer is brewed as an ale version of a Maibock. Using brewing software can help us come up with a grain bill.

If the software has a setting for the type of brewing you do (all-grain, extract or mini-mash) choose the setting that fits your brewing style. This is important, since this typically turns on the "extract efficiency" setting. This is a value between zero and 100, and means the percentage of sugars that you extract from the malted grains you are using.

A typical value to start with is 65–70% for homebrewers, with most brewpubs getting around 80% or so and 90% or more being typical for larger regional craft breweries. (65% is the value *Brew Your Own* magazine uses in its recipes.) This means the average homebrewer needs to use a bit more grain to get the same sugar extraction from the grain.

For our first stab at a Dead Guy recipe, let's use 90% base grains, with the last 10% being the other specialty malt (Carastan). If we use 1.25 lbs. (0.57 kg) of Carastan malt, and fill out the rest of the recipe with only pale malt, we get a beer with an SRM of 12. Gradually substituting Munich malt into the recipe shows that by adding 4.0 lbs. (1.8 kg) of Munich, along with 8.75 lbs. (4.0 kg) of pale malt, we end up at 16 SRM. So, this gives us a grist that is consistent with the website information and in the ballpark of a typical Maibock recipe. Our recipe has more crystal malt than is usual for a Maibock, but our color target is also significantly darker. In addition, our grain bill is reasonable — many amber beers contain approximately 10% crystal malt.

Of course, other combinations of these grains can also yield a wort of 1.065 and a color of 16 SRM. You could, for example, decrease the amount of Carastan slightly and bump up the amount of Munich quite a bit. Conversely, you could increase the amount of Carastan slightly and reduce the Munich a great deal. I chose the 4.0 lbs. (1.8 kg) of Munich malt and 1.25 lbs. (0.57 kg) of Carastan malt since I wanted the maltiness of the Munich to be stronger than the caramel/toffee flavor of the more strongly-flavored Carastan malt. Having some experience with previous brews using Munich and light crystal malts would obviously help guide your recipe formulation. At some point, when information is absent, you just need to make a decision — if your recipe is con-



sistent with the information you have, and seems reasonable in terms of the beer style and what you know about the brewing ingredients, it's time to brew it. After brewing the beer and tasting it, you may need to adjust your recipe to get a better clone. However, if you have a reasonable-looking recipe, you shouldn't fear brewing a bad batch of homebrew.

For the sake of argument, let's say that you do know the percentage of each grain — how do you formulate a grain bill based that information?

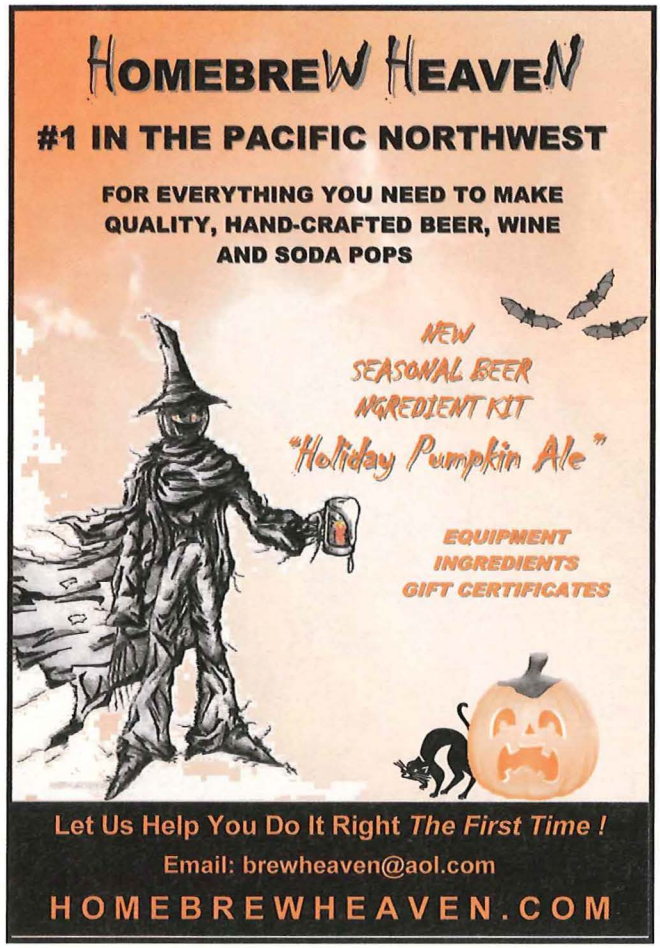
Arriving at a homebrew grain bill from a commercial formulation is a two step process. First, you formulate a homebrew-scale recipe at the extract efficiency of the commercial brewer. Next, you adjust the recipe to account for the extract efficiency you achieve, if needed.

For example, let's say the brewer specifies a grist of 92% Pilsner malt and 8% CaraMunich, with a starting gravity of 13 °Plato (OG 1.052). First, set the extract efficiency in your brewing software to the extract efficiency the commercial brewer achieves. (If you don't have this information, use 80% for a brewpub or 90% for a microbrewery.) Then, formulate your grain bill.

To do this, add pale malt alone until you reach the target original gravity. Let's say that it takes 11 lbs. (5.0 kg) of pale malt to reach our 13 °Plato target. This amount times 0.92 is 10.12. Likewise, 11 times 0.08 is 0.88. So, your grain bill would be 10.12 lbs. (4.6 kg) of Pilsner malt and 0.88 lbs. or (0.4 kg) of CaraMunich. Brewers using English units will need to convert the decimal portion of a weight in pounds to ounces. To do this, remember that there are 16 ounces in a pound. So, multiply just the decimal part of the number by 16 to get the number of ounces. In our example, we had 10.12 lbs. of pale malt. If you multiply 0.12 times 16, you get 1.92. Thus, 10.12 lbs. is equivalent to 10 lbs. 2 ounces (after rounding to the nearest ounce).

Sometimes, if the recipe contains a lot of specialty malts, your original gravity will be slightly low. This is because specialty malts have a lower potential extract than pale malt. If this is the case, you can just add pale malt to make up the small difference or multiply the amount of each ingredient by the target original gravity divided by the original gravity of the recipe as formulated by this method. For example, let's say we typed in our two ingredients and the software calculated an OG of 1.051 instead of our target of 1.052. If this was the case, we would multiply the amounts of both grains by 52/51. In most realistic cases, this would be an exceedingly slight adjustment of grain amounts. Finally, adjust the extract potential on your software to reflect the value you achieve on your system and add pale malt to reach your target original gravity.

To convert an all-grain recipe to its extract equivalent, remove the base grains and add a sufficient amount of light malt extract to reach your target specific gravity. In our case, we'll need both light malt extract for the pale malt and Munich malt extract for the Munich malt. So, remove the pale malt from the recipe, then add malt extract until you reach 1.065. Then, delete the Munich malt and add in Munich malt extract until you reach 1.065 again. The Carastan malt will be steeped.



Since extracts come in fixed quantities of 3.3 lb. (1.5 kg) for malt syrup in many retail stores, it is not uncommon to use a combination of two cans of malt syrup and then 1 to 2 lbs. (0.45–0.91 kg) of dry malt powder. Since it is easier to measure and store dry malt powder at home, dry malt is useful to hit the target gravity of your beer. I suggest using light or extra light malt extracts in all beers you make, regardless of color. Avoid amber and dark extracts. The reason is simple. You are getting the color and flavor from the specialty grains you will have in the recipe. This more closely replicates what the brewer is doing. Amber and dark extracts will use some specialty grains for additional color, but you will not know which specialty grain they used, and that gives you no control over the color and flavor.

So, for our Dead Guy clone, I substituted 3.3 lbs. (1.5 kg) of liquid malt syrup for the pale malt, and supplemented it with 2.25 lbs. (1.0 kg) of light dried malt extract. I then add 2.5 lbs. (1.1 kg) of liquid Munich malt extract. Again, we are at a 1.065 starting gravity. Note that many Munich malt extracts are actually a blend of Munich malt and a pale malt, usually Pilsner. If yours is, you may have to add more of the Munich malt extract, and subtract enough light malt extract to again hit a SG of 1.065. Brewing software makes these kinds of adjustments fairly simple.

Next Comes the Hops

From the Rogue website, we know that they used Perle and Saaz hops, with an IBU level of 40. "IBU" is the abbreviation for International Bittering Units, and is a measure of hop bitterness in beer. Check the various styles of beer in your software or brewing books for a reference chart of different beer IBU levels.

Of the two hops, Perle has a higher alpha acid rating and is frequently used as a bittering hop. Saaz has a lower alpha acid rating and is most often used as a finishing hop. Your software will ask for the alpha acid level on the hops you are using, and your hop package should specify this.

In this recipe, we will use the Saaz hop as our finishing or aroma hop. Rogue Dead Guy has a fair amount of hop aroma, which is on the low end of what is typical for many American pale ales. So, I chose to use 1.0 oz. (28 g) of Saaz hops added at the end of the boil. This is just a guess, but the level and timing of the hop addition is similar to other beers showing this level of hop character. Remember, if you don't have a specific piece of information when making your first attempt at a clone recipe, you have to make some reasonable guesses. Once you've brewed the recipe, you can taste the beer and tweak your recipe as needed. If our guess here is off the mark, our beer will simply show either more or less late hop character than the professionally brewed version. It won't be bad beer.

The Saaz hop addition will not add any bitterness to the beer. So, add Perle hops, boiled for 60 minutes, to reach your target value of 40 IBUs. Sixty minutes is a typical amount of time that bittering hops are boiled.

Here is a little known fact about hop alpha acid levels. Each year the hop processors package hops in 200-lb. (91-kg) bales. Then a random number of these bales are actually tested for hop

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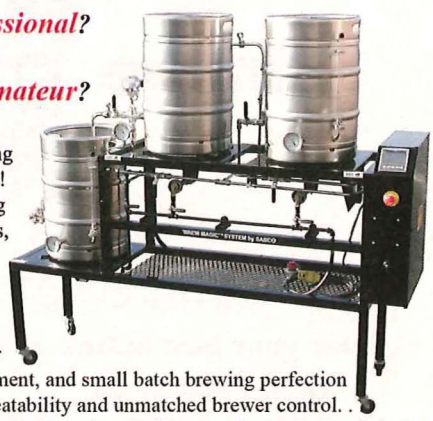

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bitterness. Then the numbers are averaged, and that entire lot of 200-lb. (91-kg) bales are sold at that alpha level. There can be a significant difference in alpha acids when you are using only 2 or 3 oz. (57–85 g) out of a 200-lb. (91 kg) bale. Hops also lose some of their alpha acids as they age. So, while we have all of these numbers to calculate hop bitterness, do not trust them too heavily and rely also on your taste buds when tasting the beer.

If you did have access to more information on the commercial hop schedule, how would you use it? Ideally, you would want to know both the weight of hops used and the IBU contribution of every hop addition. For the bittering hops, use the information on IBUs to formulate your homebrew scale additions. Scaling the weight of hops used in a commercial recipe down to a homebrew-sized batch usually leads to homebrew that is noticeably less bitter than the commercial beer.

Keep in mind that late hop additions contribute hop oils as well as bitterness. Commercial brewers often adjust the amount of late hops each year to account for differences in the levels of hop oils. If your late hops have a higher than usual alpha acid rating one year, consider adding the same weight of hops (after accounting for scale) and dialing back the amount of bittering hops to hit the correct overall IBU level. If you brew the beer more than once a year, use your sense of smell and taste to assess the level of late hops, then alter the amount of bittering hops required to hit your target IBU level.

Then Comes the Yeast

Yeast can be a difficult ingredient to choose as some breweries keep yeast choices a deep dark secret. Fortunately today, most brewers are less worried about the word getting out, so again, the brewery may give you a suggested yeast variety that is available to homebrewers from Wyeast, White Labs or another yeast company. For this beer, Rogue tells you that it is their Pacman yeast, which is currently packed for homebrewers by Wyeast.

If you are unable to get any yeast information from the brewery, you will probably be best trying to match the beer style you are making with the flavor descriptions from your yeast manufacturer. Your local homebrew shop should also be able to give you some suggestions.

And Finally, Water

In the historical past, brewers had to brew beers that were suited to their local water. Today, most commercial brewers treat their water to make it suitable for each beer they brew. Water chemistry and its effect on beer is a complex topic and is well beyond the scope of this article. For any clone recipe, use the color of the commercial beer to give you an idea of the level of carbonates that would be appropriate for that beer. Then, calculate the level of calcium required to hit a reasonable mash pH. For hop-focused beers, a little gypsum will accentuate the hop profile. For malt-focused beers, use calcium chloride instead. (See the "Techniques" column on page 54 for more on water chemistry.) For our Dead Guy Ale clone, we can rely on the fact that a wide range of waters can contribute to a good amber ale. Unless your water has an excessive amount of carbonates or is very soft, it should be fine for brewing this beer.

Methodology

Every brewer makes beer a little differently than everyone else. So if you are able to visit with the brewer, be sure to ask what they do differently to make this beer. Pay attention to mash temperature(s), hopping techniques, fermentation temperatures, how the beer is conditioned or lagered, etc. You may find new techniques that will improve all your beers!

For our Dead Guy clone, we don't have much information. The Wyeast website quotes John Maier as saying he ferments most of his beers at 60 °F (16 °C), pitches big and aerates well. For the mash, I chose "middle of the road" values.

Brew It!

Now it's time to brew the beer. Once it's finished, taste it side-by-side with the commercial brew. Think about each element of the recipe and procedures as you sample both brews and use your observations to move your clone closer to the original. You will likely need to repeat the recipe with minor alterations a few times before you settle on the recipe that you love. Even if you got the exact recipe from the brewer, the details of your water, equipment and brewing procedures affect the way the beer will turn out.

Send in the Clones

The procedure for making a homebrew clone starts with gathering information. If you can get enough information about the commercial beer — including the grains (and the percentage of each used), target original gravity, hops (both the amounts used and IBU targets for each addition), yeast (and expected attenuation) and procedural details (mash temperature, boil time, fermentation temperature) — formulating a clone is straightforward with brewing software.

If, as in the example we chose, you cannot obtain all of the desired information, you need to fill the rest in by consulting other recipes for beers of the same type and using your own brewing experiences. Remember that you don't need to guess every detail exactly for your beer to turn out well. Finally, brewing the beer and comparing it to the original, perhaps several times, will be required if you really want a dead-on clone.

Steve Bader is the owner of Bader Beer & Wine Supply in Vancouver, Washington and Brew Your Own *magazine's former "Replicator."*

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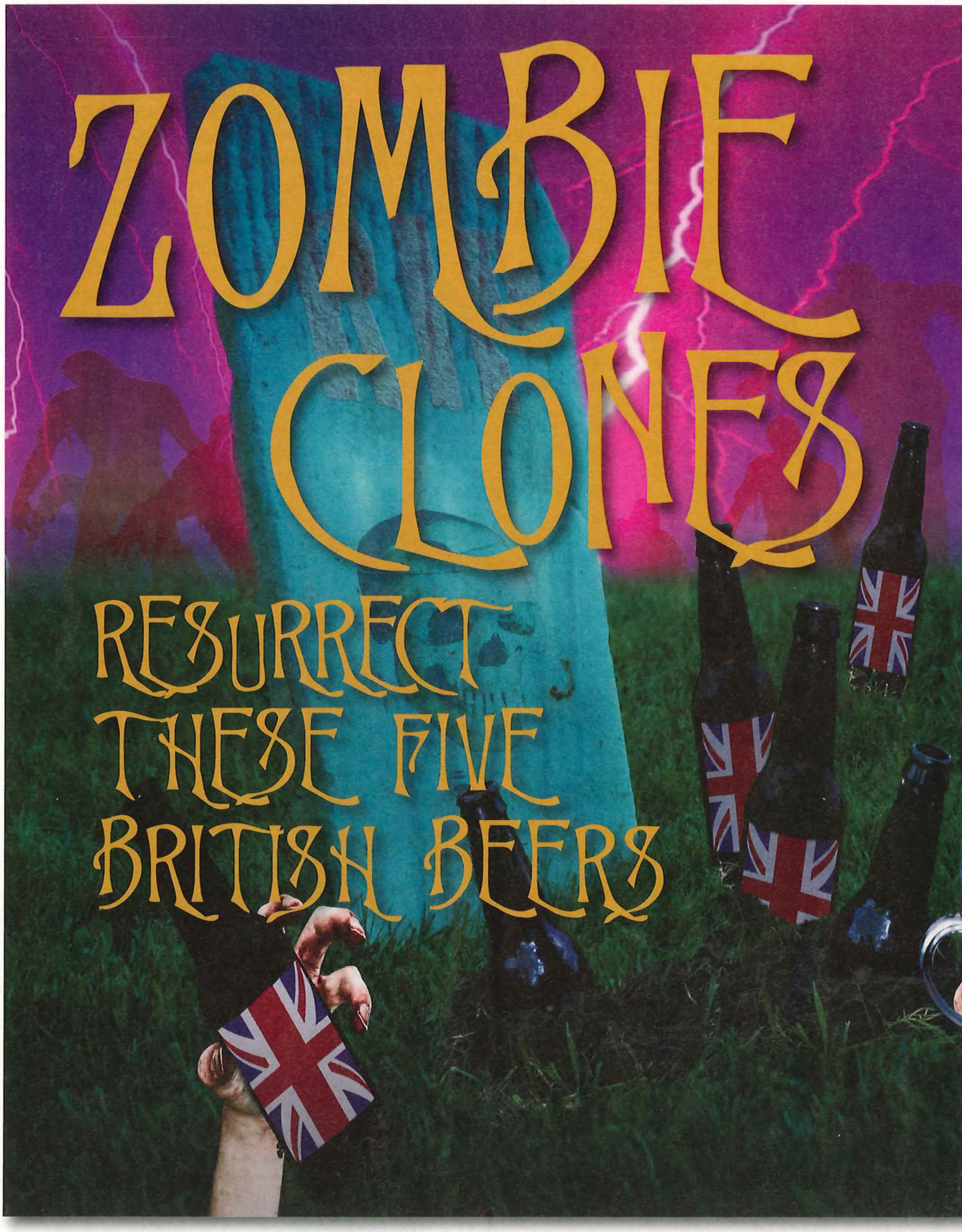
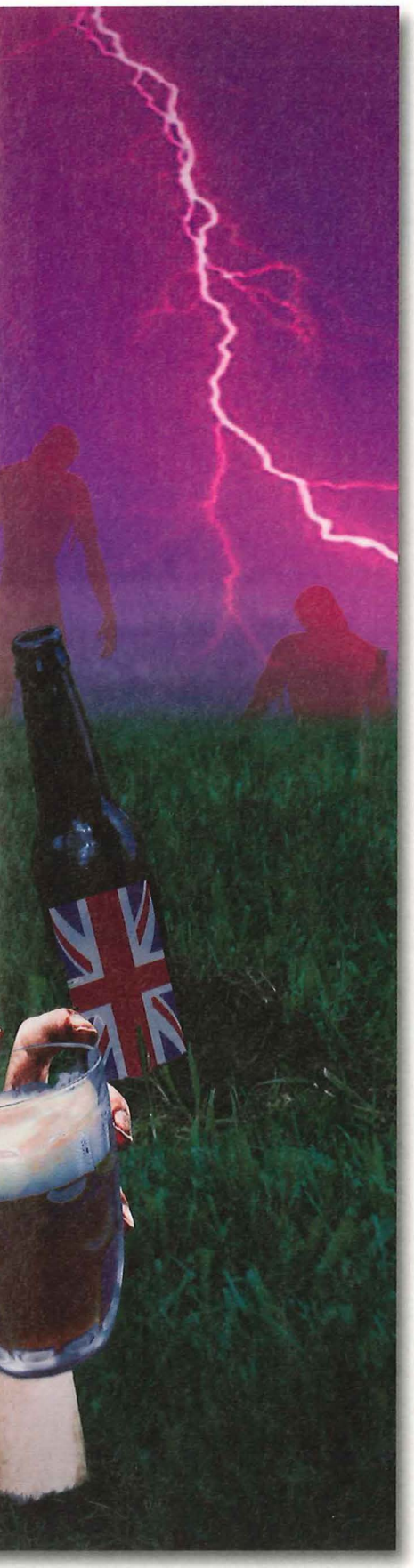
Story by **LES HOWARTH**





The British brewing scene is in flux. Smaller breweries are constantly being bought up by larger breweries. Frequently, this means that some of the brewery's brands are being discontinued. And of course, sometimes a brewery simply closes its doors. This leaves a lot of "dead beers" behind. Fortunately, with the right information, we can resurrect these dead brews as home-brewed clone beers.

I started brewing in the late 1970s using kits until I came across Dave Line's "Brewing Beers Like Those You Buy." This book includes a recipe for Greene King Abbot Ale, which was the beer that was responsible for introducing me to the many pleasures of real ale, so I had to buy it! I tried a good proportion of his recipes, but as I tasted more commercial real ales and the brewing industry changed over the years, I found that I was often finding beers that I wanted to try and clone myself, but I had no idea where to start.

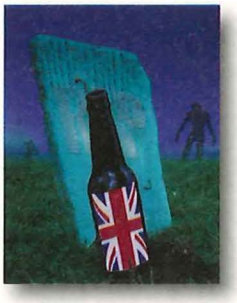
This frustrating scenario changed during the early 1990s when Roger Protz's "Real Ale Almanac" was published, followed by several clone brewing books in the UK and USA. I started collecting the ingredient data from these various sources into a database for my own use. It meant I was able to quickly find any available sources of ingredient information that would permit me to make and start designing my own clone recipe for a beer. It also allowed me to search for a specific ingredient and find beers that were brewed using it. This would give me a short list of options to consider for brewing using that ingredient. In 2002, I published this database in book form (and the much less expensive e-book) as "The Home Brewer's Recipe Database." I have now completed a second edition of the book.

So if you need some homebrew on tap for Halloween, why not bring a dead beer back to life as a zombie clone? It will show the world that you have braaaaains!

Archers Golden Bitter

(5 gallons/19 L, all-grain)

OG = 1.046 FG = 1.012
IBU = 36 SRM = 5 ABV = 4.5%



Archers Golden is a superb ale that has won a number of awards. Sadly, at the time of writing, Archers is under administration so the future of their Swindon brewery is in some doubt. We can only hope that a buyer is found for the brewery so that brewing of their fine ales may continue. The information that I have for this beer is: OG 1.046. Malt bill: 100% blended pale malt. Hops: Progress, WGV. Late hops: WGV or Goldings. IBU: 36. From this I produced the following recipe:

Ingredients

9 lb. 8 oz. (4.3 kg) Maris Otter pale malt (3 °L)
10 AAU Whitbread Goldings Variety hops (60 mins)
(1.8 oz./52 g of 5.5% alpha acids)
11 AAU Whitbread Goldings Variety hops (0 mins)
(2.0 oz/57 g of 5.5% alpha acids)
1 tsp. Irish moss (15 mins)
Wyeast 1318 (London Ale III) yeast
(1 qt./1-L yeast starter)

Step by Step

152 °F (67 °C) infusion mash temperature for 60 minutes. 60-minute boil time. Ferment at 70 °F (21 °C).

Archers Golden Bitter

(5 gallons/19 L, extract with grains)

OG = 1.046 FG = 1.012
IBU = 36 SRM = 6 ABV = 4.5%

Ingredients

2.0 lbs. (0.91) Maris Otter pale malt
1 lb. 10 oz. (0.73 kg) Muntons Extra Light dried malt extract
3.3 lbs. (1.5 kg) Muntons Extra Light liquid malt extract (late addition)

10 AAU Whitbread Goldings Variety hops (60 mins)
(1.8 oz./52 g of 5.5% alpha acid)
11 AAU Whitbread Goldings Variety hops (0 mins)
(2.0 oz./57 g of 5.5% alpha acid)
1 tsp. Irish moss (15 mins)
Wyeast 1318 (London Ale III) yeast
(1-qt./1-L yeast starter)

Step by Step

Steep grains in 3.0 qts. (2.8 L) of water at 152 °F (67 °C) for 45 minutes. Rinse with 1.5 qts. (~1.5 L) of water at 170 °F (77 °C). Add water and dried malt extract to make 3.0 gallons (11 L) of wort. Boil 60 minutes, adding hops at times indicated. Add Irish moss and stir in liquid malt extract for the final 15 minutes of the boil. Ferment at 70 °F (21 °C).

Mole's Brew 97

(5 gallons/19 L, all-grain)

OG = 1.050 FG = 1.012
IBU = 50 SRM = 13 ABV = 4.8%

According to www.molesbrewery.com, this beer is no longer brewed. The information that I have for this beer is: OG: 1.050. Malt bill: 88% Maris Otter pale male, 12% crystal malt. Hops: WGV and Fuggles/Bramling Cross. Late hops: Fuggles. It is quite normal for brewers to change their recipes over time for various reasons, but what does the homebrewer do when presented with options? In this case it would appear that the brewer has used WGV and either Fuggles or Bramling Cross for bitterness. I'd suggest you can either decide on one of the options (maybe depending on ingredient availability) or try combining all of the options into a combined recipe. Since Fuggles are added late in the boil anyway, I decided to use Bramling Cross at the start of the boil and produced the following recipe:

Ingredients

9 lb. 4 oz. (4.2 kg) Maris Otter pale malt (3 °L)
15 oz. (0.43 kg) crystal malt (60 °L)
7.5 AAU Whitbread Goldings Variety hops (60 mins)
(1.25 oz./35 g of 6% alpha acid)
6 AAU Bramling Cross hops (60 mins)
(1 oz./28 g of 6% alpha acid)
4.5 AAU Fuggles Hops (0 mins)
(1 oz./28 g of 4.5% alpha acid)
1 tsp. Irish moss (15 mins)
2 packs of Danstar Nottingham dried yeast

Step by Step

154 °F (68 °C) infusion mash temperature for 60 minutes. 60-minute boil time. Ferment at 66 ° F (19 °C)

Mole's Brew 97

(5 gallons/19 L, extract with grains)

OG = 1.050 FG = 1.012
IBU = 50 SRM = 13 ABV = 4.8%

Ingredients

1 lb. 1 oz. (0.48 kg) Maris Otter pale malt (3 ° L)
15 oz. (0.43 kg) crystal malt (60 °L)
2 lb. 2 oz. (0.96 kg) Muntons Light dried malt extract
3.3 lbs. (1.5 kg) Muntons Light liquid malt extract (late addition)
7.5 AAU Whitbread Goldings Variety hops (60 mins)
(1.25 oz./35 g of 6% alpha acid)
4.5 AAU Fuggles hops (0 mins)
(1 oz./28 g of 4.5% alpha acid)
1 tsp. Irish moss (15 mins)
2 packs of Danstar Nottingham dried yeast

Step by Step

Steep grains in 3.0 qts. (2.8 L) of water at 154 °F (68 °C) for 45 minutes. Rinse with 1.5 qts. (~1.5 L) of water at 170 °F (77 °C). Add water and dried malt extract to make 3.0 gallons (11 L) of wort. Boil 60 minutes, adding hops at the times indicated. For the final 15 minutes of the boil, stir in liquid malt extract and add Irish moss. Ferment at 66 °F (19 °C).

Merriman Old Fart

(5 gallons/19 L, all-grain)

OG = 1.050 FG = 1.013
IBU = 32 SRM = 54 ABV = 4.9%

Sadly, Merriman's Brewery in Leeds is apparently no longer brewing. The information that I have for this beer is: OG: 1.050. Malt bill: Halcyon pale malt, crystal malt, wheat malt, pale chocolate malt, roast barley. Hops: Liberty, Progress. IBU: 32. When one has no information about malt bill proportions, the only option is to guess. However, we are aware of the usual style guideline ranges for using specialty grains, so we can use these as a starting point. Accordingly, I produced the following recipe:

Ingredients

9.0 pounds (4.1 kg) Halcyon pale malt
2.5 oz. (70 g) crystal malt (60 °L)
2.5 oz. (70 g) wheat malt
1.25 oz. (35 g) chocolate malt
1.25 oz. (35 g) roast barley
4 AAU Progress hops (60 mins)
(0.67 oz./19 g of 6% alpha acid)
2.7 AAU Liberty hops (60 mins)
(0.67 oz./19 g of 4% alpha acid)
4 AAU Progress hops (5 mins)
(0.67 oz./19 g of 6% alpha acid)
2.7 AAU Liberty hops (5 mins)
(0.67 oz./19 g of 4% alpha acid)
1 tsp. Irish moss (15 mins)
1 sachet SafAle S-04 dried yeast

Step by Step

150 °F (66 °C) infusion mash temp for 60 minutes. 60-minute boil time. Ferment at 68 °F (20 °C). This recipe produced a beer which developed a lovely fruit-bitterness balance. I admit that I have no idea how it compares to the real thing, and now I have no way of knowing, so this is probably not a true clone recipe. However, it inspired me to design a recipe that produced a very pleasant ale. Maybe brewing in this way could be regarded as paying respects to a deceased beer rather than a serious attempt at resurrection via cloning. I have found that using my database in this way has led me to brew fine beers from recipes that I doubt I would have created from scratch myself.

Merriman Old Fart

(5 gallons/19 L, extract with grains)

OG = 1.050 FG = 1.013
IBU = 32 SRM = 54 ABV = 4.9%

Ingredients

6.0 oz (0.17 g) Halcyon pale malt
2.5 oz. (70 g) crystal malt (60 °L)
2.5 oz. (70 g) wheat malt
1.25 oz. (35 g) chocolate malt
1.25 oz. (35 g) roast barley
2.0 lb. (0.91 kg) Coopers light dried malt extract
3.75 lb. (1.7 kg) Coopers light liquid malt extract (late addition)
4 AAU Progress hops (60 mins) (0.67 oz./19 g of 6% alpha acid)
2.7 AAU Liberty hops (60 mins) (0.67 oz./19 g of 4% alpha acid)
4 AAU Progress hops (5 mins) (0.67 oz./19 g of 6% alpha acid)
2.7 AAU Liberty hops (5 mins) (0.67 oz./19 g of 4% alpha acid)
1 tsp. Irish moss (15 mins)
1 sachet SafAle S-04 dried yeast

Step by Step

Steep grains in 3.0 qts. (2.8 L) of water at 150 °F (66 °C) for 45 minutes. Rinse with 1.5 qts. (~1.5 L) of water at 170 °F (77 °C). Add water and dried malt extract to make 3.0 gallons (11 L) of wort. Boil 60 minutes, adding hops at times indicated. Add liquid malt extract and Irish moss for the final 15 minutes of the boil. Ferment at 68 °F (20 °C).

Oakhill Yeoman Ale / Yeoman Strong Ale / Yeoman Strong 1767 Ale

(5 gallons/19 L, all-grain)

OG = 1.050 FG = 1.012
IBU = 66 SRM = 11 ABV = 4.8%

The Oakhill Brewery in Somerset closed down when the owner retired. This beer has obviously been renamed during its history and the information that I have for it is: OG: 1.049–1.050. Malt bill: 91.5% Triumph or Halcyon pale malt, 8.5% crystal malt. Hops: Bramling Cross, Challenger, Fuggles, Goldings. In this case, we have malt bill proportions, but no IBU, so again we have to guess. However, style guidelines are a good guide to expected ballpark IBU.

Ingredients

9 lb. 8 oz. (4.3 kg) Halcyon pale malt
11 oz. (0.31 kg) crystal malt (60 °L)
4.35 AAU Challenger hops (90 mins) (0.5 oz./14 g of 8.7% alpha acid)
3.75 AAU East Kent Goldings hops (90 mins) (0.75 oz./21 g of 5% alpha acid)
4.13 AAU Bramling Cross hops (90 mins) (0.75 oz./21 g of 5% alpha acid)
4.5 AAU Fuggles hops (90 mins) (1 oz./28 g of 4.5% alpha acid)
1 tsp Irish moss (15 mins)
2 sachets Gervin English Ale or similar English ale yeast

Step by Step

152 °F (67 °C) infusion mash temp for 60

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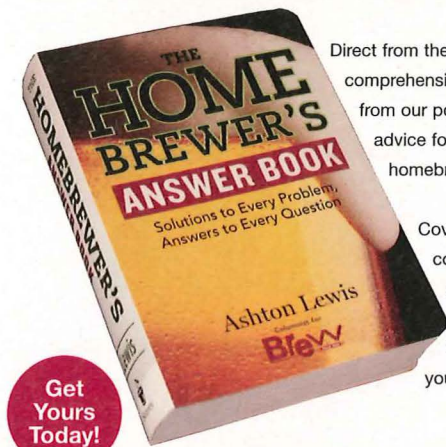

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minutes. 90-minute boil time. Ferment at 70 °F (21 °C). This recipe produced a full-bodied, but drinkable ale with pleasant fruit and bitterness.

Oakhill Yeoman Ale / Yeoman Strong Ale / Yeoman Strong 1767 Ale

(5 gallons/19 L, extract with grains)

OG = 1.050 FG = 1.012
IBU = 66 SRM = 11 ABV = 4.8%

Ingredients

1 lb. 5 oz. (0.59 kg) Halcyon pale malt
11 oz. (0.31 kg) crystal malt
2 lb. 2 oz. (0.96 kg) Muntons Light dried malt extract
3.3 lbs. (1.5 kg) of Muntons Light liquid malt extract (late addition)
4.6 AAU Challenger hops (60 mins) (0.52 oz./15 g of 8.7% alpha acid)
4.0 AAU East Kent Goldings hops (60 mins) (0.8 oz./23 g of 5% alpha acid)
4.4 AAU Bramling Cross hops (60 mins) (1.1 oz./30 g of 4.5% alpha acid)
4.8 AAU Fuggles hops (60 mins) (1.1 oz./30 g of 4.5% alpha acid)
1 tsp. Irish moss (15 mins)
2 sachets of Gervin English Ale or similar English ale yeast

Step by Step

Steep grains in 3.0 qts (2.8 L) or water at 152 °F (67 °C) for 45 minutes. Rinse with 1.5 qts. (~1.5 L) of water at 170 °F (77 °C). Add water and dried malt extract to make 3.0 gallons (11 L) of wort. Boil 60 minutes, adding hops at times indicated. Stir in malt extract and add Irish moss for the final 15 minutes of the boil. Ferment at 70 °F (21 °C).

Hardy's and Hanson's Kimberly Classic

(5 gallons/19 L, all-grain)

OG = 1.047 FG = 1.012

IBU = 31 SRM = 10 ABV = 4.5%

Brewing at the Hardy's and Hanson's Kimberly Brewery in Nottingham ceased in 2006

when the brewery was bought by Greene King. I have tasted this ale and thought it was a delicious example of the stronger end of the best bitter style. The information I have for this beer is: OG: 1.047. Malt bill: Pipkin pale malt, crystal malt, Maltose. Hops: Challenger, Northdown, WGV/Target. Late hops: Goldings, optional Styrian Goldings. Dry hops: Goldings, optional Styrian Goldings. IBU: 31. EBC: 18. In this case, we have no malt bill proportions. This permits us to use color calculations or brewing software to estimate the proportions of specialty grains required to achieve a given color. In this case, the only specialty grain is the crystal malt, which makes the calculation relatively simple.

Ingredients

7.25 lbs. (3.3 kg) Halcyon pale male
8.0 oz. (0.23 kg) crystal malt (60 °L)
1.0 lb. (0.45 kg) Muntons Extra Light dried malt extract
3 AAU Challenger hops (90 mins) (0.38 oz./11 g of 8% alpha acid)
2.5 AAU Northdown hops (90 mins) (0.27 oz./7.9 g 9% alpha acid)
2.5 AAU Target hops (90 mins) (0.25 oz./7.1 g of 10% alpha acid)
1.0 oz. (28 g) East Kent Goldings hops (0 mins)
0.75 oz. (21 g) East Kent Goldings hops (dry hop)
1 tsp. Irish moss (15 mins)
1 sachet Danstar Windsor Ale yeast

Step by Step

152 °F (67 ° C) infusion mash temp for 60 minutes. Add malt extract and boil 90 minutes. Ferment at 68 °F (20 ° C).

Hardy's and Hanson's Kimberly Classic

(5 gallons/19 L, extract with grains)

OG = 1.047 FG = 1.012
IBU = 31 SRM = 10 ABV = 4.5%

Ingredients

1 lb. 8 oz. (0.68 kg) Halcyon pale malt
8.0 oz. (0.23 kg) crystal malt (60 °L)
2 lbs. 12 oz. (1.25 kg) Muntons Extra Light dried malt extract
3.3 lbs. (1.5 kg) Muntons Extra Light liquid extract (late addition)
3.4 AAU Challenger hops (60 mins) (0.43 oz./12 g of 8% alpha acid)
2.8 AAU Northdown hops (60 mins) (0.31 oz./8.8 g of 9% alpha acid)
2.8 AAU Target hops (60 mins) (0.28 oz./8.0 g of 10% alpha acid)
1.0 oz. (28 g) East Kent Goldings hops (0 mins)
0.75 oz. (21 g) East Kent Goldings hops (dry hop)
1 tsp. Irish moss (15 mins)
1 sachet Danstar Windsor Ale yeast

Step by Step

Steep grains in 3.0 qts. (2.8 L) of water at 152 °F (67 °C) for 45 minutes. Add water and dried malt extract to make 3.0 gallons (11 L) of wort. Boil wort for 60 minutes, adding hops at times indicated. Add liquid malt extract and Irish moss with 15 minutes left in the boil. Ferment 68 °F (20 °C). Dry hop for 10 days.

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Water Profiles

Create your own chemistry

by Jon Stika

Water is the main ingredient of beer. The many different styles of beer we have today evolved for many different reasons, not the least of which is the chemistry of the local water supply where the beer was created. Historically, brewers no doubt experimented with different ingredients and techniques much as homebrewers do today. They undoubtedly settled on recipes that worked best for what they had readily available . . . including water. Without having a comprehensive knowledge of what was dissolved in their brewing water and its effect on mash pH, expression of hop bitterness, etc. the brewers nevertheless found their way and the rest, as they say, is history.

Photos courtesy of Wikipedia

Dortmund, Germany, like Pilsen, Czech Republic, is known for pale lagers. The water in each city is low in hardness and alkalinity, allowing brewers to reach the proper mash pH with only base malts. Dortmund has higher levels of minerals yielding a more assertive malt character.

What's in the water?

With the information and technology we have today, we can discern what ions are present in solution in our water and the water of famous brewing regions of the world. If you live in the US and use municipal water, your local water board should send you a summary of what is in your water every year. If you don't receive this publication, you can request it. Alternately, if you have a private water supply (well, spring, etc.), you should have it analyzed by a private or state-run lab that does such work.

Results shown on water analysis reports are typically expressed in milligrams per liter (mg/L) or parts per million (ppm). In the range of concentrations we are concerned with, you can use these interchangeably. Once you have an analysis of your brewing water, you can compare it to the analysis of the water from brewing centers from around the world and see which beer style fits your local water best. Before we dive into that, though, here's a quick refresher on the basics of water chemistry.

Water is a molecule composed of a central oxygen atom with two smaller hydrogen atoms attached. A space-filling model of water looks a bit like Mickey Mouse, with the oxygen being his head and the two hydrogens his ears.

Many different types of minerals dissolve in water. When they do, some dissociate (break apart) into their component ions. For example, sodium chloride (NaCl) dissolved in water would dissociate into two ions, Na^+ and Cl^-. An ion is simply an atom or molecule that has a different number of electrons than protons. This difference results in either a net positive charge (cation) or a net negative charge (anion). These ions float around in solution in water and are available to react with other ions and affect everything from mash pH

to the flocculation of yeast.

What if your water is best suited for a Pilsner and you wish to brew an Irish stout? Various salts may be added to adjust your water chemistry to suit a particular style of beer, but first let's look at some important ions in brewing water, how they affect beer flavor and how their concentrations relative to each other can create flavor synergies.

Basic brewing chemistry

Pure water — for example, distilled water or water purified by reverse osmosis (RO) — without any mineral ions in solution, is not used by commercial brewers. It is the dissolved ions in water that are important for mash chemistry, expression of various flavors (sweet, sour, salty and bitter in particular) and yeast nutrition. Therefore it is not a good idea to brew all-grain beer with distilled or reverse osmosis water. (See the table below for some general guidelines of desired concentrations of each important ion in brewing water).

Water with high levels of minerals dissolved in it, especially calcium (Ca^{2+}) and magnesium, is called hard water. Water with few dissolved minerals is called soft water. For brewers, it is more important to know the concentrations of key minerals that are dissolved in their brewing liquor than whether their water is hard or soft.

Water with very low levels of carbonates (i.e. Pilsen, Czech Republic) will allow mash pH to come into proper range (5.2–5.6) with only pale malt (especially if a little calcium is present). If the carbonate levels are higher, more acidic malt is necessary to properly lower the pH. For example, hard water dominated by carbonates like Dublin, Ireland, with its high level of carbonates, is well suited to brewing stouts. Carbonates and bicarbonates can be precipitated as calcium carbonate ($CaCO_3$) by boiling water in an open kettle for at least 15 minutes where it can pick up oxygen to react with and drop out of solution. This process will typically reduce carbonates and/or bicarbonates below 150 ppm. Carbonates can also be reduced by neutralizing them with acid. Food-grade phosphoric acid is a popular choice for this in breweries.

Calcium ions (Ca^{2+}) in water react with phosphates in malt, releasing acid. Thus, its presence in mash water lowers the pH of the mash. Calcium is not a significant yeast nutrient, but does facilitate yeast flocculation and subsequent precipitation. Calcium also stabilizes alpha amylase and increases its tolerance to the heat of mashing.

Magnesium (Mg^{2+}) is important for enzyme activity in the mash and for yeast nutrition. Like calcium, magnesium ions drive down the pH of a mash, but to a much lesser extent than calcium. Magnesium enhances beer flavor up to a point, then lends a dry, bitter metallic flavor to beer.

Sodium (Na^{+}) has different effects at different concentrations. At low levels, sodium contributes sweetness, probably by balancing bitterness, and adds some palate fullness, which may be appropriate in certain styles of beer. At higher levels, sodium can contribute to salty flavor.

Sulfate (SO_4^{-2}) has a very high solubility in water and waters high in sulfate are known as "gypseous" waters. Sulfate ions bring out the hop character in a beer.

Chloride ions (Cl^{-}) give a full, sweet flavor to beer, but they are not a significant player in mash chemistry or yeast nutrition. Many brewers use calcium chloride instead of calcium sulfate because chloride has a flavor affect that many brewers like.

Chlorine (Cl_2) is often included in municipal water supplies as hypochlorous acid (HOCl) or chloramine (NH_2Cl) to serve as a disinfectant. If either of these compounds remains in brewing water they can lend a harsh, medicinal flavor to beer. Hypochlorous acid can be removed by boiling brewing water in an open pot for at least 15 minutes prior to using the water in the mash or boil. Remove chloramines from water by adding a crushed Campden tablet to 20 gallons (76 L) of brewing water and letting the water sit uncovered overnight to allow the resulting chlorine gas to dissipate.

Of course, the simplest way to lower an ion in your water is to substitute a portion of your tap water with distilled or reverse osmosis (RO) water that is essentially free of mineral ions. For example; to reduce the concentration of the ions in your tap water by half, use half tap water and half distilled or RO water to make up the total volume of water for the batch of homebrew.

The short course on water treatment

The details of water chemistry can be complex and many brewers may simply wish to know if they can use their water as is, or learn a simple treatment plan to deal with their water.

Two things all brewing waters require is that they taste good and they be free of chlorine compounds. (See the section above for how to treat for these.)

If you are an extract brewer, the requirements your water must meet are broader than if you are an all-grain brewer. This is because you do not have to worry about mashing your grains. This has been done for you at the malt extract plant. Malt extract is condensed wort, and all (or most) of the dissolved solids present when the grains were mashed are con-

DESIRED ION CONCENTRATIONS IN BREWING WATER

		Desired Range	
		Minimum	Maximum
Calcium	Ca^{2+}	50	150
Magnesium	Mg^{2+}	10	30
Sodium	Na^{+}	0	150
Carbonate Bicarbonate	CO_3^{2-} HCO_3^{-}	0	250
Sulfate	SO_4^{2-}	50	350
Chloride	Cl^{-}	0	250

London, England is best known for brewing British bitter, ruby-dark porters and copper-colored pale ales. Dark malts are often used to balance the mash in the high-carbonate water.

tained in the extract, including mineral ions. When brewing with malt extract, you simply reconstitute your wort from this concentrate. If you use distilled water, or very soft tap water, your reconstituted wort should contain all the minerals required for brewing. If your water is hard, you will be adding minerals to your wort beyond what is required. In small amounts this will likely have no discernible effect. If your water is very hard, especially if it is rich in carbonates, you may want to consider blending it with distilled or RO water to make your brewing water. You do not need to add salts to your brewing water to try to emulate the water of different brewing cities (such as Burton). Unless you know the minerals that are already in your malt extract, you are blindly piling on more minerals. For hoppy beers, you may wish to accentuate the hop profile by adding a little gypsum. Likewise, for malty beers, a little calcium chloride may make for a smoother beer. In either case, don't overdo the addition. Use a maximum of 2 teaspoons per 5 gallons (19 L) of these salts.

All-grain brewing additionally requires that the water chemistry yields a suitable mash pH. A simplified version of how to obtain this can be had by remembering a few key things. Calcium ions (and to a lesser extent, magnesium ions), dark malts and acids will lower mash pH. Carbonates neutralize acids and decrease the amount that mash pH is lowered by these things.

Calcium has other beneficial actions in brewing, such as stabilizing alpha amylase in the mash. Thus, unless stylistically required to have less, it's best to have at least 50 ppm calcium in your wort. For pale beers, the amount of carbonates should be minimized, at least under

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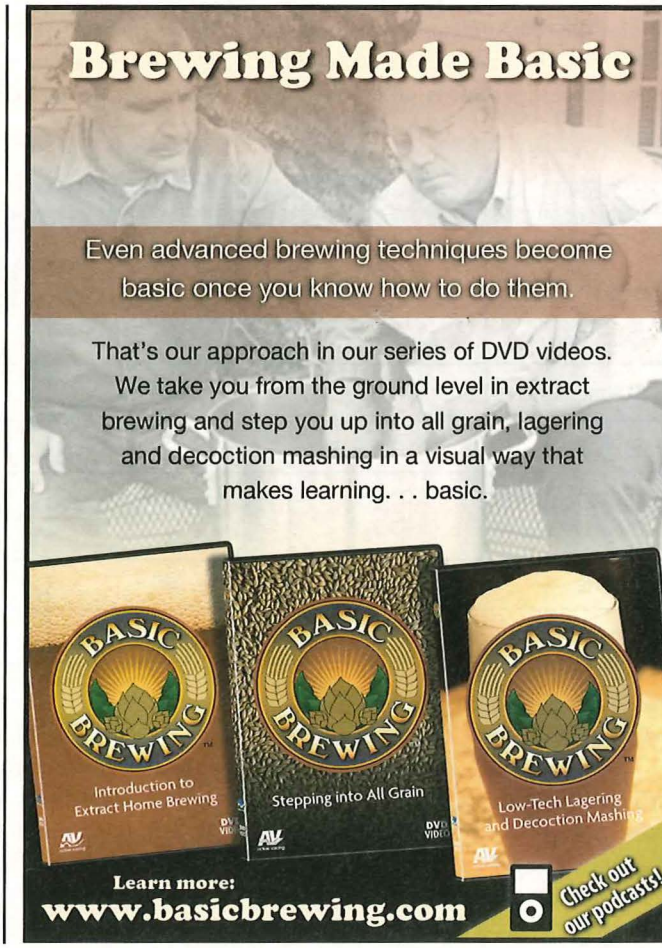

50 ppm. For dark beers, carbonate can be a good thing and for stouts, your water may require up to 250 ppm carbonates.

Manipulating just the calcium and carbonate levels is the simplest way for an all-grain brewer to treat their water. To reduce carbonates, if needed, you can blend your tap water with distilled or RO water, or add acid. If you need to increase it, you can add calcium carbonate (chalk) or sodium bicarbonate (baking soda).

Once your carbonate levels are adjusted, you can add calcium — if needed — as either calcium sulfate (usually in the form of gypsum) or calcium chloride ($CaCl_2$). Simple water chemistry calculators are available online that will do all the math for you. These include Greg Noonan's "Water Witch," available for download at www.byo.com.

Whether an all-grain or extract brewer, always taste your brewing water after you have treated it, and don't proceed if you detect off flavors or aromas. If you do taste something off, double check that you used the correct mineral salts. Don't taste your water for several hours after adding Campden tablets.

Creating chemistry

Another approach to dealing with brewing water chemistry is to start from scratch with distilled or reverse osmosis (RO) water and add salts to make the water what you wish it to be. This method may be preferred if you are attempting to brew a beer with a water profile at an extreme end of the brewing spectrum. For example, say you wanted to reproduce the water profile of Dublin, Ireland in order to brew a traditional Irish stout. How could this be done at your home brewery? Beginning with distilled or RO water, you would need to add some of the major brewing ions (Ca^{2+}, HCO_3^-, Na^+, SO_4^{2-}, Mg^{2+}, Cl^-) to approximate the water profile of Dublin. Charts detailing specific information about the brewing water of famous brewing regions are readily available online or in most brewing texts.

Adjusting or creating a brewing water profile to suit the production of a particular style of beer does not require a degree in chemistry. If you get a handle on the concentrations of the major brewing ions in your water, and compare it to your target water, you can approach your water treatment one of two ways — either by altering your tap water to approximate your target water or by starting from scratch with distilled or RO water and adding some commonly available salts. Getting to know what is in the water you brew with and how it can be manipulated to fit the style of beer you wish to brew can make a big difference in your finished beer. After all, water is the main ingredient in everyone's brew.

Jon Stika is an avid homebrewer from Dickinson, North Dakota.

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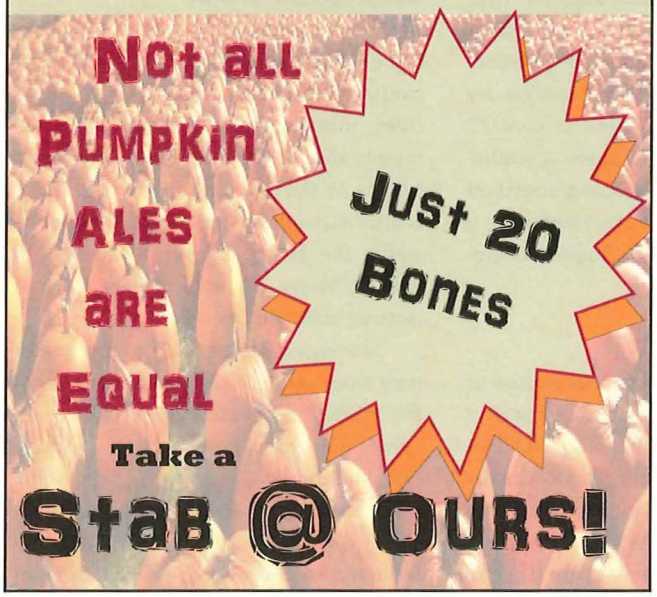

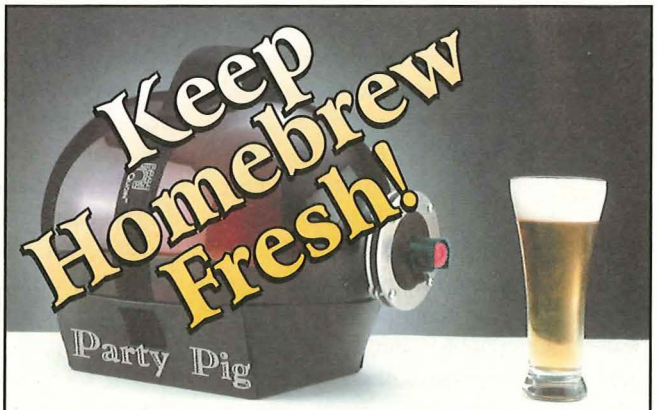

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Advanced Brewing

Sanitizers

. . . . and how they kill microbes

by Chris Bible

Perhaps the single most important skill a brewer can have is the ability to properly clean and sanitize equipment. No other step in the brewing process can undo the damage that may result from poor attention to detail in the cleaning and sanitation steps of the brewing process. Many bacteria and wild yeasts have the potential to ruin your lovingly-prepared wort. Because bacteria thrive in a warm, moist environment, your wort makes an ideal home for both yeast and bacteria. To be a successful brewer, you must be a skilled bacteria killer.

There are three different activities that may be undertaken to eradicate bacteria — cleaning, sanitizing and sterilizing.

Cleaning

Cleaning is simply removing the dirt and scum from your brewing equipment. Detergents and soaps are commonly used to help with this step. Detergents and soaps are able to remove dirt and scum that water alone will not. Soap and detergent molecules are comprised of long chains of carbon and hydrogen atoms. At one end of the chain is a group of atoms that is soluble in water (hydrophilic). The remainder of the chain is not soluble in water (hydrophobic), but is soluble in grease and other types of organic matter. The hydrophobic portion of the soap or detergent molecule attaches itself to the organic matter on your brewing equipment. The particles of grease or organic matter are then dislodged and surrounded by the soap or detergent molecules. Grease or organic matter can then be carried off into the wash water solution while surrounded by the soap or detergent molecules. The organic material is "emulsified" by the soap or detergent molecules.

Commercial brewers frequently use caustic (sodium hydroxide) to clean their equipment. Caustic works by simply dissolving dirt and grease and cleaning solutions containing it often contain other agents to keep the dirt from redepositing on the surface of the equipment.

Many chemicals are available to help the homebrewer sanitize brewing equipment. These chemicals are effective only if they are actually able to contact the spoilage organisms — so clean your equipment first, then sanitize.

Sanitizing

Sanitizing is the act of applying either chemicals or heat to your equipment in order to kill bacteria and reduce the number of potential spoilage organisms present on brewing equipment.

Sanitizing does not kill all organisms. To sanitize means to reduce the number of microorganisms to a "safe" level. One legal definition states that a sanitizer must be capable of killing 99.999% of a specific bacterial test population within 30 seconds. An alternate definition is that a hard surface sanitizer is a chemical agent that is capable of killing 99.9% of the infectious organisms present in a bacterial population within 30 seconds. A sanitizer may or may not necessarily destroy pathogenic or disease-causing bacteria as is a criteria for a disinfectant.

A disinfectant is a chemical agent that is capable of destroying disease-causing bacteria or pathogens, but does not necessarily kill spores or all types of viruses. A disinfectant must be capable of reducing the level of pathogenic bacteria by 99.999% within 5–10 minutes of contact. The primary difference between a sanitizer and a disinfectant is that at a specified use dilution, the disinfectant must have a higher kill capability for pathogenic bacteria than a sanitizer.

Sterilizing

Sterilizing is the complete eradication of all organisms. The term sterilize conveys an absolute meaning; a substance cannot be partially sterile. Sterilization is usually not a practical option for homebrewers because it is just not possible to kill every organism that is present on every piece of your brewing equipment using the tools and techniques that are typically available to a homebrewer.

Sterilants are chemicals, such as glutaraldehyde or formaldehyde, which are capable of eliminating all forms of microbial life, including spores and viruses. These types of chemicals are generally not used in a homebrewery due to their potentially toxic and dangerous nature. Steam and hot water can also be sterilants. As homebrewers we are concerned with spoilage organisms in our wort but not necessarily with pathogenic bacteria or spores, so I will focus on sanitizers and, to a lesser extent, disinfectants.

Mechanisms of action

When bacteria cells are exposed to a sanitizer or disinfectant, irreversible damage occurs to the various physical structures within the bacteria cell. Sanitizers and disinfectants work by either attacking a specific part of the cell, or by causing damage to some of the components of the cell. Sanitizers and disinfectants (or germicides in general) may attack bacteria cells in four ways: destruction of the cell membrane, inhibition of food uptake and waste excretion, inactivation of critical enzymes and destruction of DNA.

Germicides such as sodium hypochlorite or peroxyacetic acid (PAA), are strong oxidizing agents that react with the molecules that comprise the bacteria's cell membrane. This eventually causes a breach in the integrity of the cell membrane and allows the vital components within the cell to escape. This kills the cell. Sufficient amounts of heat will also destroy cell membranes.

Some germicides, such as the quaternary ammonium compounds (quats), have the ability to chemically attach themselves onto specific sites on the bacterial cell membrane. They have this ability because the molecules carry a positive electrical charge in solution and are attracted to the negatively charged por-

tions of the bacterial cell membrane. Once attached, the quats block the uptake of nutrients into the cell and prevent the excretion of metabolic waste products. These waste products accumulate within the cell. The cell is effectively both starved and internally poisoned from the accumulated wastes.

Biocides, such as phenolics, work by entering the cell and chemically reacting with certain key enzymes that support cell growth, or by reacting with enzymes that support the metabolic activities that supply the bacteria cell with energy. If enzyme inactivation is incomplete, the injured bacteria can possibly recuperate several hours later and re-contaminate the surface.

Ultraviolet light can be used as a sanitizer. Its mechanism of operation is the destruction of the DNA of organisms illuminated by the light.

Here are the advantages and disadvantages of commonly-used sanitizing and disinfecting chemicals.

Acid sanitizers

Acid sanitizers exhibit broad-spectrum germicidal activity. They are also relatively unaffected by organic matter. Because of their low pH, acid sanitizers have the added advantage of being able to react with hard water deposits and so are ideal for use when hard water conditions exist. Because of their combined acid cleaning, free rinsing and sanitization properties, they are also ideal for use in the clean-in-place (CIP) systems that are typically found in commercial breweries and food processing plants. Despite their advantages, they are probably not the best choice for homebrewers due to their potentially toxic and dangerous nature.

Alcohols

Alcohols work by denaturing bacterial proteins. In the absence of water, proteins are not readily denatured by alcohol so a 70% solution of isopropyl alcohol is a much more effective sanitizer than the pure (99%) isopropyl alcohol. Isopropyl alcohol is capable of killing most bacteria within 5 minutes of exposure but is ineffective against spores and viruses. A main disadvantage of isopropyl alcohol is its flammability. Also, its effectiveness is greatly reduced if the alcohol solution is diluted, or if lots of organic matter is present. Ethyl alcohol is a fairly effective germicide and is often used by homebrewers for disinfection of smaller pieces of equipment (for example, equipment used for culturing yeast or small items like hose fittings or couplings).

Aldehydes: (formaldehyde and glutaraldehyde)

Aldehydes are extremely reactive chemicals that combine with and denature key bacterial proteins. They are generally not used for routine sanitization and their primary application is for high-level disinfection. A 2% solution of either compound exhibits sterilization properties over a given period. Formaldehyde can leave a residual film on the surfaces that it comes into contact and therefore it poses a potential health hazard. Formaldehyde films can also combine with certain organic components and impart an undesirable medicinal flavor. Because formaldehyde has been identified as a potential carcinogen, its use is declining and limited to specific applications. For all of these reasons, aldehydes are not recommended for use on brewing equipment.

Chlorine dioxide

Chlorine dioxide is a very powerful sanitizer and disinfectant that is produced by reacting sodium chlorite in solution with an acid. The yellowish-green gas produced in this reaction is allowed to remain in a closed system until it dissolves in the solution from which it was generated. This aqueous solution of chlorine dioxide is then used for sanitizing. Chlorine dioxide is 3 to 4 times as potent as sodium hypochlorite as a sanitizing agent and is generally effective against all bacteria and viruses. It does not have the disadvantages that sodium hypochlorite has with respect to corrosivity of metal surfaces. Its main disadvantage is that the extremely reactive nature of the sodium chlorite from which chlorine dioxide is generated poses a serious potential fire hazard. Chlorine dioxide is used as a sanitizer by many commercial breweries.

Hypochlorites

Household bleach is a solution that contains 3-6 % by weight sodium hypochlorite. Because of their effectiveness and low cost, hypochlorites are widely used in many different sanitization applications, and have become a standard to which other sanitizers are compared. Hypochlorites exert their germicidal activity by destroying cell walls and inactivating vital bacterial enzymes.

A disadvantage of hypochlorites is that they are corrosive to metal surfaces including stainless steel. Hypochlorites also degrade in strength with time and are affected by the presence of organic matter. Their effectiveness is also pH dependent. Hypochlorites function best within the narrow pH range (5–7) because hypochlorous acid formed at that pH is the chemical component that actually performs the germicidal activity. High pH waters (pH > 9) inhibit the sanitization effect of hypochlorites, and require longer exposure times in order to achieve the desired results.

Hypochlorites (bleach) have been used for years as a sanitizer by homebrewers. In order to avoid off-flavors in the finished beer, it is important that the sanitizer solution be well-rinsed from the brewing equipment. If they are not well rinsed, plastic, medicinal or band-aid-like flavors may result in the beer.

Iodophors

Iodophors work in a way that is similar to hypochlorites but they do not act as quickly. Iodophors attach themselves to proteins that contain sulfur in their composition (cysteine), and inactivate them. Iodine solutions usually consist of elemental iodine that is complexed to a carrier such as polyvinylpyrolidone (PVP) or to a non-ionic surfactant. The iodine carrier provides a sort of sustained-release reservoir for the iodine. The iodine stays bound to the carrier until the iodine concentration in the sanitizer solution falls below a certain equilibrium level. Once this concentration level is reached, additional free iodine is released into the solution. The main disadvantages of iodophors are that they can be highly staining on many different types of surfaces, they work only within an acidic pH range and they tend to evaporate away at temperatures greater that 95 °F (35 °C).

Iodophors are a popular no-rinse sanitizer used by homebrewers. In order

to avoid off-flavors in the finished beer, however, it is important that the sanitizer solution be allowed to fully drain from the brewing equipment.

Peroxyacetic acid (PAA)

Peroxyacetic acid (also known as peracetic acid) is manufactured by reacting acetic acid with hydrogen peroxide. PAA has grown in popularity because of its effectiveness and friendliness to the environment. PAA breaks down to form acetic acid (vinegar), water and oxygen.

One of the major advantages of sanitizing with PAA is that it works well under cold conditions (around 40 °F/4 °C). PAA solutions are generally used at concentrations between 150 to 200 ppm and are highly effective against a wide variety of bacteria and spores. PAA is more expensive than hypochlorite, but it is generally cost effective and is also rapidly gaining in popularity among commercial institutions and homebrewers as a sanitizer. It is a good choice for use as a no-rinse sanitizer for homebrewers.

Phenolics

Phenolics are effective at sanitization and remain effective in the presence of organic matter. A disadvantage of phenolics, however, is that they are relatively expensive to use and they react with certain types of plastic surfaces. They are also difficult to oxidize and therefore difficult and expensive to dispose of in an environmentally suitable manner.

Quaternary ammonium chlorides (QUATS)

Quats have varied germicidal activity and generally used when only low-level sanitization is required. Their main advantages are that they are odorless, non-staining, non-corrosive to metals and are relatively non-toxic at working concentrations. They exhibit broad germicidal activity when used in hard water and are effective over a wide pH range. Quats leave a non-volatile residue on surfaces to which they are applied, rendering the surfaces bacteriostatic for a given time. For this reason, they require rinsing if the surface will come in contact with wort or beer.

Summary

Which chemicals best help a homebrewer achieve the goal of sanitizing the brewing equipment? As with almost all things, it depends. To be a successful brewer, you must also be a successful bacteria killer. To do this, all your brewing equipment must be cleaned before it is sanitized. On brewing day, sanitize all brewing equipment that will come in contact with cooled wort, choosing the sanitizer that best fits your situation, based on budget, potential for corrosion of your equipment, safety concerns and environmental impact. Finally, remember to perform "preventive cleaning" whenever possible. Anything you can do in advance will save you time in the long run — perhaps enough to squeeze in an extra homebrew at the end of your brewday.

Chris Bible is a regular feature article contributor to Brew Your Own *and the new "Advanced Brewing" columnist.*

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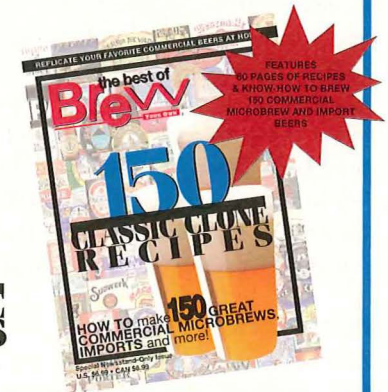

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Pumped-Up Toolbox

It's a pump. It's an organizer. It's both.

Story and photos by Ryan R. Lockard

There are many reasons why a pump can be a significant time saving addition to your brew day. How the brewer implements the equipment to the process can have just as large an impact. About three years ago, I decided the time had come to upgrade to a pump, but without a dedicated brewing structure, I needed to design a portable solution. Since there was also an ongoing need to organize many of the smaller brewday items, this design for a brewing toolbox seemed to solve multiple needs at once.

In this configuration, the brewer has control over the transfer of wort during mash/boil recirculation and for vessel transfer. In the past I have used my pump in conjunction with a plate chiller with great results and I currently use it with a counterflow chiller and recirculation.

When I first developed this piece of equipment I had doubts about the pump heat displacement and the durability of the build. This configuration has been used for dozens of brew sessions, usually with the lid closed in both the heat of summer and ice of winter. I have run the pump nonstop for up to 45 minutes during a large lager batch chilling recirculation (I typically begin recirculation with 15 minutes remaining in the boil to sanitize the pump, lines and chiller). Over time, there has been no visible or noticeable impact to the pump performance — and more importantly to the quality of the beer.

My system uses a hodgepodge of brass and stainless fittings. Brewers should be sure to properly pickle, or remove surface lead, from brass fittings prior to use on brew day. With the exception of the March pump, all the components of this build can be found at any local home improvement store, although stainless fittings may have to be sourced online.

Once you acquire a pump, take a trip to your local home improvement store and look for a plastic toolbox that has adequate storage options and space for the pump motor height, plus about 2 inches (~5 cm). It is better to be conservative and go bigger if you have any doubt. Once all of the required items are sourced, it is time to get to work.

First thing is first: if you do not have access to a GFCI (ground fault circuit interruptor) outlet during your brew day, you **must** modify this plan to incorporate an inline GFCI breaker, otherwise do not take on this project. You can find an inline GFCI breaker at most homebrew stores. Liquid and electricity can seriously hurt or kill you.

Step 1 - Remove the four screws securing the pump head to the pump motor, and remove the pump head.

Step 2 - Affix the pump motor to the 2x4 scrap using the worm clamp. Ensure the wire box on the pump motor is accessible for later use (see Photo 1).

PARTS LIST

OPTIONAL PARTS

March 809 Pump
Misc Fittings
Plastic Toolbox
Inline GFCI Breaker
Grounded Extension Cord

SWITCH BOX REQUIRED TOOLS AND PARTS

Electric Switch
1" Hole Saw
(2) Coat Hook
Drill
Scrap 2x4
Screw Drivers (Phillips and Slotted)
6" Worm Clamp
Utility Knife
½" Street Elbow Fitting
(2) Wire Clamps
Wire Nuts
Wire Stripper
(8) Size 10 Machine Screws
Marker
(8) Size 10 Machine Nuts

Step 3 - Dry fit the pump and 2x4 inside the toolbox, and mark where the pump shaft meets the toolbox wall, mark this point with a marker. Using a drill, make a pilot hole at the point you marked inside the box.

Next, using a hole saw centered on your pilot hole, drill through the toolbox wall. The hole should be large enough for the shaft to easily fit through the wall. Remove any burrs with a knife. Your pump should now easily fit inside the toolbox and the shaft should fit through the wall (see Photos 1 and 2).

Step 4 - Cut a 1" (2.5 cm) hole in the middle center of the back of the toolbox for the power supply cord (see Photo 3).

Step 5 - Cut the female end off the extension cord. Cut a 12–15 inch (~30–38 cm) section of cord, and set aside. Feed the cut end of the longer cord through a wire clamp and the hole drilled in step 4. Remove the insulation and strip the three wires (green, white and black) from the longer section of cord. Tighten the wire clamp with about 12–15 inches (~30–38 cm) of spare wire inside the toolbox (see Photo 2).

Step 6 - Strip the insulation from both ends of the shorter cord, and strip the insulation from the three interior wires at both ends. Remove the cover plate from the pump motor to expose the pump wiring. Match the colors to one end of the small section of extension cord and secure with wire nuts. Re-attach the wiring cover plate (see Photos 2 and 4).

"Since the pump is portable, it makes for easy transport to group brew days . . ."

Step 7 - Measure the outside dimensions of your light box and mark the dimensions on the front of the toolbox. Cut out the marked dimensions with a knife. The switch box should dry fit into the new hole. Punch out one wire hole in the switch box and feed in the remaining end of the shorter cord and the remaining end of the longer section (leave a minimum of 5 inches/13 cm of cord inside of switch box, excess can always be trimmed later). Secure both cords with a wire clamp. Secure the switch box to the toolbox with screws and nuts as shown (see Photo 4).

Step 8 - Mark the non-stripped section of cord (this is your source wire). Strip the insulation and interior wires from the longer section of cord. Feed both the shorter and longer cords through the wire clamp and the back of the switch box. Wire the switch using the two black exposed wires. Ensure the ground (green) and current (white) wires are secured with wire nuts, and

attach the switch to the switch box. Attach the switch plate. Tighten the wire clamp (see Photo 4).

Step 9 - Dry fit the pump head to the outside of the toolbox on pump motor shaft with the inlet at the 6 o'clock position and the outlet at the 12 o'clock position. Using a marker, mark the location of the six pump head screws and remove the head and move the motor so the drill does not cause it damage. Using a ⅛" bit, drill pilot holes for the four marked screw holes. Refit the motor and head and secure the head to the motor using the manufacturer's screws. The pump should be secure to the toolbox now. Add the street elbow fitting to the inlet port of the pump head. The street elbow will allow for easy tubing connection later.

Step 10 - Screw the two coat hooks to the back of the toolbox as shown in Photo 3. Wrap the exterior cord around the hooks as shown in Photo 5.

Step 11 - Fill the toolbox with your brewing items. At the risk of sounding obvious, you should think about where you place your items. The pieces you may need in a pinch or have easy access to should be either in lid compartments, or the inner tray so you do not have to rummage (see Photo 6).

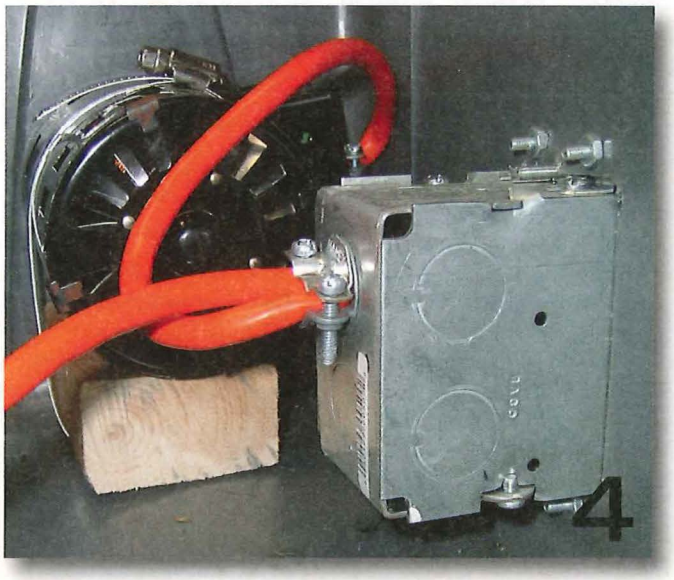
Pump priming and additional fittings

One of the largest issues with first time pump users is priming the pump. Without proper priming the pump will not create a vacuum and not perform properly. Because of the inlet/outlet orientation, the vacuum can be created fairly effortlessly. When using the pump, position the toolbox lower than the vessel, open the valve on your vessel and allow the liquid to flow into the pump head. This will force the air out of the pump head. After a minute or two, switch on the pump and you should be flowing issue free.

In my setup, I have a tee fitting on the outlet of the pump head, with two valves. I use one valve (red) to throttle the pump flow rate. Flow must be controlled after the pump, never before. I use the blue valve to purge any air in the pump to create my prime or to collect wort samples for either gravity readings or future starters.

Since I originally built my toolbox, I have upgraded to a dedicated brewing structure, but I continue to use my brewing toolbox. It is just too convenient and has never failed. Since the pump is portable, it makes for easy transport to group brew days or to lend to other brewers if they want to test drive the joy of pump-assisted brew days.

Ryan Lockard is a homebrewer from the Philadelphia area. This is his first article for Brew Your Own.



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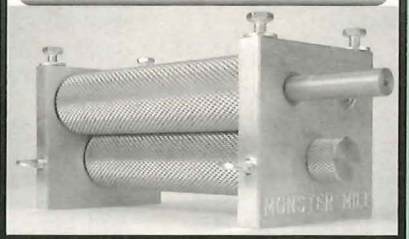

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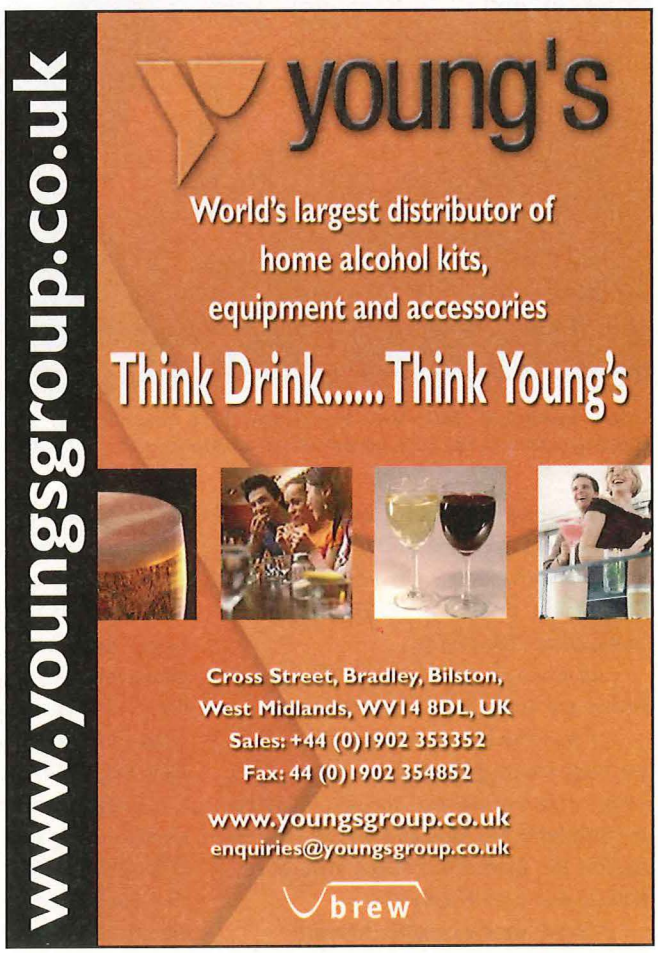

Sunday Spirit

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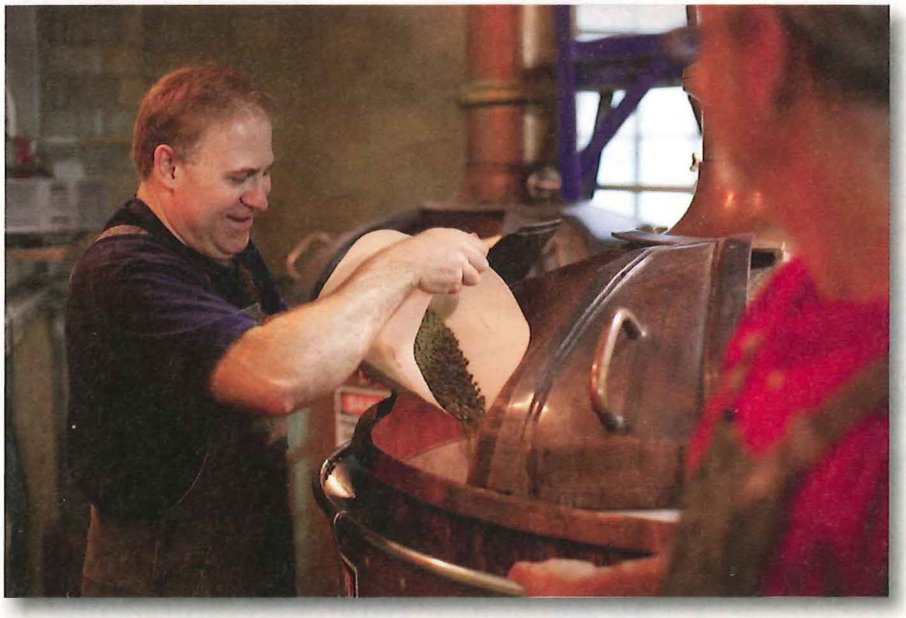
Ham and eggs, popcorn and movies, disco and roller skates, bacon and — well, everything. Some things in life are just better when paired together. Everyone has a preference as to which combination of items brings them the most joy. For David Rosenbaum, it's beer and football.

Hailing from Andover, Massachusetts, the 47-year-old computer software salesman has only been homebrewing for three years, but already the hobby is paying off.

This past summer, Rosenbaum bested nearly 200 opponents in the second annual Samuel Adams Patriot Homebrew contest. His winning entry, an oatmeal stout, is now being served in Gillette Stadium at each New England Patriots home game this season.



David Rosenbaum adds hops to a batch of his prize-winning oatmeal stout at the Boston Brewing Comany. His beer will be served at Gillette Stadium during the 2009 football season.

Rosenbaum took news of his victory with gusto and a little automotive skill.

"I was driving when I got the call. It was very exciting news, but I managed to keep control of the car," he said. "I called my girlfriend, my kids and my parents, e-mailed the (homebrew club) mailing list, and posted it on Facebook."

"Then I took a breath!" he said.

Winning awards wasn't new for Rosenbaum. He'd won some competition ribbons for his homebrew in the past, but this win was different. Something made this win taste just a little bit sweeter than most. The Pats.

"I've been a Pats season ticket holder since 1994, through five Super Bowls and two stadiums," he said. "Now my beer will be served at the stadium and I can drink it in my own seat while I watch the game, knowing other fans are enjoying it too. It's a huge thrill and honor!"

Samuel Adams founder Jim Koch was proud to add Rosenbaum's entry to the list of available choices served at the stadium this season.

"David's Oatmeal Stout is a delicious beer," Koch said. "Its full-bodied, roasty character is complemented with a slight sweetness that will make (it) a perfect choice for the chilly Patriots games that we New Englanders attend."

Rosenbaum said he entered another version of his oatmeal stout in last year's competition, though it didn't place. But the experience helped him fine-tune the beer into what would become this year's best brew.

"I got feedback from the judges that it was too thin, though the flavor was good," he said. He later tweaked the process by toasting the oats, mashing at 154 °F (68 °C) to create a smoother mouthfeel, and omitting the Irish Whiskey-soaked oak chips that were called for in the original recipe.

Rosenbaum started modestly like most homebrewers, with his first batch being an American amber extract kit. And like many first-time brewers, the first batch hit a couple of snags.

"The instructions were not specific enough on a couple of points, so I ended up with all my hops in the fermenter and then distributed in the bottles as trub," he said. "The net result was a slightly phenolic, but moderately drinkable, beer. I shared it with some friends and they seemed to like it."

After a few more attempts, Rosenbaum made the switch to all-grain. He still brews in his apartment kitchen on a gas stove, which he says limits him to 5-gallon (19-L) batches, but he's adding more capabilities as often as he can.

"I'm working on converting my beer fridge into a kegerator — every homebrewer's dream!" he said.

But when he's not selling computer software, attending homebrew club meetings, or brewing the latest batch of bitter in his kitchen, you can bet that every Sunday through the end of this NFL season, Rosenbaum will be enjoying beer and football.

"For home games, I plan to be in my seat at Gillette cheering on the Patriots and enjoying — responsibly of course — my beer," he said. "For away games, I'll be watching on a big-screen HDTV with a homebrew and some friends. Either way, I'll be wearing Patriots blue!"

Web extra:

Brew David's oatmeal stout recipe:
http://www.byo.com/component/resource/article/1953

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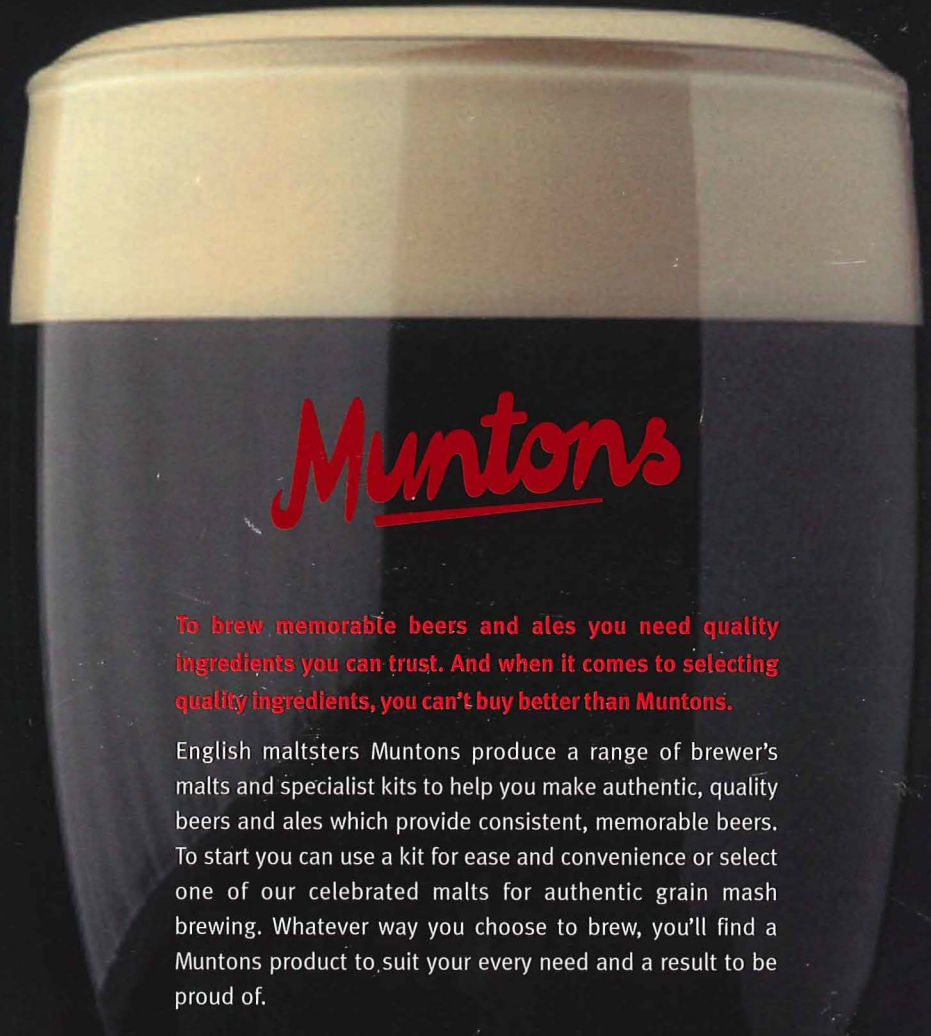

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