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MARCH-APRIL 2007, VOL.13, NO.2

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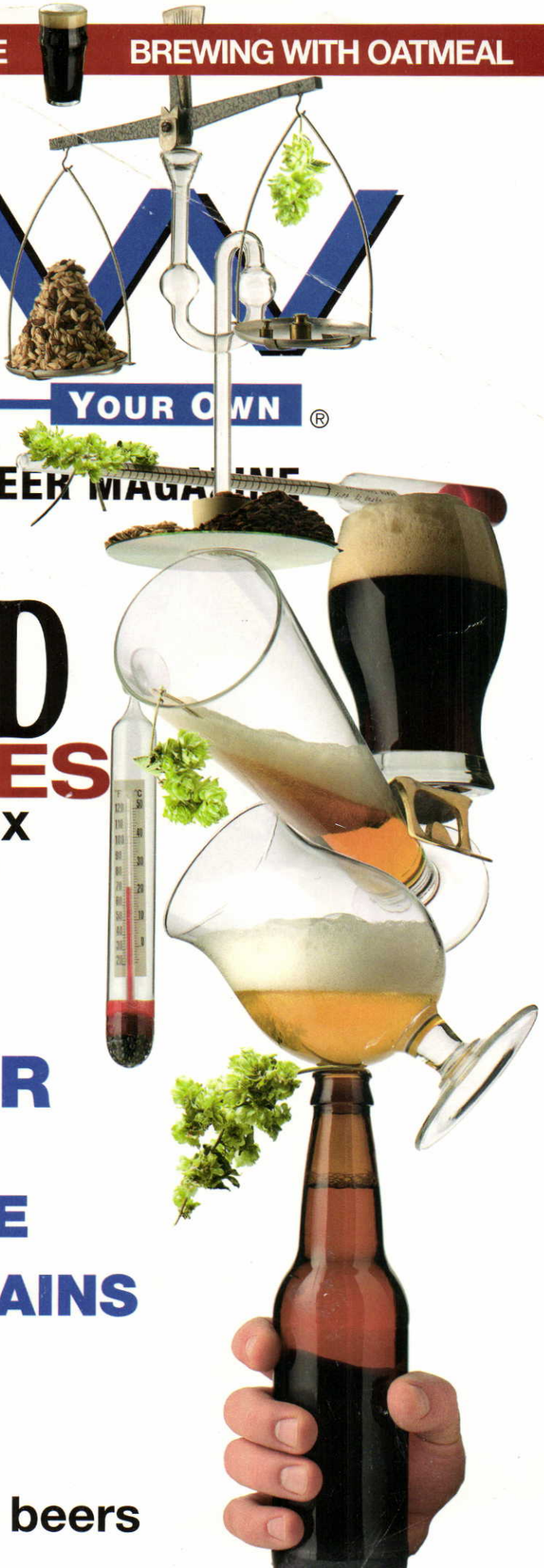

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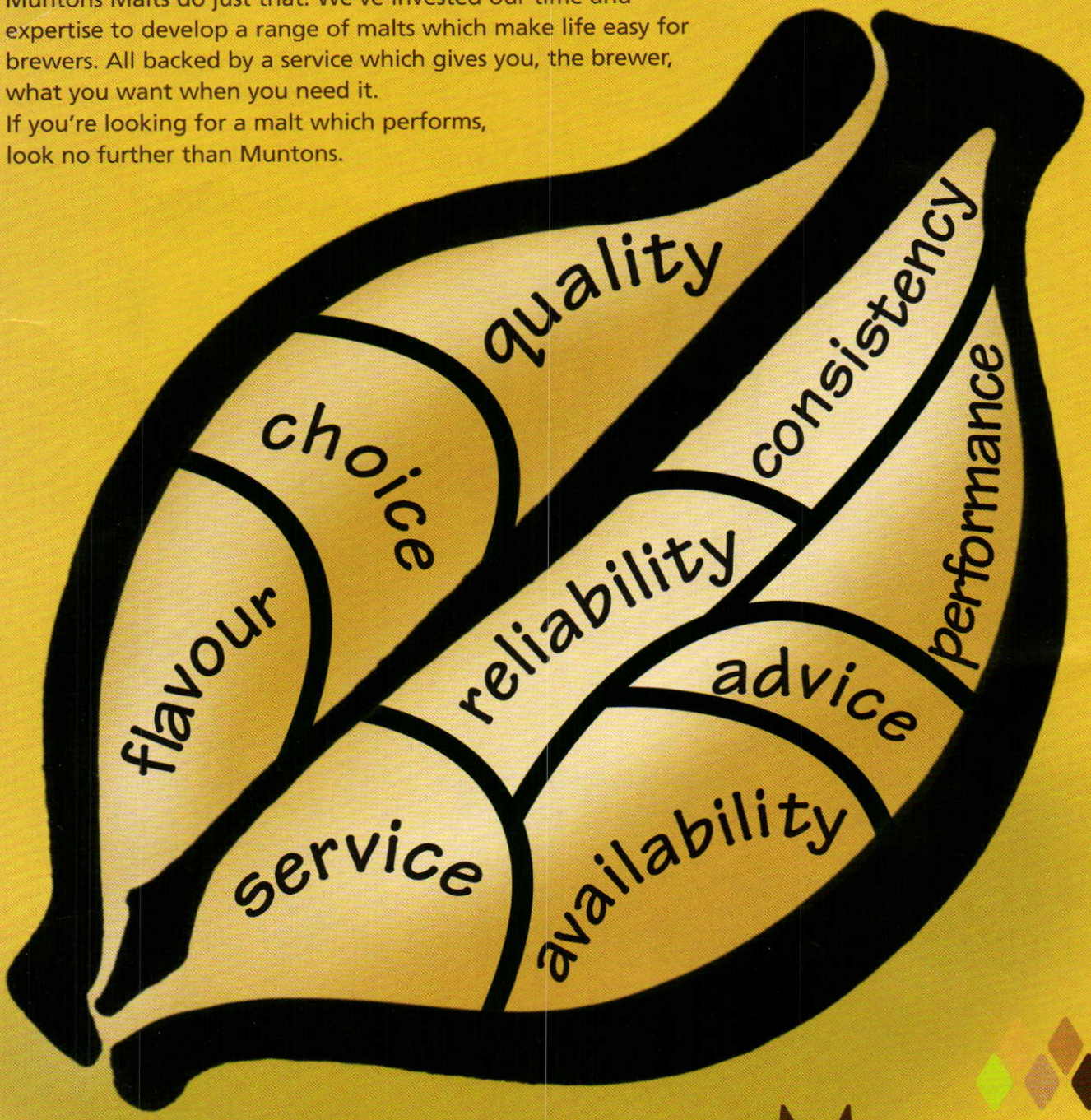


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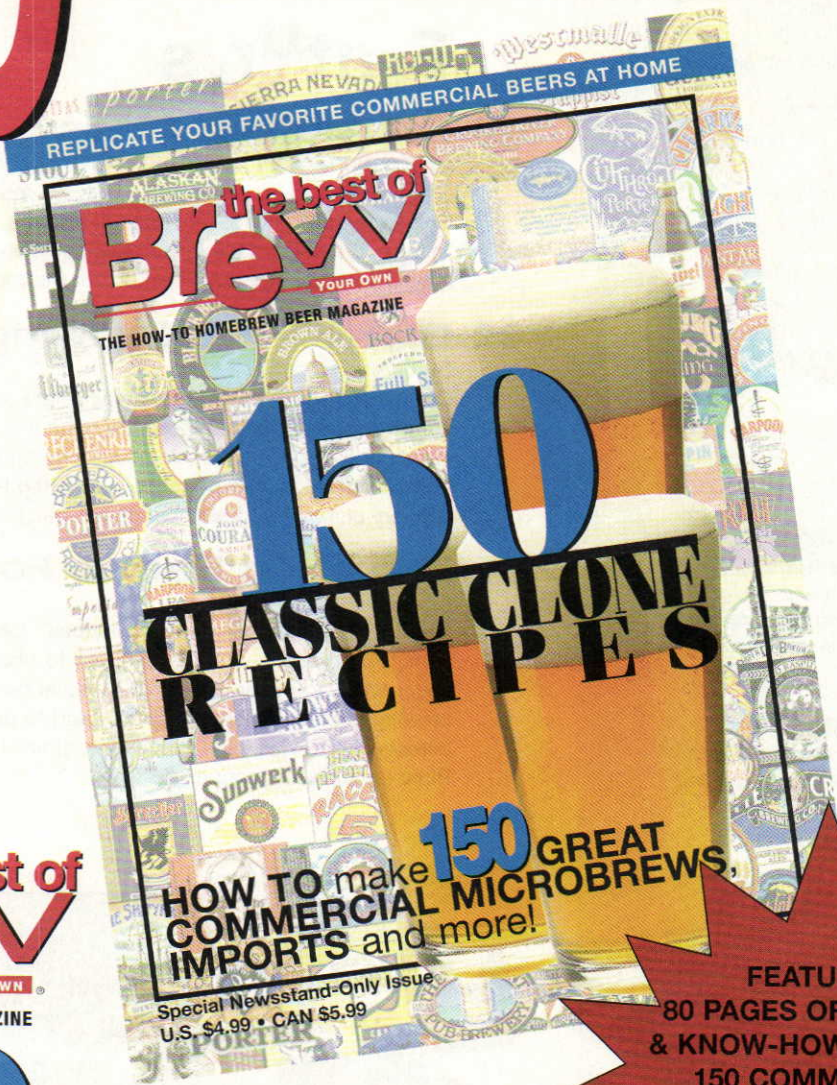


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MARCH-APRIL 2007
Volume 13 Number 2

# Departments



COVER PHOTO: CHARLES A. PARKER

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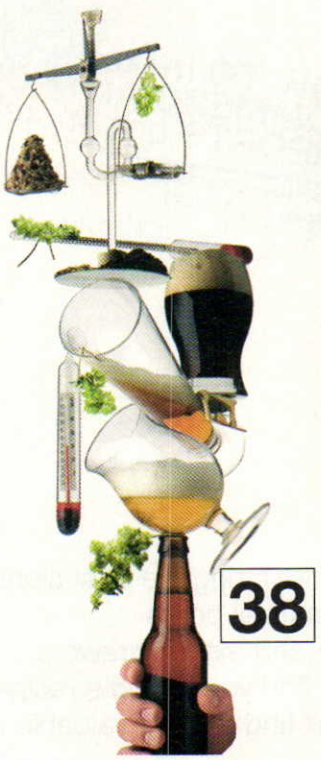
# Features








## Where to find it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# RECIPE INDEX



## 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.


Brew Your Own

THE HOW-TO HOMEBREW BEER MAGAZINE




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## Karo for a Cream Ale?

After reading the article, "American Pilsner," in *BYO* (January-February 2007 issue) and listening to Chris Colby's interview on Basic Brewing Radio, I went looking for brewers corn syrup. None of the homebrew shops I checked with carried it. Is "regular" corn syrup the same? I'm looking to use it in a cream ale as a substitute for flaked maize.

*Jack McKillip*
*Carbondale, Illinois*

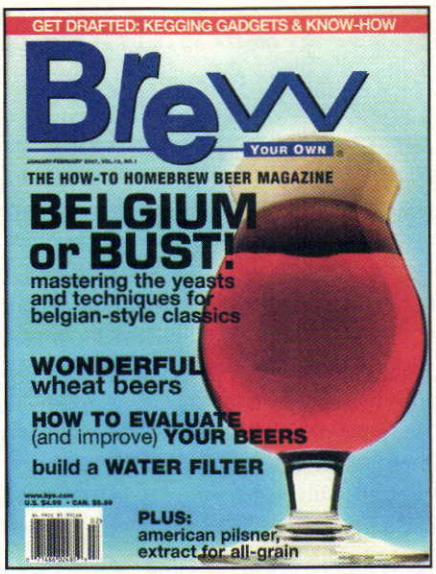
*Author, and* BYO *editor, Chris Colby responds: "There is a short and sweet (no pun intended) answer to this. I will not be giving that answer.*

*"Back in 1811, the Russian chemist K. S. Kirchof published his discovery that potato starch could be turned into a sweet, viscous syrup if the starch was heated along with sulfuric acid. Later, he discovered that the same conversion could be accomplished using an extract from malted barley in place of the acid.*

*"Today, corn syrup is made by treating the starch granules from dent corn with starch-degrading enzymes under acidic conditions. The enzymes come from the fungal species* Aspergillus niger *and* A. oryzae, *the fungus that is used to break down rice starch in the production of* sake *(rice wine). The result is a syrup that is roughly half as sweet as sucrose (table sugar), with a pH of 3.5 to 5.5. The predominant sugar in 'regular' corn syrup is glucose.*

*"In the 1960's, the process for making high-fructose corn syrup (HFCS) from regular corn syrup was discovered. In high-fructose corn syrup, much of the glucose is converted enzymatically to fructose, yielding a syrup almost as sweet as table sugar, but much cheaper to produce. In the 1980s, high-fructose corn syrup began replacing the beet or cane sugars found in soft drinks at the time. Today, all but a few use HFCS.*

*"By altering the conditions or the enzymes used in syrup production, syrups with different proportions of various sugars (and other carbohydrates) can be obtained. Brewers corn syrup (a form of high-maltose corn syrup) is prepared such that the carbohydrate profile of the syrup is similar to wort. There are also rice syrups made this way. You have to look around a bit to find a homebrew shop that carries this type of syrup, but they do exist.*




*"So where does this leave a homebrewer in 2007, looking to brew a cream ale? Well, aside from the sweetness, most plain corn syrups are nearly flavorless — and the sweetness will ferment away. However, the carbohydrate profile of brewers corn syrup should be easier for brewers yeast to deal with than a "regular" or high-fructose corn syrup.*

*(Note: 'The 'plain' corn syrups found at your grocery store may have flavors added, such as the vanilla added to Karo Syrup, the most popular supermarket brand. Some may also have molasses added to produce a dark corn syrup.)*

*"If you are making a beer that uses a lot of corn syrup (over 20% or so of the grain bill), such as a cream ale or American Pilsner, I would try to find brewers corn syrup. If not, I would use flaked maize in the mash or do a full cereal mash.*

*"In a beer that calls for only a small amount of corn syrup, you could probably substitute plain corn syrup (with no flavorings added) — or good old corn sugar or cane sugar — with little change in the resulting beer.*

*"When brewing any beer with a substantial amount of kettle adjunct, adding some yeast nutrients to the boil will help the yeast perform better. And, as with any beer, aerating the wort well and pitching the proper amount of yeast is always a good idea."*

## Keg Kit Q

I found a lot of great information in the article "Rebuilding Kegs" (January-February 2007 issue), but had one question after reading it. Where did Mr. Allison purchase the rebuilding kit? I have a few kegs that need to be rebuilt this would be great information that will save me a lot of time.

*Mark Ransom*
*via email*

*Almost all homebrew shops will sell the large O-ring and four small O-rings needed to rebuild a keg as a package or individually. (Likewise, all the poppet valves, pressure relief valves, posts and dip tubes are sold individually.) The tool kit Ralph used was composed of tools that you should be able to find at any decent hardware store.*

## Spunding 'Splosion?

I read with great interest Marc Martin's "Build Your Own Spunding Valve" (January-February 2007 issue) and had one question. What happens if the valve gets plugged with foam from the fermentation? Will your keg blow up?

*Randy Koenig*
*Appleton, Wisconsin*

*Used correctly, there is no way a Corny keg would blow up from the use of a spunding valve. Even if you used the valve deliberately incorrectly, you'd have to try pretty hard to induce any harmful effect. First of all, the spunding valve is designed to be attached only after the beer has been racked from the primary fermenter and the fermentation is winding down. There shouldn't be any foam or kräusen to plug the valve when it is in use. Secondly, the lid of a Corny keg has a pressure release valve that would pop far before the keg would rupture. Thirdly, a Corny keg can hold up to 130 PSI of pressure, but brewers yeast is sensitive to pressure and likely could not develop this level of pressure — around 9 atmospheres, 3 atmospheres higher than the level of carbonation in Champagne. Long story short; it can't happen. (It would make a cool YouTube video, though.)*

**Glenn BurnSilver** is a freelance writer and a frequent contributor to *Brew Your Own* magazine. He has written many articles about brewing beer with ingredients other than one of the "big four" — barley, hops, yeast and water. These include an article on coffee beers (December 2002) and an article on spiced beers (December 2003).

He has also authored a couple clone beer roundups, including 12 winter or holiday beers in our December 2004 issue and 5 "double" or "imperial" beers in the December 2006 issue's cover story, entitled "Tasting Double." In this issue, Glenn does double duty, writing a piece on brewing gluten-free beers (p. 32) and also helping us out on the editorial side as an associate editor. Glenn lives and brews — and also collects vinyl records — in Colorado.

In this issue of *Brew Your Own*, we welcome **Jon Stika** as our new "Techniques" columnist. When Jon says he brews his own, he really means it. Jon grows his own hops (as seen in Homebrew Nation in the September 2004 issue) and has grown and malted his own barley. He has also brewed with some unusual ingredients, including sweetgrass, something he wrote about in the May-June 2003 issue.

Jon grew up in Milwaukee, Wisconsin, within sight of the Miller brewery and is now a member of the Heart River Homebrewers Club, of Dickinson, North Dakota.

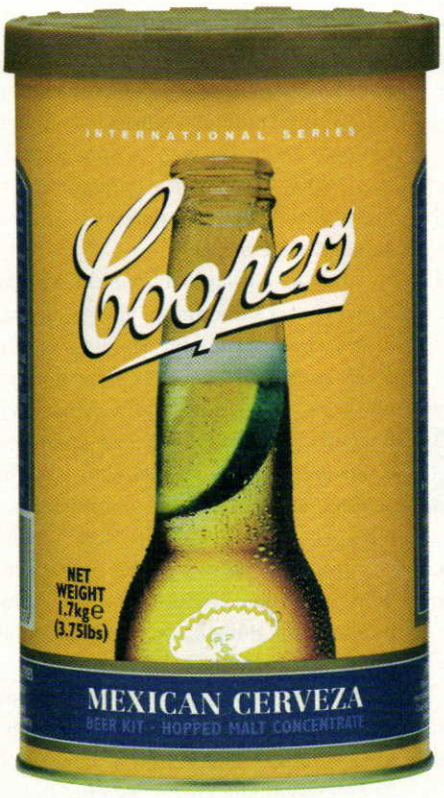
On page 51, he kicks off his column with an article on malting barley at home. He writes that home malting is something any homebrewer can accomplish.

We also welcome a new "Style Profile" columnist to *BYO*, **Jamil Zainasheff**.

"I've never met a beer style I didn't like," says Jamil. "Properly made, they're all wonderful. There are bad beers, not bad beer styles." He's also never met a beer style he hasn't brewed, as he learned about beer styles by brewing every one of the styles recognized by the Beer Judge Certification Program (BJCP). Jamil is also a BJCP judge and Assistant IT Director for the BJCP. Plus, he also hosts a bi-weekly internet radio show on brewing and beer styles.

On page 19, Jamil shows off his extraordinary knowledge of beer styles with an article on ordinary bitter, the classic British session beer that is anything but ordinary.

# FAST, EASY, SIMPLY THE BEST.




## Mix, Brew, Bottle...

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## homebrew PROFILE

### John Jurgensen • Houston, Texas

The Bay Area Mashtronauts Homebrew Club, located just south of Houston, was originally formed by homebrewers that worked at NASA or were NASA contractors. Over the years the Mashtronauts have had the privilege of having some of NASA's finest minds as members. One particular Mashtronaut is not only one of the best homebrewers in the nation, but also a NASA legend.

John Jurgensen has spent over thirty-seven years at NASA with several different assignments during this time. John worked with Mission Control on both Apollo 11 and Apollo 13. In later years he was in charge of testing software for the Space Shuttle and the International Space Station. John currently works at the Johnson Space Center in the Office of the Chief Information Officer.

From Mission Control to Brew Control with a NASA legend.

In the Houston area homebrew scene, John is also a legend. For the last few years John dominated the Bay Area Mashtronauts' monthly competition, won multiple ribbons at Houston's Dixie Cup and the Bluebonnet Brew Off in Dallas, and dominated the regional AHA competition where multiple entries moved to the national level. He won a Gold Medal in the 2004 AHA Nationals in the Spice/Herb/Vegetable Category with his Jalapeño Wheat Beer.

John is a prolific brewer, making two batches at a time and generally brewing about twice a month. He has multiple freezers and refrigerators in his home for all of his fermenting and serving needs. Recently, John added a sun room/brew room onto his home; including sink and cabinet space for John's brewing supplies. The room is dubbed "John's Pub."

John has served as his club's president and coordinator for the Lunar Rendezbrew Homebrew Competition held each July.

John uses a simple system of a cooler mash tun and a stainless pot with a turkey cooker burner, glass carboys for fermentation and corny kegs for storage. John's philosophy is to keep it simple and hold the variables as constant as possible. It seems to serve him well—with NASA, and with his beer.

## Homebrew CALENDAR

**March 10**
**THE DRUNK MONK CHALLENGE**
**Aurora, Illinois**
Entries—two bottles per entry—are due by March 4 and should be dropped off or shipped to Walter Payton's Roundhouse America's Brewpub, 205 N. Broadway, Aurora, IL, 60505. Visit www.knaves.org/dmc for more information.

**March 18**
**SHAMROCK OPEN**
**Raleigh, North Carolina**
Entries should be mailed or dropped off at American Brewmaster, 3021-5 Stonybrook Dr., Raleigh, NC, 27604 or Dave Buning, 212 Excalibur Ct., Cary, NC, 27513 no later than 8:30 a.m., March 18. Go to: http://hbd.org/carboy/shamrock.htm for more information.

**April 28**
**8 SECONDS OF FROTH / LIQUID POETS MUGSHOT CHALLENGE**
**Ft Collins, Colorado**
Entries are due April 21 and can be dropped off (not mailed) at Hops & Berries, 125 Remington St., Fort Collins, (970) 493-2484. Contact Stephen Jones for more information at: skijones@gmail.com.

**April 30**
**11TH ANNUAL CASCADE BREWERS' CUP**
**Seattle, Washington**
Entries due April 30th with public event held May 19th. Conical fermenter and other prizes. Top 3 beers will be brewed by commercial breweries. Visit www.cascadiabrewersclub.org for details.

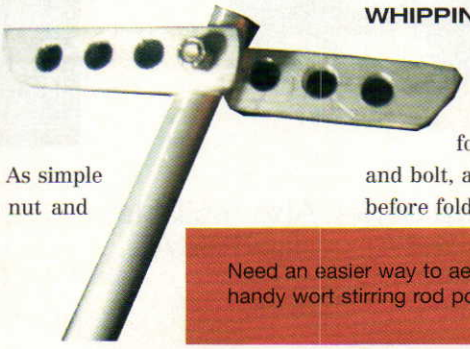
## reader PROJECT: WORT STIR ROD

### Tony Profera • Charlotte, North Carolina

I am often described as a brew gadgeteer so I figured it was time to share one of my latest devices: a stir bar with folding wings that attaches to a drill. The vanes fold up to easily fit in the neck of a carboy, or for use in a plastic bucket. I use it to aerate wort and mix ingredients such as honey and water for my mead. Let me tell you, this really creates a vortex and whips the wort into a froth when I want to aerate before pitching my yeast (remember, this is a good thing). Plus, it sure beats the heck out of endless carboy rocking!

If I had known this stir rod worked this well I would have made one long ago. The project consists of four basic parts.

**THE HEAD** (see photo at right)- As simple as one, two, three pieces—and a nut and bolt to hold it all together.



**TAIL END** - I designed my rod to fit into a cordless drill. I can attach a standard drill bit to the tail end of the rod. Next, put the bit into the drill and the wort will be shaking (well, frothing actually) in the carboy.

**DRILL ATTACHMENT** - This simple bit fitting works with any drill. I prefer my cordless model so I can take my stir rod anywhere I need to aerate wort or mix ingredients.

**WHIPPING END** - Note the angle cut on the wing ends in the photograph at left. This angle forces the wings to extend out from the center rod in an opposing way when spun, increasing the amount of aeration. The folding action of the wing, held loosely in place by the nut and bolt, also allows the rod to fit easily into the neck of a carboy before folding back out to provide the whipping action.

Need an easier way to aerate your wort than endless carboy rocking? A handy wort stirring rod powered by a cordless drill could be your answer.

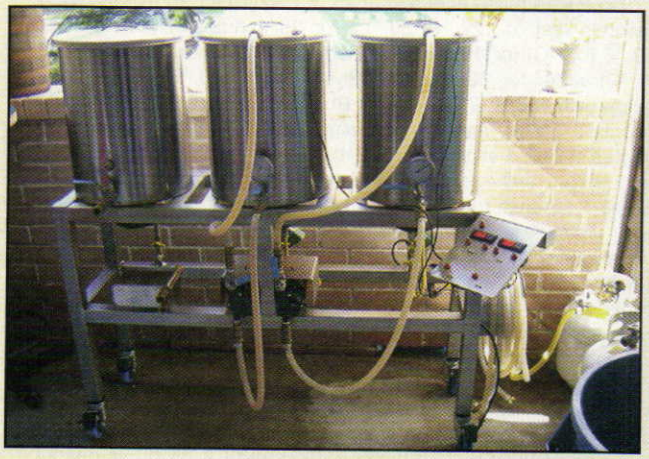
# homebrew systems that make you DROOL

## Lonnie McAllister • Houston, Texas

Meet Brutus Ten! What this mechanized, dedicated behemoth brewing system offers is repeatable and very consistent brewing from batch to batch. It is indeed just a downright pleasure to brew on the fruits of your own hard labor.

Brutus Ten is an all stainless 11-gallon (42-L) brewing system designed and fabricated from 2" stainless steel square tubing right on our very patio. The temperature controlled MLT and HLT allow extremely accurate temperature control throughout the brew day. With its recirculating direct heated MLT, I am confident in reproducibility. I can count on the HLT temperature being right where I want it to be, ready for the sparge at a flip of a switch. The pilot-light driven low pressure burners are temperature switch controlled. Gas solenoid valves mounted to a pressurized gas beam command them to fire only when necessary. A dual pump system opens the door for dual recirculation, allowing a unique chilling scheme that stifles this dreaded Texas heat. Compactness and portability also allow Brutus to be parked on our apartment living room carpet after each use. (WARNING: Requires EXTREMELY willing spouse!)

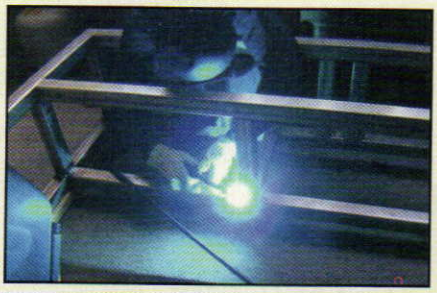
Fabricating a system of this caliber on a small apartment scale was very challenging and extremely rewarding. Cutting, grinding, drilling, milling and welding all required specific tools and skill agility; more from the heart, and no more so than the knowledge it takes to craft fine ale. I would implore anyone with a smidgen of fabricating skills to give your dream system a go!



The Brutus Ten weighs in at 210 pounds (95 kg) and is ready to rumble. A dual pump system opens the door for dual recirculation, allowing a unique chilling scheme that stifles the dreaded Texas heat. "Set it and forget it," Lonnie says. "It's brewing utopia!"

**Picture 5:** Key construction issues included portability and compactness on this self-contained system.

**Picture 1**: "Does it take a modern brewery to fabricate a fine Texas craft beer?" No, but it sure is fun.

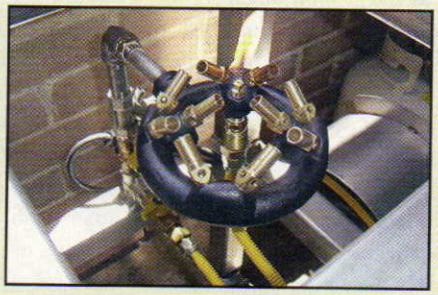


**Picture 2:** Brutus was fabricated from 2" stainless steel square tubing.

**Picture 6:** The temperature controlled MLT and HLT allow accurate temperature control throughout the brew day.

**Picture 3:** Specific tools and skills are required, but Lonnie says much of that comes "from the heart."

**Picture 4:** Lonnie fabricated Brutus on his very small apartment patio and made his system portable with wheels.



**Picture 7:** The pilot-light driven low pressure burners are temperature switch controlled and fire only when necessary.

## reader RECIPE

# Mike Prilla • Pittsburgh, Pennsylvania

### Peanut Butter & Chocolate Sweet Stout

I used peanut butter extract and cordial oil, but you could also use 6 oz. of low fat peanut butter and add it at intervals during the boil just like the cocoa powder is added.

**Ingredients**

7 gal. distilled water
¼ tsp. salt
¼ tsp. Epsom salts
¼ tsp. calcium chloride
¼ tsp. baking soda
¼ tsp. gypsum
¼ tsp. Burton water salts
1 tsp. amylase enzyme
12 drops of lactic acid
1 lb. German Pilsner malt
1 lb. Wheat malt
1 lb. American crystal malt (60 °L)
8 oz. dextrine malt (CaraPils)
1 lb. Belgian Special B malt
1 lb. British chocolate malt
4 oz. roasted barley
9 oz. of flaked oats (that have been toasted for 30 min at 325 °F/162 °C)
9 oz. flaked oats
8 oz. flaked wheat
3.3 lbs. light liquid malt extract
3 lbs. dried wheat malt extract
1 stick licorice
6 tbsp. Hershey's dark cocoa powder
6 tbsp. Hershey's cocoa powder
2 vanilla beans
1 tsp. Irish moss
1.5 oz. Fuggles hops (4.75% AA) for 60 minutes of boil
1.5 oz. Kent Goldings hops (5% AA) for 60 minutes of boil
0.5 oz. Fuggles hops (4.75% AA) for 15 minutes of boil
0.5 oz. Kent Goldings hops (5% AA) for 15 minutes of boil
1 packet of Wyeast 1084 (Irish Ale) yeast
1 tsp. yeast nutrient
1 tsp. diammonium phosphate
1 tsp. yeast energizer
1 bottle (2 oz) of Watkins peanut butter extract
1 bottle (½ oz) CK products peanut butter cordial oil
6 oz. medium toasted oak chips or cubes
One packet of plain gelatine
1 tsp. polyclar
1 tsp. isinglass
1 lb. lactose
8 oz. maltodextrin

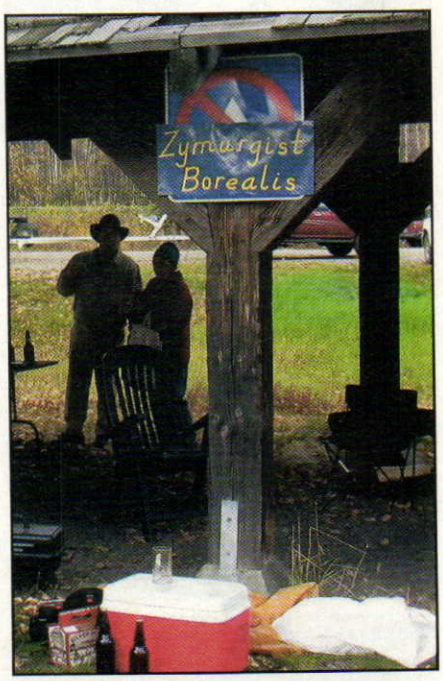
**Step by Step**

Do a step mash acid rest at 95 °F ( 35 °C) for 25 minutes with a protein rest at 122 °F (50 °C) for 25 minutes. Then mash at 149 °F (65 °C) for 90 minutes. Remash in another pot of 149 °F (65 °C) water for 30 minutes. Mash out at 168 °F (78 °C) then sparge with 168 °F (78 °C) water. Boil 60 minutes and add hops as described above. Add the following based on time intervals: 60 minutes of boil: 1 stick licorice, 2 tbsp. Hershey's dark cocoa powder, 2 tbsp. Hershey's cocoa powder, 1/2 vanilla bean; 15 minutes of boil: 1 tsp Irish moss, 2 tbsp. Hershey's dark cocoa powder, 2 tbsp. Hershey's cocoa powder, ½ vanilla bean; 5 minutes of boil: 2 tbsp. Hershey's dark cocoa powder, 2 tbsp. Hershey's cocoa powder, ½ vanilla bean. Cool wort and siphon out 1 gallon (3.8 L) of this concentrated wort into a clean empty distilled water container and put it in the fridge. Then add water to the remaining wort to the 5-gallon (19-L) mark. Pitch yeast between 68 °F and 72 °F, add yeast nutrient, diammonium phosphate and yeast energizer. In 3 to 7 days, after fermentation has slowed down and the kräusen has settled, add the stored wort and rack to secondary. Then add Watkins peanut butter extract and CK products peanut butter cordial oil, ½ vanilla bean and 6 oz. medium toasted oak chips or cubes. Fine with plain gelatine, Polyclar and Isinglass. Carbonate at 3.0 volumes with 12.5 oz. dried malt extract. Also add lactose and maltodextrin at bottling.

## club PROFILE

# Zymurgist Borealis • Fairbanks, Alaska

Alaska breeds a different type of person: rugged, individual and above all independent. Located in Fairbanks, Zymurgist Borealis is a homebrew club started in 1991 that reflects the idealism of the people in the Great White North. For starters, Zymurgist Borealis members do not pay club dues or elect officers. Club dues are somewhat reminiscent of taxes, which all Alaskans passionately despise. Without club dues there was, of course, no need for a treasurer. Upon further consideration, other club officers seemed pretty superfluous as well. Zymurgist Borealis is more of a loose affiliation of about 20 people sharing a common interest that meet twice a year at a local campground. Zymurgist Borealis also hosts the E.T. Barnette Homebrew Competition each July. This competition is unique in that it boasts a Best of Show prize of $500 — one of the largest cash prizes of any homebrew competition. In Fairbanks, people pay a bit more for many items, including beer. A natural outcome of this situation was for homebrewing to become a popular means of reducing costs while still maintaining high quality. The formation of the local homebrew club was kind of inevitable as well. And it follows that such a homebrew club would reflect the quirky character of the local folks. Zymurgist Borealis: a unique club for a unique people.



# replicator

by **Marc Martin**


*Dear Replicator,*

I have now found a beer that may be my all-time favorite and would love to be able to clone it. This summer my wife and I took an Alaskan cruise that ended in Anchorage. Knowing we would spend an extra day there, I had already searched the web for breweries. We did go to three, but our favorite by far was Midnight Sun. It's not easy to find as it is tucked away in a residential area, but worth the search since they had 6 excellent beers on tap. The best of the bunch had to be their Full Curl Scotch Ale, which was nice and malty with a good alcohol punch. I am hoping you can show me how to replicate this fine brew.

*Thomas Fruedheim*
*Asheville, North Carolina*

As I have mentioned before, my regular job allows me to travel throughout the northwestern states including Alaska. I have visited Midnight Sun several times before and this gave me a good excuse to stop by again. I would agree that at Midnight Sun they consistently develop excellent beers with a definite focus on high gravity and some very nice Belgian varieties.

I was eagerly greeted by Gary Busse, the general manager, and Ben Johnson, one of the brewers. After a round of sampling, they gave me some history of their small, quirky brewery. Since opening in 1995, they have produced over 1,000 batches and in May of 2005 released an anniversary Belgian-style barley wine to commemorate this milestone. Their beers have garnered several Great American Beer Festival (GABF) medals and their Arctic Devil barley wine consistently wins awards at the Alaskan Barley Wine Festival.

Ben and head brewer Gabe Fletcher both started as homebrewers and now brew on their 15-barrel system. Unfortunately, many of their beers never make it to the lower 48 since they are so popular in Alaska. Ben reports that their Full Curl Scotch ale has been a consistently good seller, but is going to be discontinued so they can further expand their line-up.

Ben describes Full Curl as a wee heavy strong scotch ale and at 7% alcohol by volume, it fits the style. He reports that by using a good percentage of Special B and crystal malts they achieve the sweet, malty finish. One hop addition provides just enough bitterness to back up a big malt bill. As Ben and I shared a bottle I found it to be very reminiscent of Belhaven's Wee Heavy. An excellent choice, Thomas, and now you can brew your own.

For further information visit their website www.midnightsunbrewing.com or call them at 907-344-6656.

## Midnight Sun Brewing Full Curl Scotch Ale

**(5 gallons/19 L, extract with grain)**

OG = 1.074 FG = 1.020
IBU = 22 SRM = 14 ABV = 7.0 %

### Ingredients

6.6 lbs. (3.0 kg) Muntons light, unhopped, malt extract
2.2 lbs. (1.0 kg) dried malt extract
8.0 oz. (0.22 kg) Special B malt
4.0 oz. (0.11 kg) crystal malt (30°L)
2.0 oz. (57 g) Special Roast malt
½ tsp. yeast nutrient (15 min.)
6 AAU Perle hop pellets (60 min.) (0.71 oz./20 g of 8.5% alpha acid)
White Labs WLP 028 (Edinburgh) or Wyeast 1728 (Scottish Ale) yeast
0.75 cups corn sugar for priming (if bottling)

### Step by Step

Steep the crushed grain in 2.5 gallons (9.5 L) of water at 150 °F (66 °C) for 30 minutes. Remove grains from the wort and rinse with 2 quarts (1.9 L) of hot water. Add the liquid extract and bring to a boil. While boiling, add the hops as per the hopping schedule. During the boil, use this time to thoroughly sanitize a fermenter. Add the yeast nutrient after 45 minutes of boiling. Now add the wort to 2 gallons (7.6 L) of cold water in the sanitized fermenter and top off with cold water up to 5 gallons (19 L).

Cool the wort to 75 °F (24 °C). Pitch your yeast and aerate the wort heavily. Allow the beer to cool to 68 °F (20 °C). Hold at that temperature until fermentation is complete. Transfer to a carboy, avoiding any splashing to prevent aerating the beer. Let the beer condition for 1 week and then bottle or keg. Allow to carbonate and condition for two additional weeks and enjoy your scotch ale.

### All-grain option:

This is a single step infusion mash. Replace the malt syrup with 14 lbs. (6.4 kg) 2-row pale malt. The specialty grains increase slightly. Special B, 12 oz. (0.34 kg), crystal malt, 6 oz. (0.17 kg), and Special Roast, 4 oz. (0.11 kg). Mix the crushed grain with 4.5 gallons (17 L) of 168 °F (76 °C) water to stabilize at 150 °F (66 °C) for 60 minutes. Sparge slowly with 175 °F (79 °C) water. Collect approximately 6 gallons (23 L) of wort runoff to boil for 60 minutes. Reduce the bittering hop amount to 0.6 oz. (17 g) to allow for the higher utilization factor of a full wort boil. The remainder of this recipe is the same as the extract with grain recipe.

# Partial Mashing

## "Steep" any grain you want

by Chris Colby

Most beginning homebrewers steep crushed specialty grains when making their wort. Later, they learn that there are steepable grains and grains that should not be steeped. Grains that can be steeped include crystal malts and darkly roasted grains such as chocolate malt and roasted barley. However, base malts — such as pale malt, wheat malt, Pilsner malt, Vienna malt and Munich malt — should be mashed instead of steeped. Although these grains can't be steeped, you may still want to brew recipes that include them. And luckily, you can. All you need to do is learn how to perform a partial mash.

In practice, steeping and mashing are very similar. They both involve soaking crushed grain in hot water. The main conceptual difference is what the soaking does to the grains. In steeping, colors and flavors from the husk of the grain, and sugars from the interior, are dissolved into the brewer's wort. In mashing, colors and flavors from the husk dissolve into the wort, but inside of the base malt there are no sugars, only starch. The starch dissolves into the wort, then enzymes from the base malt convert it into sugars.

The practical difference between steeping and mashing involves the relative volume of water used and the temperature the grains are soaked at. When steeping specialty grains, the amount of water you steep in and the temperature of the water are not that important, within reasonable bounds. You can steep grains in just enough water to cover them, or a much larger volume of water. (Over 6.0 qts. of water per pound of grain (13 L/kg) is not recommended.) Likewise, you can steep grains in cool water or at temperatures up to 170 °F (77 °C). Higher, even, if you use only a small amount of water.

In contrast, when mashing, you need your grain and water mix to have a certain thickness. The thickness of a mash should be between 1 and 2.5 qts. of water per pound of grain (2–5 L/kg). In addition, the grains should be held in the 148–162 °F (64-72 °C) range during the mash. If you mix your mash at this thickness and hold it in this temperature range, you will convert all the starches.

So what does this mean for a beginning extract brewer? It means that if you've already brewed recipes that involved steeping some specialty grains, you only need to keep two additional things in mind if you want to try a partial mash recipe. The first thing is the volume of water. Many partial mash recipes, including most in *BYO*, list the amount of water required for the partial mash. If the proper mash volume is not listed, you can calculate it easily — just take the combined weight of all the grains (base and specialty) and multiply by 1.5. This will give you the number of quarts of water to use for your partial mash. (Multiply the total kilograms by 3 to get the number of liters of water for your partial mash.)

Secondly, keep in mind that your grains will be colder than the mash water. So, you will need to heat this above the target mash temperature. (Try heating the mash water to 11 °F (6 °C) over the target; this should get you close.)

The recipe will likely specify a single temperature to mash at. The length of the mash should also be specified. However, in a small mash, temperatures will drop fairly quickly. If you are mashing on your stovetop, you can add heat in short bursts every few minutes. Some homebrewers put their brew pot in the oven on the lowest setting (sometimes with the door open). Still others mash in small insulated coolers and try to insulate the cooler as best they can. Keep in mind that heat loss affects the character of your partial mash wort, but not the quality. If your mash temperature dips into the low end of the above range (or below), your partial mash will exhibit a high degree of fermentability. However, your partial mash wort will be combined with malt extract, and the blend of the two almost always yields good results. Do whatever you reasonably can to hold temperatures steady, but don't sweat fluctuations that are beyond your control.

So don't get scared off by the words "partial mash" in a recipe. If it looks interesting, try it. You're guaranteed to enjoy it, at least partially.

# Rye Not?

## Add a little spice with rye

by Glenn BurnSilver

*Rye is a grain that many homebrewers are interested in experimenting with. While a common ingredient in many U.S.-made whiskeys and bourbons, only a handful of commercial or craft brewers use it with any regularity. Those that do find the small, earthy grain adds a mild spiciness that balances malt sweetness, while simultaneously leaving a clean palate.*


**BRIAN "SPIKE" BUCKOWSKI (right) is the head brewer for the Athens, Georgia-based Terrapin Brewery, run with partner John Cochran (left). On the advice of an old college roommate, Buckowski tried brewing his own beer. Soon, his "real job" briefcase contained not only his regular work, but his homebrewing books too. Eventually, he took a leave of absence to study at the American Brewers Guild. Back in Georgia he wore his suit for a final three months before his "hobby turned into a career" when he landed his first brewing job with the Atlanta Brewing Company in 1997. Terrapin Brewery was launched in April 2002. Six months later the Rye Pale Ale took home a gold medal at the 2002 Great American Beer Festival (GABF) in Denver in the "American Pale Ale" category.**

We're based out of Athens, Georgia and when people found out that the Terrapin flagship beer was going to be a big west coast-style pale ale, the first thing I heard was, "You guys are going to release an aggressive hoppy pale ale in the southeast? Is it going to sell?"

"Why not?" was my response. Most of the answers I got were (concerned with) how the bitterness sits on your tongue. People were concerned with that.

So when I started developing the recipe, I looked at hops, but also the malt bill. Being a big Jim Beam rye whiskey fan, I noticed how the rye in the whiskey dries out the palate. I started playing with the rye so my beer would have that crispness or dryness on the palate. I use about 10% rye in the grist bill and all low cohumulone hops, which have the lower level of harshness. Basically that's how we got that nice crisp finish to our beer. Everything is up front. The bitterness is upfront, the aroma is upfront and after 10–15 seconds it's a nice clean beer.

I would say the beer remains in style since we only use 10% rye in the grist bill. I can't say how it would be with more than 10%, but the more rye the spicier the character. I would assume if you used a lot of rye, it might be more of a sharp palate rather than a full palate and might not adhere to style. The reason I started playing with rye was for that little extra spiciness and that cleansing of the palate. It can add a spicy, yet clean flavor.

For homebrewers, how much rye to use depends on the type of recipe. I would start in increments of 10%. If you want a little more flavor, try 20%. It depends on the flavor profile you're after. If you want to find out what rye really tastes like, you can go big, like 60% rye. Then you'll really know what the rye flavor will be like and can adjust accordingly. Or maybe do a 50–50 split with pale malt and rye malt. You already know what pale malt gives you; so all that extra flavor must come from the rye, right? Once you figure that out, you can adjust the recipe to get the desired rye flavor characteristics.

I use malted rye, and because there are no husks, I pulverize it as much as I can. It's not like a fine powder or dust, but you wouldn't want to crush your grains the way I crush my rye. When you mill your grains, you want to have your husks intact. Rye is a smaller grain, so if I left my mill gap the same as for my other grains, you'd get a lot of whole kernel rye coming through. You have to be careful. I just mill the barley and rye separately.

If you use a lot of grains that don't have husks, you may have to add rice hulls. The hulls will help create a nice fluffy grain bed and act as a filter. So, you might want to look into using rice hulls if you are going over 10% rye in the grain bill. I haven't had a lot of lautering problems, because I only use 10%.

I find that because I use only 10% rye, I can go for normal conversion. I mash in at 154–155 °F (~68 °C) and go from there. I don't separate the rye and add it in later. I get enough enzymes from the bulk malt and other grains that I don't worry about it. I mash for about an hour. It's 15 minutes for the mash in, then I let it rest for 10 minutes to firm up the bed, and then whirl off for about an hour until I get a nice clear wort. If I had different equipment though, times could be a little longer or shorter.

We use Wyeast 1272 (American Ale II), and I have not seen any negative affects that the rye contributes to the yeast. We get normal fermentations all the time.

Basically, with the Terrapin Rye Pale Ale, I wanted to make an American pale ale and I also wanted to use low cohumulone hops. The Fuggles and Goldings bring some earthiness to the beer, while the other hops are big American citrusy hops. For my malts I use pale, Munich Victory, rye and honey malt. I am just trying to get a variety of flavors. Of course, each malt brings a different character, plus I like complex beers. The reason I started playing with rye was for that little extra spiciness and that cleansing of the palate. It can add a spicy, yet clean flavor.

**TIM SCHWARTZ is headbrewer at Real Ale Brewing in Blanco, Texas. (The name is not meant to imply that they brew British cask-style ales.) The brewery is the home of Full Moon Pale Rye Ale. Schwartz began homebrewing in college, eventually honing his skills as an assistant brewer at The Bitter End brewpub in Austin, Texas in 1994. He became headbrewer in 1995 where he crafted many of the pub's fine brews before moving to Real Ale in 2004.**

Rye is a unique ingredient. With the Full Moon Pale Rye Ale, we have a pretty high percentage of medium crystal malts in there, so the rye adds complexity and balances out all that crystal. The rye dries it out a little bit and the crystal gives it that sweetness and body. In some ways the recipe would have too much crystal malt, too much body, without the rye. That interplay works really well. They balance each other out.

We use about 17% rye in Full Moon. If you put that percentage in a light ale it can be too dry, but with all the crystal in this beer, it works well.

Since we are currently brewing in an older facility, we grind the rye the same as other grains. However, the rye is smaller, has no husk and it is a little harder to crush. But we've done it both ways with our grains. If you want to get better extract efficiency, you should set your mill to a smaller gap and grind it a little finer.

To aid in lautering, we do add some rice hulls, but we don't add too much — only about 1 ½% of the grain bill. It doesn't take too much, but it does help float that mash.

All-grain brewers, if you want to do a single-step infusion and not mash out I would definitely mash high around 157–158 °F (69–70 °C), but I would add rice hulls if that's the case. The higher temperature allows it to run off a little better. If you have the time and want to do a full procedure, you can step-mash, do a protein rest at 122–124 °F (50–51 °C) for 10 minutes, and then step it up to 156–157 °F (~69 °C). Mash out at 168 °F (76 °C). It's just going to run off better; it will be less viscous.

The yeast we use is a high flocculation similar to the Wyeast 1968 (London ESB) or White Labs 007 (Dry English Ale), in that family. We don't notice much difference as far as fermentation characteristics from the rye. There is no major effect.

# Home vs. Pro Beer

## Temperature of wort and the surrounding air

"Help Me, Mr. Wizard"

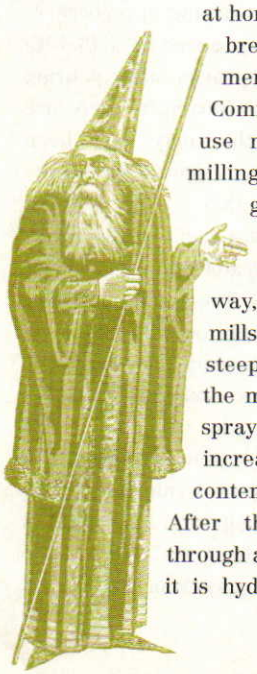
by Ashton Lewis

### What Don't I Know About the Pros?

**I have been homebrewing for several years and have read quite a bit about homebrewing from books and magazines. The other day, a buddy and I were sitting at a brewpub, having a pint and talking about beer and brewing. Looking at the brewing equipment behind the glass, it wasn't too hard to figure out what the vessels were for. So my buddy asked me if I could jump back there and brew one of my beers. I had to admit that I didn't really know. I've always assumed that commercial brewing was just a "bigger" version of homebrewing, but I didn't know for sure. I know that many commercial brewers do steps that most homebrewers don't, such as filtering or pasteurization. But, do homebrewers make beer fundamentally the same way as brewpub brewers, or as large commercial brewers?**

*Randy Decker*
*Altoona, Pennsylvania*

In a very generalized sense, all beer is made using the same basic steps. All beer begins as wort that is then fermented, aged, clarified to some extent and packaged. The biggest difference between what is done at home versus in a big brewery is the equipment used. Commercial brewers use multi-roll or wet milling to crush their grains. Wet milling can be performed more than one way, but most wet mills these days have a steeping tank above the mill where malt is sprayed with water to increase the moisture content of the husk. After the malt passes through a single set of rolls it is hydrated with mash water and the mash is then pumped directly to the mash mixer. Many breweries use adjuncts like rice and corn and these are often milled using special mills.



Mashing is basically the same process, except most commercial breweries use steam-heated mash mixers with special agitators that help keep the mash uniform in temperature while at the same time not beating up the malt so that wort separation runs smoothly. Brewers who use adjuncts have to boil the adjunct in order to gelatinize the starch and it is common to have a cereal cooker and a mash mixer when adjuncts are involved. In fact, this set up is basically the same as a decoction brewhouse that has a decoction kettle and a mash mixer. One big difference in the whole mashing and lautering steps is that ingredient yield is closely monitored. Most commercial breweries achieve at least 92% of laboratory yields and many breweries are pushing yields that are nearly equal to the theoretical laboratory yield.

Most American breweries use lauter tuns to separate wort from malt solids while some use mash filters. Lauter tuns used in commercial breweries have slow moving rakes that gently cut through the grain bed to facilitate wort separation and then the same device is used to move the spent grains out of the lauter tun and into a pump that takes the grain to a spent grain storage area.

Some smaller breweries, especially pub brewers, use infusion mash tuns for mashing and wort separation. This is much more akin to what is done at home. It is common for the brewer to use a mash paddle when mashing in to evenly lay down the mash and to use some sort of hoe to remove the spent grains from a door in the side of the mash tun after mashing is complete. Then the plates are removed and the mash tun is given a good cleaning. There is a lot of brewpub equipment that actually grew out of homebrew equipment.

Mash times are similar. In fact many pub brewers mash-in, take a short breather and begin wort collection. My old professor from University of California-Davis is the one who started pushing this idea. The reason it works is that there is no mash-off step and as long as the wort collected in the kettle is not prematurely heated, conversion of starchy worts continues in the kettle during wort collection and the amylases in the mash are active during almost the entirety of sparging. Brewers doing this use much shorter mash times.

Wort boiling also uses different equipment because of the much larger batch sizes. Small pub operations use either steam heated or flame heated kettles that are not much different than a big pot with an external heating jacket. As kettles get larger than about 1,000 gallons (3,800 L), more heating surface is needed than that available on the exterior of the kettle. Internal or external heat exchangers called calandrias are used to increase the heating area and the boiling wort exiting the calandria is directed to a wort spreader (the cone-shaped "hat" seen on top of the giant kettles) that fans wort out over the surface of the boiling volume. This helps to knock down foam as well as creating a large surface area for DMS to evaporate and exit through the kettle stack, or exhaust pipe. Some kettles are even pressurized and other designs cycle the pressure up and down to create uniform, nucleate boiling periods when the pressure is released. Most

The biggest difference between what is done at home versus in a big brewery is the equipment used.

commercial breweries boil for 60–90 minutes, even with some of the newer kettle designs. The trend, however, is towards reduced evaporation rates. The old standard was 8% per hour and many new kettles are being designed for a total evaporation of 4% or less. Certain laws in Europe are really driving this because of energy penalties being imposed on breweries who buy new equipment designed for high (>4%) evaporative rates.

Hop separation is also different for commercial brewers because of the larger batch sizes. Most beer these days is made using hop pellets and these can be separated in large whirlpool vessels. Homebrewers can also use the whirlpool method to help separate hop pellets and trub from yeast. Breweries using whole hops typically use a hop separator that strains the hops from the wort and continuously augers the spent hops out of the device. Smaller brewers use hop backs that look very similar to a mash tun.

Finally, the wort is cooled using a plate heat exchanger with enough surface area to cool down the batch in anywhere from 30–60 minutes. This means that the hot wort sits in the whirlpool vessel for a fairly long time. After cooling, wort is aerated in-line with either filtered air or oxygen and then flows into the fermenter. Many brewers inject yeast in-line after aeration and others put the yeast in the bottom of the fermenter where it mixes with the wort.

I would say that wort production in a commercial brewery is pretty darn different than the way most homebrewed wort is made, either with extracts or all-grain mashing. When it comes to fermentation and aging, however, the process is pretty similar. One big difference is that larger brewers typically ferment 4–6 batches in the same fermenter and various techniques of yeast pitching and aeration are used when a tank is filled over the course of 12–18 hours.

Another notable difference used by the largest breweries is the use of a technique called high gravity brewing. This means that high gravity wort, usually between 14–18 °Plato (1.056–1.072 SG), is fermented and later diluted with deaerated, carbonated water. The reason big breweries do this is to reduce their fermentation requirements by up to about 33%. Craft brewers typically do not use this method.

Aging is not much different at home unless we are talking about the King of Beers and the use of beechwood chips in their chips tanks. Anheuser-Busch is the only brewery that I know of who still uses this once not so uncommon technique.

Next comes filtration and there are all sorts of methods used by commercial brewers to clarify beer. Diatomaceous earth (DE) pressure leaf filters, DE plate and frame filters, centrifuges and sheet filters are the conventional methods. Many brewers use chill-proofing agents, such as silica hydrogels and PVPP, at the time of filtration to protect against chill haze and some brewers add isinglass finings before filtration to improve filter run times. The most modern filtration method is cross-flow membrane filtration and the aim is to eliminate the use of DE in beer filtration.

Some commercial breweries even recover beer (called ruh beer) trapped in the yeast cake. Not only does this reduce beer losses associated with spent yeast but it also reduces effluent. This method is not practiced by the majority of commercial breweries in the U.S. because the quality of the beer may easily suffer due to yeast autolysis.

The last step is packaging beer into bottles, cans or kegs. Most large breweries pasteurize their bottles and cans in a tunnel pasteurizer after filling to kill any spoilage organisms that may be in the beer. Some draft beer is flash pasteurized like milk before kegging.

As a general rule, craft-brewed beer made in the United States is not pasteurized. There are a few craft brewers out there who do have pasteurization equipment, but these are the exceptions. There is nothing wrong with pasteurization when done correctly, but it does prevent beers to be bottle conditioned because it kills the yeast.

Simply put, homebrewed beer and commercially brewed beer start with the same basic ingredients and may taste very similar when poured into a glass, but they arrive at that point by very different paths.

## Hot and Bothered About Temperature Differences

**I was pouring a homebrewed Belgian wit today and I was wondering if I was about to enjoy the fruit of my labor at the proper temperature. I measured the temperature with a recently calibrated thermometer at approximately 50 °F (10 °C). Typically, I keep my converted chest freezer at approximately 38 °F (3.3 °C) using a refrigerator thermostat and I monitor the temperature with an accurate commercial grade thermometer. I ferment in another converted chest freezer using the same method of temperature control. The 12 °F (6.7 °C) difference in temperature raises several questions. Are there variations between fermenting wort/beer temperature vs. ambient temperature? What, if any, affects will these temperature variations have on my finished product? Are the recommended temperatures by yeast labs suggested for wort/beer temperature or ambient temperature? Please enlighten me.**

***Thomas Crawford***
***Tallahassee, Florida***

I want to clarify my understanding of your question. Your question is about fermentation temperature and this question came to you when you were pouring your wit. I will address this question, but first want to comment on what may have happened with the wit you poured. Let's assume that both of your thermometers were reading correctly and the refrigerator temperature was indeed 38 °F (3.3 °C) and the beer temperature after pouring was 50 °F (10 °C). Obviously, there are only two things that may have been responsible for this difference in temperature. The first is that the wit was not refrigerated for long, had not equilibrated with the refrigerator and was warmer than 38 °F (3.3 °C). The second possibility, which most likely occurred to some extent, was that the glass you poured the wit into was warmer than 38 °F (3.3 °C) and it warmed the wit.

Based on an assumption about the specific heat of glass, I calculate that a glass beer mug weighing 32 oz. (900 g) could warm beer from 38 °F (3.3 °C) to 50 °F (10 °C) if the glass was originally at

72 °F (22 °C). This is not a very unusual scenario and explains why some bars used those awful frosted mugs for beer. Tossing a mug in the refrigerator before use prevents this heating affect from occurring and does not turn your cold beer into a beer slushy like a frosted mug.

The real question you have is about differences between the fermenting beer in your carboy and the air temperature of the refrigerator. Heat is produced by yeast during fermentation and is removed by the surrounding air. In all cooled systems, the difference in temperature between the thing being cooled and the cooling medium drives the rate of cooling. (The same is true of heated systems.) As the temperature of the two components of the cooling system approach each other, the rate of cooling slows. When thickness is added to this argument, a temperature gradient between the core of the body being cooled and the surface of the body is seen. If the body is solid, the mode of heat transfer is called conduction because the heat is conducted through the solid. In liquids things get a bit more involved since the liquid moves and this movement sets up convection currents.

Applying this rule to a fermenter of beer, you can see that the center of the fermenter will be warmer than the surface and that stirring the fermenter will increase the rate of heat transfer through convection. Although beer fermenters are not usually stirred using a mixer, there is considerable movement caused by the release of carbon dioxide from fermenting beer. In any case, there is a temperature gradient in a beer fermenter and the temperature at the surface is typically cooler than the temperature within the fermenting beer.

At home this difference is small because the volume of liquid is small and the surface to volume ratio is large. In larger fermenters, the surface-to-volume ratio decreases and the temperature gradient within the fermenter can become significant. When yeast companies suggest a certain fermentation temperature for a certain yeast strain, they are referring to the temperature of the fermenting beer, not the air temperature of the surrounding environment. However, in a small fermenter such as a 5-gallon (19-L) carboy the difference between the air temperature and the beer temperature is usually within about 5 °F (3 °C). So if you have a yeast strain that produces the best beer when fermentation is held at 70 °F (21 °C) the surrounding air temperature should be around 65 °F (18 °C). You can periodically monitor this by inserting a thermometer into the fermenting beer.

In larger fermenters, a cooling jacket is used because air cooling is ineffective and the fermenter becomes way too warm. A cooling medium such as propylene glycol (food-grade anti-freeze) is pumped through the cooling jacket and the heat added to the glycol coolant is then removed using a refrigeration system. (Even though the anti-freeze does not touch the beer, the jackets can develop leaks and anything in a food plant used as a coolant must be food-grade in

the event of a leak.) These larger fermenters are typically equipped with a valve that opens and closes in response to the temperature of the beer inside of the tank. Simple systems use "on/off" control and the beer temperature fluctuates around the target temperature. The difference between the target, 70 °F (21 °C) for example, and the temperature where the valve opens or closes is called a dead-band. Most simple controllers are set up to control the beer within a 2 °F (1 °C) dead-band around the set-point and the beer temperature is constantly moving within this 2 °F (1 °C) dead-band around the set-point.

More sophisticated control systems employing proportional control valves and PID controllers (proportional, integral and derivative control is a mathematical-based control scheme to achieve much tighter process control) greatly reduce temperature fluctuation around the set-point value and in many cases can match the actual temperature to the set-point value over long time periods.

Where I work, we have on/off control and operate on a 2 °F (1 °C) dead-band. The key, in my opinion, is having some target and being consistent in controlling around that target. When it comes to fermentation temperature, it is important to have a target fermentation temperature and have some method to achieve the goal. Absolute accuracy is less critical than having a target and a plan of action. If you allow the temperature to get too far off course, you will most likely see the effect of temperature of the fermenting beer. If it is warmer than planned, expect accelerated fermentation rate and the production of more esters. An overly cool fermentation may be very sluggish and it may fail to properly attenuate.

The key with most brewing is to keep it simple. There is absolutely nothing wrong with relying on the ambient temperature of your chest cooler to control fermentation temperature. Just remember that the temperature of the beer in the carboy will never be the same as the air temperature as long as the yeast is producing heat. This means that temperature of the wort will increase as yeast begin to ferment. When activity peaks and the rate of fermentation wanes, the temperature will begin to drop and will eventually equilibrate with the ambient temperature of your cooler when fermentation ceases. If you measure the temperature of the fermentation, you can get a good feel for where your thermostat should be adjusted.

*BYO* Technical Editor Ashton Lewis has been answering homebrew questions as his alter ego Mr. Wizard for the last 12 years. Do you have a question for him? Send inquiries to *Brew Your Own*, 5053 Main Street, Suite A, Manchester Center, VT 05255 or send your e-mail to wiz@byo.com. If you submit your question by e-mail, please include your full name and hometown. In every issue, the Wizard will select a few questions for publication. Unfortunately, he can't respond personally. Sorry!

# Ordinary Bitter

## It's not so ordinary after all

by Jamil Zainasheff

On returning from a visit to London, a friend asked me what I liked best about my trip. I responded, "bitter." This was met with a blank stare. I quickly told him about how bitter is a flavorful, low-alcohol, English ale and when served on cask as real ale, it takes on a slightly different character in each pub. This was met with another blank stare. Then I explained that bitter is a session beer. Session beers allow one to stop at their local public house (called a pub or local), have a couple of pints, and remain sober enough to discuss issues of the day, thus lubricating social discourse. (OK, maybe I'm more of a beer geek than I thought.)

photo by Jim Witmer

Ordinary bitter is a style that sometimes draws blank stares even from beer geeks. Contrary to its name, ordinary bitter is neither ordinary nor extremely bitter. While this is a low-alcohol, low-gravity beer style, a properly made bitter is more flavorful and more balanced between malt sweetness and hop bitterness than the name would lead you to believe. An ordinary bitter should be firmly bitter, but the bitterness should not be overwhelming or completely overpower the malt. Ordinary bitter is a session beer meant to be consumed in multiple pints, so balance is important.

One of the characteristics that many people identify with English beers is a slight biscuity malt flavor and aroma. Ordinary bitter is no exception and in a good rendition of the style you should be able to pick up at least a hint of biscuit. This style should also have a moderate amount of fermentation derived fruity esters, often pear and apple. The hop aroma and flavor in the beer come from traditional English hops of the earthy and floral types, but it is usually a minor note in the beer and it should not hide the fruity esters.

Ordinary bitter most often ranges in color from deep golden to a very light copper, with a few exceptions on either end. These beers are also very clear, due to the highly flocculent yeast. Any head is minimal, due to the light body and low carbonation. The overall result is an easy drinking, flavorful, low-alcohol beer.

### Appropriate Base Malt

To brew a great ordinary bitter, you need to pay particular attention to your base malt selection. British pale ale malt

**ORDINARY BITTER by the numbers**

| | |
|---|---|
| OG: | 1.032–1.040 (8–10 °P) |
| FG: | 1.007–1.011 (1.8–2.8 °P) |
| SRM: | 4–14 |
| IBU: | 25–35 |
| ABV: | 3.2–3.8% |

(story continued on page 20)

## RECIPE

### Ordinary Bitter

**(5 gallons/19 L, all-grain)**

OG = 1.038 FG = 1.011

IBU = 30 SRM = 11 ABV = 3.5%

**Ingredients**

7.0 lb. (3.2 kg) English pale ale malt

0.50 lb. (0.23 kg) crystal malt (120 °L)

0.25 lb. (0.11 kg) Special Roast malt (50 °L)

5.75 AAU East Kent Goldings hops (60 mins)
(1.2 oz./33 g of 5% alpha acids)

2.5 AAU East Kent Goldings hops (30 mins)
(0.50 oz./14 g of 5% alpha acid)

0.50 oz. (14 g) East Kent Goldings hops (1 min.)

White Labs WLP002 (English Ale) or Wyeast 1968 (London ESB) yeast

**Step by Step**

Mill the grains and dough-in at around 1 qt. of water per pound of grain (about 2:1 L/kg) and a temperature of 152 °F (67 °C). Hold the mash at 152 °F (67 °C) for 60 minutes. Infuse the mash with near boiling water while stirring to 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 5.9 gallons (22 L) and the gravity is 1.032. Boil wort for 75 minutes. Add the bittering hops with 60 minutes remaining and the flavor hops with 30 minutes left in the boil. Add 1 tsp. Irish moss with 15 minutes left in the boil and add the last hop addition just before shutting off the burner. Chill the wort to 67 °F (19 °C), pitch yeast and aerate thoroughly. Ferment around 67 °F (19 °C) until the yeast drops clear. Allow the lees to settle and the brew to mature without pressure for another two days after fermentation appears finished. Rack to a keg or bottling bucket. Target a carbonation level of 1 to

recipe continued on page 20

recipe continued from page 19

1.5 volumes. (Use about 2.0 oz./57 g of corn sugar for bottle conditioning.) If you're cask conditioning the beer, add priming sugar, any cask finings (gelatin or isinglass), and dry hop with 0.25 to 0.5 oz. (7–14 g) of whole East Kent Goldings hops. Allow the beer to condition in the cask for several days and serve via a beer engine or by gravity feed at 50–55 °F (10–13 °C).

## Ordinary Bitter

**(5 gallons/19 L, extract w/ grains)**

OG = 1.038 FG = 1.011

IBU = 30 SRM = 11 ABV = 3.5%

**Ingredients**

4.7 lb. (1.95 kg) Muntons or John Bull pale liquid malt extract

0.50 lb. (0.23 kg) crystal malt (120 °L)

0.25 lb. (0.11 kg) Special Roast malt (50 °L)

5.75 AAU East Kent Goldings hops (60 mins)
(1.2 oz./33 g of 5% alpha acids)

2.5 AAU East Kent Goldings hops (30 mins)
(0.50 oz./14 g of 5% alpha acid)

0.50 oz. (14 g) East Kent Goldings hops (1 min)

White Labs WLP002 (English Ale) or Wyeast 1968 (London ESB) yeast

**Step by Step**

Place the crushed grains in a grain bag and steep in about 2 gallons (~8 L) of water at ~170 °F (77 °C) for 30 minutes. Lift the grain bag out of the steeping liquid and rinse with warm water. Add enough water to the steeping liquid and malt extract to make a pre-boil volume of 5.68 gallons (21.5 L) and a gravity of 1.033 (8.40 °P). Stir thoroughly and bring to a boil. Once the wort is boiling, add the bittering hops. The total wort boil time is 1 hour after adding the bittering hops. During that time, add the flavor hops with 30 minutes remaining, Irish moss at 15 minutes, and the aroma hops just before shut-down. Chill the wort to 67 °F (19 °C), pitch yeast and aerate thoroughly. Follow the fermentation and packaging instructions for the all-grain version.

is the key to getting that biscuit-like malt character mentioned above. British pale ale malt is kilned a bit darker (2.5 to 3.5 °L) than the average American two-row or pale malt (1.5 to 2.5 °L) and this higher level of kilning brings out the malt's biscuity flavors. A few malt companies — Crisp Malting, for example — still produce British pale ale malt from cultivars such as Maris Otter using a traditional floor malting method. The result is malt with a slightly darker color (3.5 to 4.0 °L) and more flavor than other pale ale malts. It is the malt of choice for many English beer fanatics.

If you're brewing with malt extract, your best choice is an extract made from British pale ale malt. There are British style malt extracts on the market made from 100% Maris Otter malt and they are an excellent choice for English beers. If you can't get it through your local home-brew shop, you can find it online from several retailers. If you end up using domestic two-row malt or extract made from it, you'll need to compensate with some additional specialty malts such as Munich, biscuit or Victory, but use restraint. For a 5-gallon (19-L) batch, add no more than 0.5 lbs. (0.23 kg) total.

A few malt companies still produce British pale ale malt from Maris Otter using a traditional floor malting method.

British pale ale malt is highly modified and well suited to single infusion mashes, typical for all British beers. Since this style has such a low starting gravity, 1.032–1.040 S.G. (8–10 °P), you need to create some long chain, unfermentable sugars to provide enough mouthfeel and fullness in the finished beer. The lower the starting gravity of your bitter, the higher your mash temperature should be. A high mash temperature creates wort with more non-fermentable, complex sugars. It is these polysaccharides which result in enough residual gravity and body to keep the beer from being thin and watery. A mash temperature around 152–154 °F (67–68 °C) creates wort with the proper balance between long chain, non-fermentable sugars and simpler fermentable sugars. Mash thickness also plays a roll in determining the mix of fermentable and unfermentable sugars, though it is not as significant as mash temperature. A thicker mash favors long chain sugars and a thinner mash favors simpler sugars. If your setup is geared toward thinner mashes — more than 1.5 qts./lb. (3.1 L/kg) — you should stick to the higher end of the mash temperature range for this beer.

## Crystal and Other Malts

In many bitter recipes, there is often some portion of crystal and other specialty malts, such as Special Roast, Victory and biscuit. Commercial examples range from minimal, low color additions to considerable amounts of mid-color specialty malts. Crystal malt adds body to the beer and helps fill out the malt flavors. Darker crystal malts add richer colors, as well as some dark caramel, toasty, roasted and raisin flavors. This style can handle up to a total of 10% crystal malt in the range of 40 °L to 150 °L without getting heavy and cloying. However, the darker the crystal, the less you should use. A bitter with 10% 150 °L crystal malt may not be cloying, but it can be too intense a flavor for this style. Specialty malts are a big part of what differentiates one brewer's bitter from another, so feel free to play around with the amounts.

While corn or cane sugar is traditional in brewing many English beers, avoid using it in the smaller styles, such as ordinary bitter. Simple sugars ferment fully, thin the beer, and provide very little in the way of flavor contributions. Even brown sugar adds minimal caramel flavor, which is much better supplied by caramel malts.

## Bittering a Bitter

Bitters are best brewed with moderate alpha acid English hops, such as East Kent Goldings or Fuggles. The bittering level is often in the range of 25 to 35 IBU, depending on the starting gravity and attenuation anticipated. Try to keep the bitterness to starting gravity ratio (IBU divided by OG) between 0.7 to 0.9, with the bulk of the hopping as a bittering

addition at 60 minutes. A fine bitter can be made with just the single bittering hop addition, but I prefer a little more hop flavor and aroma, similar to what you might find in some of the more bold commercial examples. A small hop addition around ¼ to ½ ounce (7 to 14 g) at 20 minutes and another addition of the same size at flame-out gives the beer just enough extra hop character to add interest. Remember that this isn't a very hoppy style. If you do go with late hop additions, don't go overboard. If you want to experiment with different hops, Challenger, Northdown and Willamette are interesting alternatives.

Traditional cask conditioning can include dry hopping, perhaps at ¼ to ½ oz. (7 to 14 g) per 5 gallons (19 L). If you do dry hop this beer, you might want to reduce the late hop additions to keep the flavor and aroma subtle. For competition, sometimes a bit more hop character can be OK, but don't go over the top.

## It's the Water?

Much has been written about the high sulfate water of Burton-upon-Trent being a key element in brewing bitters. It is true that water with high sulfate content enhances the sharp, bitter aspect of hops. However, this is very easily overdone, resulting in a chalky, metallic or harsh character. Brewers today brew good bitter with a wide range of water types. In most cases, any water is well suited as is, unless it is on the soft end of the spectrum. If you have soft water, add some gypsum or Burton Salts, but start low, targeting half the amount of sulfate typical of Burton water. Use no more than 1 tsp. of Burton Salts per 5 gallons or no more than 0.75 g/L. It is always better to add less than more. While this won't exactly mimic the water of Burton-upon-Trent, it is more than enough to accentuate the hop bitterness. You can add your mineral salts to the mash water or, if you're extract brewing, you can add it to your water before you heat it. For all other water types, try brewing without any additional mineral salts.

## English Ale Yeast

Fermentation creates much of the flavor and aroma in a bitter. "English" yeast strains provide a variety of interesting esters and many of them do not attenuate quite as much as other ale yeasts. It is these characteristics, low attenuation and ester formation, that make English ale yeasts perfect for brewing low alcohol session beers. There are a number of other excellent English yeast strains to choose from, but my favorites are White Labs WLP002 (English Ale) and Wyeast 1968 (London ESB Ale).

Both of these yeasts attenuate 70% or less, leaving some residual sweetness to balance the bitterness and help fill out the beer. They are also extremely flocculent, which makes them ideal for cask conditioning. These yeasts produce a fairly low level of esters at cool fermentation temperatures (<65 °F/18 °C) and abundant fruity esters at high temperatures (>70 °F/21 °C). In general, it is better to start in the middle of this range, letting the temperature rise slowly, a few

degrees, over a couple days. This creates the expected level of esters and also keeps the amount of diacetyl in the finished beer at a minimum. These yeasts can produce a fair amount of diacetyl. A cooler temperature at the start of fermentation and a warmer temperature toward the end help reduce the amount of diacetyl in the finished beer.

If you like to experiment with different yeasts, try to select English yeasts that create interesting ester profiles and attenuate no more than 75%. Several worthy of a batch or two are White Labs WLP005 (British Ale), WLP013 (London Ale), WLP017 (Whitbread Ale), WLP022 (Essex Ale), WLP023 (Burton Ale) and WLP026 (Premium Bitter Ale) or Wyeast 1098 (British Ale), 1318 (London Ale III) and 1099 (Whitbread Ale) yeast. If you prefer dry yeast, DCL Safale S-04 produces good results. A single fresh vial or pack of liquid yeast is the appropriate amount to pitch when making a 5-gallon (19-L) batch of ordinary bitter. With such a low gravity beer, you can get away with no starter, if your yeast is nice and fresh. If there is any doubt about the viability of your yeast, it is a good idea to make a 1 qt. (~ 1L) starter to proof the yeast and give it a bit of a head start. If you're using dry yeast, 5 grams of properly rehydrated dry yeast is plenty. Ferment around 67 °F (19 °C), for all of these yeasts, with a minimum temperature of 65 °F (18 °C) and maximum of 70 °F (21 °C). No matter which yeast you're using, it is important to aerate the wort immediately before or after pitching your yeast. Oxygen is important to proper cell growth and growth is important to flavor development.

## Pulling Your Pint

It is very important to serve bitters at the proper temperature and carbonation level. While it might seem like it would be too warm, serving the beer at cellar temperature, around 55 °F (13 °C), allows the character of the beer to come out. Colder temperatures prevent the drinker from picking up the interesting flavors and aromas of this style, so don't go below 50 °F (10 °C).

Gassy beers are much more difficult to drink in quantity and proper carbonation level is even more important for low gravity beers like bitter. Too much carbonation in a low gravity beer results in a harsh, carbonic bite. While carbonation is important to filling out the mouthfeel of a beer, and it helps drive aromas up to the nose, too much carbonation can make a small beer seem thin. Target a low level of carbonation, around 1.5 volumes of $CO_2$ for bottled beer and 1 volume of $CO_2$ for cask conditioned beer. A typical American pale ale is carbonated to around 2.5 volumes of $CO_2$, so cut your priming sugar in half at bottling time and you'll be close to the right level of carbonation.

*Jamil Zainasheff is* Brew Your Own's *new "Style Profile" columnist.*

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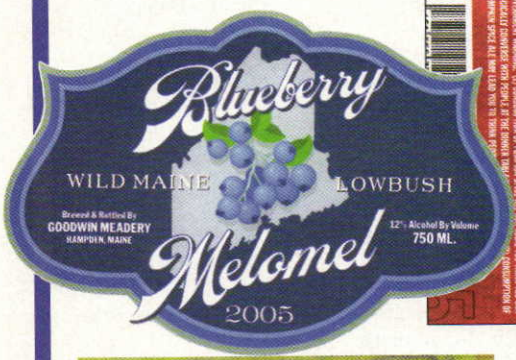




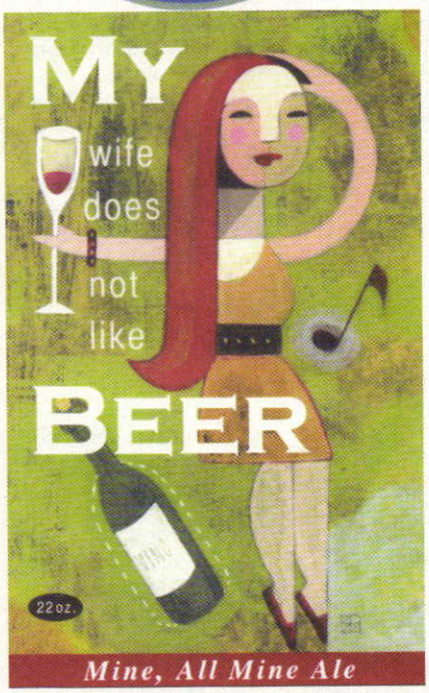





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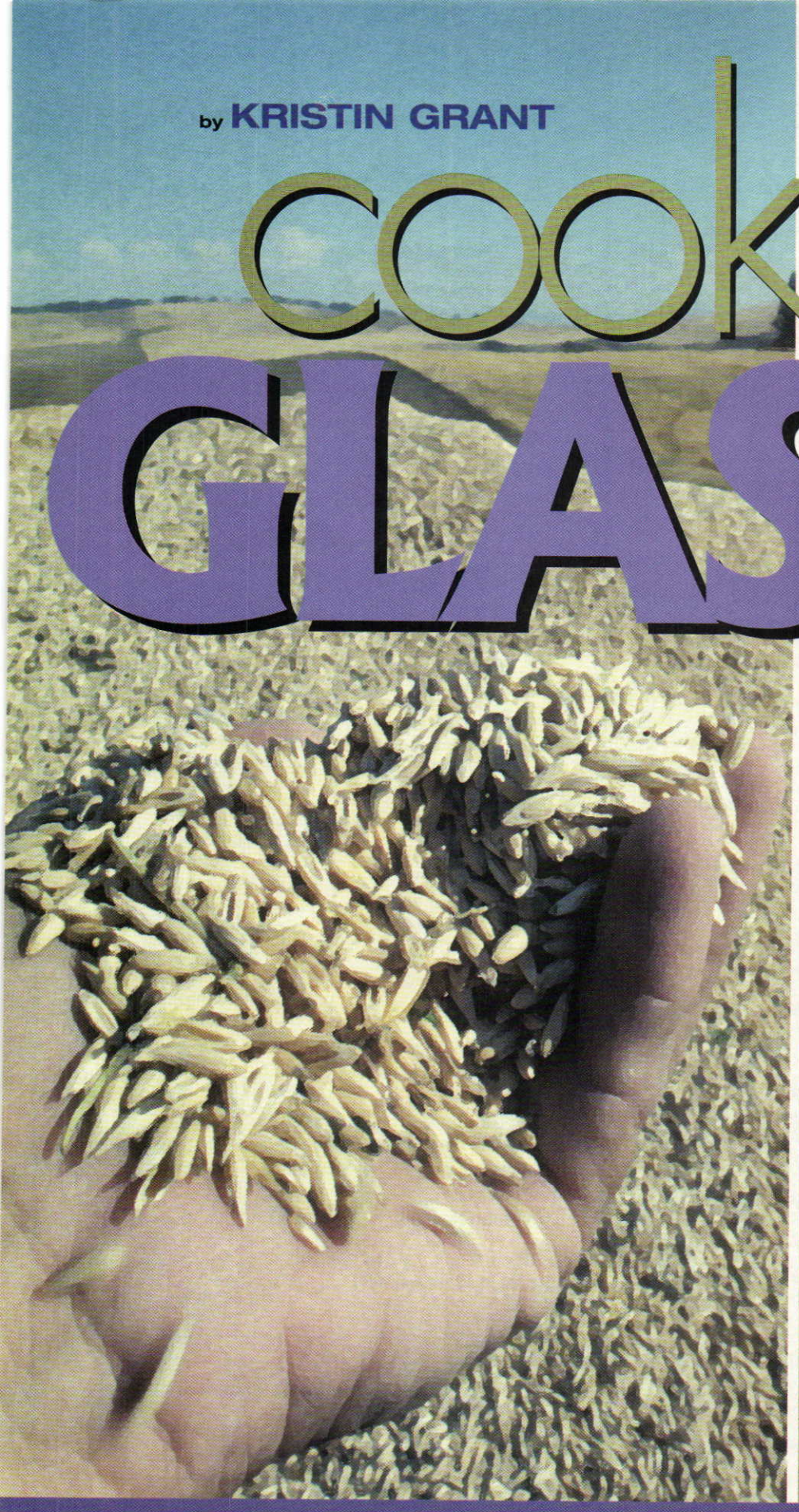
by KRISTIN GRANT

# cookie IN A GLASS



Silky. Creamy. Slightly sweet. If you're looking for an adjunct amply equipped to infuse your brew with these characteristics, flip open your cupboards, reach in and grab a handful of your favorite hot breakfast treat. That's right. Oatmeal. Good old rolled oats can impart a smooth, mild flavor reminiscent of the cookies grandma used to make, only better because, well, it's beer.

If the thought of using oats in brewing conjures images of sticky mashes rather than fresh-baked cookies, think back to the last time you enjoyed a tasty oatmeal stout. Ah yes, a creamy sip of roasted, chocolaty goodness topped off with a dense, rich head. The outcome is clearly worth the effort. And if medieval peasants produced oat-based brews, you can, too (sticky mash or not!).

## GROUTERS UNITE!

"Oats go way back in brewing, at least to medieval times," says Randy Mosher, author of "Radical Brewing" (2004, Brewers Publications). "Because oats are cheap, and because they produce a cloudy beer poorly suited to aging, they were usually associated with smaller, lower quality beers."

Although the consumers of today's oatmeal brews might be considered connoisseurs, early consumers of oatmeal ales had a reputation quite to the contrary. "People who drank such weak, thick, grainy ales were known as grouters, a term that indicated poverty and is related linguistically to 'grits,' 'grist' and 'groat,' which is a term specifically referring to oat kernels," Mosher says. While the low cost of oats attracted many early brewers, the color imparted by oats also played a role in drawing brewers to this plentiful grain. "Because of their pale color, oats often found their way into white beers all up and down the North Sea region. The classic Louvain/Hoegaarde witbier recipe still includes oats (5%)," Mosher says.

Although cheap, oats have frequently been held up as a healthy grain — remember the oat bran craze of the late 1980s? And, until government regulations prevented them from doing so, brewers used to remind their oat beer drinkers of this. As recently as the late 1800s, oatmeal stouts in the United Kingdom touted their supposed health benefits to lactating and pregnant women. Unfortunately for brewers, some of the factors that make oats so healthy can contribute to problems in the brewhouse. Oats have a high protein content, averaging around 17% and peaking around 24%. (Compare this to barley malt at around 12%). The much-touted creaminess of oats is largely due to its high lipid content, around 10% — 3 to 5 times more than most other cereal grains (other than corn, which has a lot of lipids in its germ). Finally, the nice consistency you enjoy in a bowl of hot of oatmeal is mostly due to its beta-glucan content, around 4% in rolled oats.

The secret recipe of one oatmeal-based white beer even offers up a mysterious trans-continental challenge, à la "The Da Vinci Code."

"One white beer survived in Devon and Cornwall, England until the late nineteenth century. Known as Devon white ale, it included a large proportion of oats, plus oddities such as egg whites. The exact recipe, apparently, was a secret, and there is no complete Devon white ale recipe, at least that I have been able to find," Mosher says.

In 1980, Samuel Smith's Old Brewery revived commercially

Kernels of the oat (*Avena sativa*). Most oats (over 95% percent of those grown) are fed to animals. Due to their low gluten content, oats cannot be made into bread, and their high fat content makes them susceptible to turning rancid. However, they have many healthy properties.

produced oatmeal stout, which hadn't been mass-produced since before World War I. Since then, at least 60 breweries, including Tröegs, Harpoon and Wild Goose, began pumping out oatmeal stout.

Fortunately, brewers don't need the Devon white ale recipe or a craft brewery to create a rich, satisfying oatmeal ale or stout, or even an oat-adjunct witbier at home.

## OATS OR OATMEAL? FLAKED, ROLLED OR WHOLE?

Quick: What's the difference between oats and oatmeal? Oats are the actual seeds of the plant, *Avena sativa*. These seeds are categorized as cereal grain, in the same family as barley. Oatmeal, on the other hand, refers only to rolled, crushed or cut oats. This definition is used primarily in North America; the definition of "oatmeal" outside North America generally refers solely to finely ground oats.

Brewers can even purchase oat flakes at most homebrew supply stores. In fact, flaked oats are the most popular type of

# THE SECRET IS OUT ON OATMEAL STOUT . . . AND OTHER OATMEAL BEERS

## Breakfast of Champions (Oatmeal Stout)

**(5 gallons/19 L, all-grain)**

OG = 1.052 FG = 1.013
IBU = 33 SRM = 40 ABV = 5.0%

### Ingredients

8.5 lbs. (3.9 kg) 2-row pale ale malt
12 oz. (0.34 kg) flaked oats
10 oz. (0.28 kg) crystal malt (40 °L)
6.0 oz. (0.17 kg) crystal malt (60 °L)
5.0 oz. (0.14 kg) chocolate malt
4.0 oz. (0.11 kg) roasted malt (500 °L)
1 tsp. Irish moss
9 AAU Kent Goldings hops
(1.8 oz./51 g of 5% alpha acids)
Wyeast 1084 (Irish Ale) or White Labs WLP004 (Irish Ale) yeast
(1.5 qt./~1.5 L yeast starter)
3.5 oz. (100 g) corn sugar (for priming)

### Step by Step

Although unusual for an English-style ale, a step mash will work well for this beer. In your kettle, heat 12 quarts (11 L) of water to 133 °F (56 °C). Mix hot water and grains in your kettle and mash in to 122 °F (50 °C). (This is a thick mash at this point.) Let mash stand for 30 minutes. In a large kitchen pot, heat 5 quarts (~5 L) of water to a boil and stir this into mash after initial rest. (Now the mash with be at a "normal" thickness for an infusion mash.) Then, add direct heat to the kettle to bring mash to 154 °F (68 °C). Let mash rest for 45 minutes. Heat mash to 170 °F (77 °C), transfer mash to lauter tun and let rest for 5 minutes (to settle). Recirculate wort until clear, then begin running off wort. Heat sparge water to point that grain bed temperature remains around 168 °F (76 °C) during sparge. Collect 6 gallons (23 L) of wort. Bring wort to a boil. Once hot break forms, add hops and boil for 60 minutes. Add Irish moss with 15 minutes left in boil. Cool wort and transfer to fermenter. (You should have 5 gallons/19 L at this point.) Aerate wort and pitch yeast. Ferment at 70 °F (21 °C).

### Countertop partial mash option:

Replace amount of 2-row pale ale malt in all-grain recipe with 1 lb. 11 oz. (0.77 kg) 2-row pale ale malt, 14 oz. (0.40 kg) light dried malt extract and 4.0 lbs. (1.8 kg) light liquid malt extract. Heat 5.5 qts. (5.2 L) of water to 167 °F (75 °C) and pour it into a 2-gallon (7.6-L) beverage cooler. Add crushed grains and flaked oats to a large steeping bag and slowly submerge in cooler. Open bag and stir grains with a spoon. Break up any "lumps." Note level of water in cooler after grains are added. Let partial mash rest, starting at 154 °F (68 °C), for 45 minutes. While mash is resting, bring 0.75 gallons (2.8 L) of water to a boil in your brewpot. Also, bring 5.5 qts. (5.2 L) of water to 180 °F (82 °C) in another pot. Open spigot on cooler and collect first wort. Add it to boiling water in brewpot. Begin heating this wort to a boil. Add 180 °F (82 °C) water to cooler until liquid level is the same as before. Stir grains and let sit for 5 minutes, then collect second wort and add it — along with the dried malt extract — to your brewpot. Bring wort to a boil, add hops and boil for 60 minutes. Stir in liquid malt extract and Irish moss for final 15 minutes of the boil. Cool wort and transfer to fermenter. Add water to fermenter to make 5 gallons (19 L). Aerate, pitch yeast and let ferment at 70 °F (21 °C).


oat used in homebrewing, offered by homebrew supply stores for about two dollars a pound or in bulk for around thirty-six bucks for twenty-five pounds. Some manufacturers use the terms "flaked oats" and "rolled oats" interchangeably. To that end, Rick Sellers, host of the brewing podcast Pacific Brew News, notes, "You probably have rolled oats in your cupboard, so just check before you order your brewing ingredients."

Also, Rick Hagerbaumer, cohost of the podcast BigFoamyHead.com, cautions against using instant oats with added sugars and flavors (such as maple brown-sugar oats or fruit-infused oats).

Whether using oatmeal (as in Quaker from your cupboard, which are rolled oats) or flaked oats (as in your local homebrew supply store), the oats should ideally impart a rich body to the final product. "The goal is to give the beer a smooth, creamy mouthfeel and a nice thick foamy head," says Hagerbaumer.

When using flaked oats or rolled oats, such as instant oatmeal, you do not need to cook the oats prior to brewing with them. These types of oats have already been treated with heat and pressure, which makes the starch soluble.

However, if you use rolled oats not packaged as instant oatmeal or use oats packaged as "quick oats," you must cook the oats before brewing with them. Simply cook as instructed on the package, but add a bit more water. (For example, raw, crushed oats should be cooked for 15 minutes at 190 °F (88 °C) in at least two quarts of boiling water.) Let the cooked oats cool to at least 157 °F (69 °C) prior to adding to the mash.

When adding the cooled, cooked oats to the mash, be sure to do so slowly. Otherwise, excessive oxidation may occur in the mash, or the mash may be scorched.

Finally, if you use whole oats, you must either cook the oats thoroughly prior to use, or more commonly, mill the oats to a coarse or medium grist to ensure the starch is exposed for conversion. The hard casing around the oat makes conversion impossible without some adjust-

oats

ment to the whole oat. Unless you have some good reason to use whole oats, you'll be better off using one of the more convenient forms.

Homebrew supply stores also offer variants such as roasted or malted oats.

## USING OATS

Pure oats (in any form) must be mashed with barley malt to be converted; however, Mosher suggests an easier, alternative method. "It is malted oats that are normally used in oatmeal stout. Malted oats are a lot easier to use with conventional brewing, and are less likely to create sticky, hard-to-lauter mash."

"One tidbit about malted oats is that oat diastase (the group of enzymes that that catalyze starch-degrading reactions) contains almost exclusively beta amylase, which means they are converted best at a somewhat lower temperature (140–145 °F/60–63 °C) than malted barley, and when mashed, tend to produce a very fermentable wort."

Another added edge to the oats' flavor can be achieved right at home prior to brewing. "My own trick for using oats is to toast them slightly. Put them on a cookie sheet in an oven at 325 °F (163 °C), and bake them a few minutes. When they start to smell like cookies, they're done. It's best to let the toasted oats sit for a few days before brewing, as freshly roasted grains sometimes have a harsh edge to them. The cookie aroma stays in the finished beer, and can be quite lovely. Very nice in a brown ale," Mosher says.

## WHY OATS?

"I love oatmeal stouts. The body can be so smooth and silky," says Sellers. "I think most beer enthusiasts also love a good oatmeal stout," he adds.

Brewers who use oats can expect an array of satisfying characteristics:

- Creamy: the lipids in the oats expel oils into the brew, creating a creamy, medium- to full-bodied brew.
- Chocolaty: oats generally add a slightly bittersweet flavor of chocolate to the brew.
- Roasted: even if the oats are not toasted /roasted prior to the brewing process, the grain itself lends a roasted flavor to the beverage.
- Silky: one word used time and again to describe oatmeal stouts is "silky." This trait arises from the oily properties of the oats.
- Darker color: the color for an oatmeal stout should range from a medium brown to black in color.
- Nutty: oats can impart nutty undertones.
- Earthy: oats can impart earthy undertones.
- Coffee: a perfect oatmeal stout is similar to coffee with a dash of cream.
- Frothy: ample carbonation adds to the zest of an oatmeal brew.

According to the Beer Judge Certification Program (BJCP), oatmeal stouts should have "mild roasted grain aromas, often with a coffee-like charac-

ter." The BJCP also calls for a head that's creamy and thick, with coloring ranging from tan to brown. Ideally, the oatmeal beverage should be full-bodied and dark with at least a hint of oatmeal flavor.

Earthy? Silky? Sounds like grandma's oatmeal cookies in a glass.

## ALL IN THE TECHNIQUE

The adage "a little goes a long way" is no exception when brewing with oats. According to Mosher, "a small amount of oats (5–10%) can add a nice oily creaminess to any beer where appropriate, and aids in head retention." The oats in this case are added to the mash.

The mash may become gummy as a result of the oats, especially when using larger quantities of oats. "I don't brew a lot with oats because I am afraid, personally, of stuck mashes in my brews," Sellers says. "I have used small amounts of oats, always using rice hulls when I do to avoid the aforementioned problem."

Rice or oat hulls added to the mash help alleviate the clumping and stickiness derived from using oats. The added bulk hulls (no more than 5% of the grain bill, according to Sellers) basically keeps the oats from settling to the bottom and obstructing the sparge. The hulls are flavorless and left behind in the lauter tun, so the beer's flavor is not impacted by their addition.

If using more than 25% oats (not generally recommended), one way to reduce the gumminess is by incorporating a beta-glucanase rest. The mash should rest for 20 minutes at 98–113 °F (37–45 °C).

If you're just not up for the possibility of a sticky mash, oats can also be steeped in a muslin bag, according to Hagerbaumer. You can also use a cheesecloth and add oats to an extract batch, taking the bag out around 115 °F (46 °C), Sellers says. Be warned, however, that the starch in oatmeal can only be converted to fermentable sugar if it's mashed, so steeping clearly eliminates that conversion. Also, experts do not recommend boiling oats.

Sellers offers advice to novice homebrewers: "The only hesitation I have for brewing with oats is for new homebrewers, brewers who have fewer than five batches of all-grain brew under their belts, who may be discouraged with mash or sparge difficulties. Even if your favorite beer is oatmeal stout, hold off until you're confident in your beer-making ability, because panicking has never been a confidence builder and I've often had to call for help from experts when things like stuck sparges occur."

Nearly any type of beer can achieve enhanced flavor and creaminess by adding oats. "I've used oats in several different stout recipes, for example, a double chocolate oatmeal stout. I've also used oats as an adjunct in a witbier recipe that came out exceptionally well," Hagerbaumer says.

Whatever oat-based beer you brew, the serving temperature should be between 55–62 °F (13–17 °C).

## COMPLEMENTARY FLAVORS

Options for complementing the oat flavor in your brew are limitless. You can keep it pure by using just the oats in addition to the big four. Or, you can try to jazz it up. "If you're new to brewing, and have a wide appreciation of beer of all colors and styles, I highly suggest you play with oats and see what you can do to your favorite beers — heck, I strongly suggest you play with just about anything you think will do something different for your beer," Sellers says. For oatmeal brews, chocolate malt (0.5 lbs.), coffee (0.75 lbs.), honey (8 oz.), mixed spice, brown sugar or any ingredient that sounds intriguing can be added to the mash to create your perfect rendition.

If you're up for something more comforting, take on this variation, which might even make you feel like a kid again (a very happy kid). If you're longing for that fresh-baked cookie taste in frothy form, look no further than Randy Mosher's special recipe: "You could even brew an oatmeal cookie ale: toasted oats (about 10% of the grist), seasoned with a little cinnamon and vanilla," he says. "A couple handfuls of raisins added to the secondary might add another layer." Oh, yeah. That's what I'm talkin' about.

*Kristin Grant is a frequent contributor to* Brew Your Own. *She wrote about brewing podcasts in the October 2006 issue of* Brew Your Own.

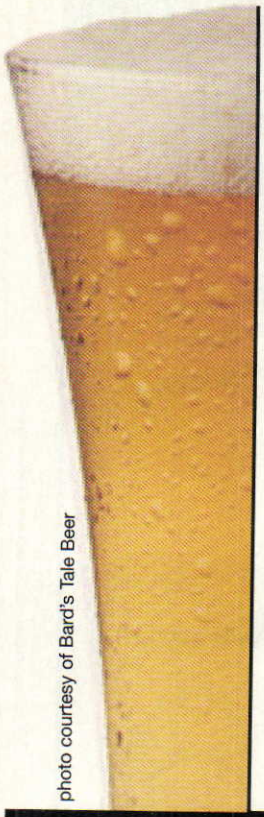


photo courtesy of Bard's Tale Beer

# IMAGINE LIFE WITHOUT BEER.

## If you're reading this magazine you probably can't, but for someone with celiac disease, drinking a tall cool one at the end of the day is not usually part of the plan.

by **Glenn BurnSilver**

# GLUTEN FREE

Celiac disease is the intolerance to gluten, a common protein found in most grains including barley, wheat, rye, oats — the grains most commonly used in beer production — as well as spelt, kamut and triticale. The gluten proteins trigger an immune response in the small intestine of people suffering from the disease. The only treatment for those affected is to avoid foods made with gluten-containing grains.

But there is hope for the beer-loving celiac sufferer. Several grains that do not contain gluten — corn, rice, sorghum, buckwheat, millet and quinoa — can be used to make beer.

Currently, a few breweries in the United States have begun producing gluten-free beer. Bard's Tale was the first US brewery to introduce a gluten-free beer, Dragon's Gold, a lager beer brewed with sorghum. Dragon's Gold is available in many northeastern states and on the west coast. Late in 2006, Anheuser-Busch rolled out another gluten-free lager, called Redbridge, made with sorghum and rice. Around the world, there are a few craft breweries that make gluten-free beer. In Africa, locally-made sour sorghum beers have been common for a long time, since sorghum is a widely planted crop there. SABMiller also makes a clear sorghum beverage there called Eagle.

For the homebrewer, brewing gluten-free beer is certainly possible. However, for all-grain brewers, it is much more difficult than brewing a traditional-style beer.

"It's a hell of a lot more difficult brewing a good gluten-free beer than people think," Craig Belser, co-owner and brewmaster at Bard's Tale Beer declares, effectively tossing out a challenge to homebrewers everywhere.

The main challenge is that malted versions of gluten-free

# BREWING FOR SUFFERERS OF CELIAC DISEASE

grains are not usually commercially available, so you will have to malt your own. In addition, many gluten-free grains are huskless and the malts made from them are low in diastatic power. And finally, the gelatinization temperature of the starches in most gluten-free grains is higher than that of most brewing grains.

## THE EXTRACT OPTION

For extract brewers, sorghum syrups can be used as the base for a gluten-free beer. Briess Malting makes two such syrups from white sorghum. The syrup called BriesSweet White Sorghum Syrup 45 DE High Maltose is an amber extract with a carbohydrate profile similar to malt extract (or, once diluted, wort). The level of protein and free amino nitrogen (FAN) is also similar to malt extract. It will yield a wort that will exhibit approximately 75% apparent attenuation when fermented with brewers yeast. Their other syrup — BriesSweet White Sorghum Syrup 60 DE — contains more simple sugars and would yield a more fermentable wort (around 80–85% apparent attenuation) and a drier beer. Bob Hansen, technical service manager at Briess, says the syrups yield a "grain-like flavor," albeit a different flavor than malted grains as the sorghum syrup is made from raw, not malted, sorghum.

Sorghum syrup can be combined with corn sugar, cane sugar, corn syrup, rice syrup, molasses, honey, fruit juices or other sugars (except malt extract) to make a gluten-free wort. Keep in mind, however, that all of the carbohydrates from these sources are completely or nearly completely fermentable and will lead to a drier, less full-bodied, beer. (The protein content of sugar sources may also be low enough that adding yeast nutrients will be necessary.)

Belser cautions that brewing a beer exclusively from syrups and sugars may lack flavor and body. Without the kilning that malted grains go through, the flavors of the grain will not be as developed.

"What you're dealing with here are beers that don't quite taste like beer anyway," Belser says. "If you use one of the grain extracts, it isn't really going to taste like beer. You just can't get there. They taste close, but if you don't have malts you won't have beer with character."

If you're an extract brewer and you want to enhance the flavor of your gluten-free beers, you have a couple options to add grain or malt flavors.

## EXTRACT WITH EXTRAS

For an extract brewer making a 5-gallon (19-L) batch using sorghum syrup, try toasting 0.5–1.5 lbs. (0.23–0.68 kg) of raw sorghum grain in your oven (at 350 °F/177 °C) and steeping it

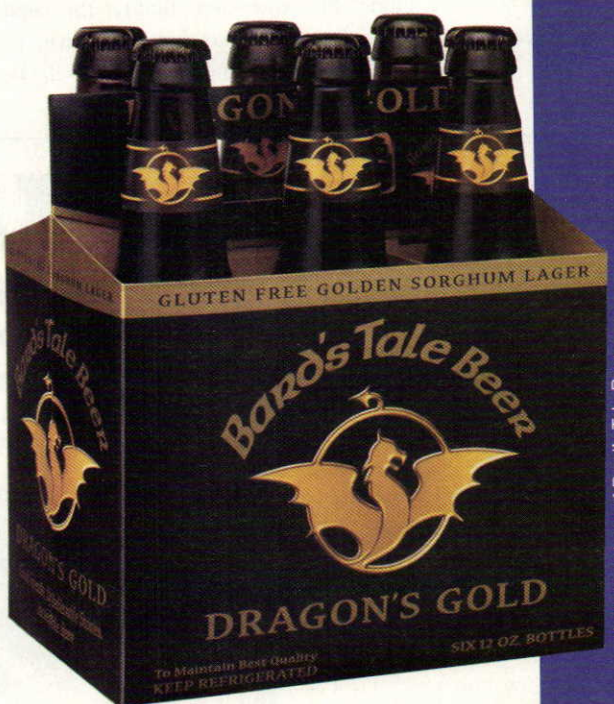



photo courtesy of Bard's Tale Beer

Dragon's Gold from Bard's Tale was the first commercial gluten-free beer released in the U.S. It is a lager brewed with sorghum.

**You should be able to find many gluten-free grains for brewing in better grocery or health food stores.**

(uncrushed) to infuse your gluten-free wort with some additional flavor. Toast the grain for 10–30 minutes, depending on the type and level of flavor you desire. You may want to take a small test batch of toasted sorghum, pulling out a small sample every few minutes, to help you fine-tune your toasting schedule.

Of course, toasting unmalted sorghum is not going to yield exactly the same flavors as found in kilned barley specialty malts. But, it will make your beer more beer-like. Alternately, you can malt a small amount of sorghum, as all-grain brewers will need to do, and perform a partial mash.

## GOT GRAINS?

The first consideration is, of course, procuring the right grains. You should be able to find many gluten-free grains in better supermarkets or health food stores. If not, try searching for them online. Be aware that finding the right grains can be somewhat expensive, as fairly large amounts of grain will be needed. But for someone who can't drink beer otherwise, every sip will certainly be worth the price.

Also be aware that some grains from some sources may be sold as seed, not for consumption (by humans or other animals). This seed may be treated with things you do not want in your beer.

White sorghum and rice are the most popular grains for brewing gluten-free beers. Although corn does not contain gluten, Belser has not had good luck with it in the brewery.

## MALTING YOUR GRAINS

OK, here is where the main difficulty comes in — malting your grain at home. For the complete details on malting, see the Techniques column on page 51. The basic idea is to sprout the grains, then dry them. To do this, first soak the grains in a bucket of water, flushing every eight hours or so and aerating well. Belser recommends using a fish tank aerator to get plenty of air circulating. Repeat this process over a couple days until the

grains begin to sprout. Next, dry them with a dehydrator. Once dry, the grains can be kilned gently in the oven on low heat. (In this case, you will want to heat the grains only as much as a base grain would be, not to the extent that specialty grains such as crystal or darker malts are. However, you may want to separately "roast" a small amount of your homemade malt to a greater degree for color and flavor.) Keep a close eye to get the desired color and flavor characteristics desired. Some dehydrators can get hot enough for light roasting as well.

## MASHING A MAJOR MESS

Once the malted grains are dried and kilned, they are ready to be mashed. A single infusion mash may work, but a decoction mash is a much better option. Decoction mashing was developed to get the most out of the poorly-modified and unevenly modified malts of the past. Until you gain significant proficiency at malting at home, a little extra work in the mash will likely pay big dividends in terms of extract efficiency. (See the December 2006 issue for how to perform a decoction mash.) Since sorghum is huskless, you will want to add rice hulls — around 0.5 lbs. (0.23 kg) for a 5-gallon (19-L) batch — to your mash in order to be able to lauter efficiently.

There is one other factor to keep in mind. Sorghum and rice, Belser says, have gelatinization temperatures that are higher than traditional beer-making grains. "With sorghum, corn and rice, the gelatinization temperature is 180 °F (82 °C)," Belser explains. "So you have to take it to a low boil, but there are fewer enzymes left to convert the starches to sugar." Belser has found a way around this problem, but as it took him three years to "find the perfect balance," he won't divulge his trade secret.

One option for homebrewers would be to add a final step to a traditional triple decoction mash. Heat the entire mash to 180 °F (82 °C), then stir in an amylase enzyme preparation — about 1 tsp. for a 5-gallon (19-L) batch — and let the mash rest until an iodine test gives a negative result. (Amylase enzyme preparations come from fungi and do not contain gluten.) Once the mashing and lautering is completed, the brewing process

becomes typical of a regular beer. "If you're using your malted grains, you're good to go," Belser says.

## YEAST AND GROWTH MEDIA

While almost any hops can be chosen depending on the desired flavor profile, some yeast strains work better than others. Through experimentation, Belser says ale yeast — English, Irish and American — works best, while Belgian yeast doesn't react well with sorghum or rice. Some lager yeasts can work too.

Yeast creates another potential issue for celiacs, too. Liquid yeasts are cultured in a medium made partially from barley and will contaminate the beer. Dry yeast is cultivated on beet sugar, cane sugar or molasses and can be pitched directly to the carboy. If you make a yeast starter, it must also be made gluten-free, too.

To use a liquid yeast strain, you would need to plate out the yeast on a petri dish or slant, then grow up the culture from a single yeast colony, using molasses or sorghum syrup as your culture media. (See the January-February 2005 issue for more information on yeast handling techniques.)

## FLAVOR DIFFERENCES

Gluten-free beers do not taste exactly like "regular" beers. Many brewers report that their first efforts seem thin and sour. Many of the African sorghum beers are sour due to "wild" fermentations, but sorghum beer can have a sour edge to it, even when fermented with brewers yeast.

Compared to "regular" brewing, the ingredients available for gluten-free beer are limited. So you will have to use your imagination and everything you know about brewing when formulating your gluten-free beer recipes.

## EQUIPMENT

Finally, when making a gluten-free beer you need to avoid cross-contamination. If you consider basic brewing hygiene tantamount, double your efforts for this project as even the smallest amount of gluten can make some celiac sufferers ill. Either buy a second grain mill or very thoroughly clean your present mill. Store and mill your barley malts away from your gluten-free malts. Replace "soft surfaces" in your brewery — such as siphon hoses, airlocks and rubber stoppers — if you have brewed "glutenous" beers before. And finally, be extra diligent in cleaning carboys, kettles, utensils, funnels and anything else that could come into contact with the beer.

If you attempt to brew a gluten-free beer — especially an all-grain brew — you will be venturing into an area of homebrewing that is not well-charted. Take good notes on your malting sessions, brewing sessions and beers and be prepared to experiment.

Making a gluten-free beer may take a little more effort to produce, but for the celiacs who will now be able to enjoy a beer, the payoff never stops.

*Colorado-based Glenn BurnSilver is a frequent contributor to* Brew Your Own.

## SIMPLE SIMON SORGHUM BEER

(5 gallons/19 L, extract)
OG = 1.047 FG = 1.011
IBU = 22 SRM = 8 ABV = 4.7%

**Ingredients**

6 lb. 11 oz. (3.0 kg) BriesSweet White Sorghum Syrup 45 DE High Maltose
0.50 lbs. (0.23 kg) honey
6 AAU Tettnang hops (60 mins) (1.5 oz./43 g of 4% alpha acids)
Danstar Nottingham dried ale yeast
0.75 cups corn sugar (for priming)

**Step by Step**

Heat 2.5 gallons (9.5 L) of water to a boil, then stir in sorghum syrup. Return wort to a boil, then add hops and boil for 60 minutes. At the end of the boil, stir in honey with a sanitized spoon, then cool wort until sides of brewpot are cool to the touch. Transfer wort to a sanitized fermenter and top up with water to 5 gallons (19 L). Aerate wort and pitch yeast. Ferment at 68 °F (20 °C). Bottle with corn sugar.

## OVERLOOK AMBER ALE

(Redrum Sorghum Beer)
(5 gallons/19 L, partial mash)
OG = 1.055 FG = 1.014
IBU = 33 SRM = 10+ ABV = 5.3%

**Ingredients**

5.0 lbs. (2.3 kg) white sorghum malt (base malt)
1.0 lbs. (0.45 kg) white sorghum malt (kilned/toasted malt)
4.0 lbs. (1.8 kg) BriesSweet White Sorghum Syrup 45 DE High Maltose
1 tsp amylase enzymes
7 AAU Centennial hops (60 mins) (0.58 oz./16 g of 12% alpha acids)
2.5 AAU Cascade hops (30 mins) (0.50 oz./14 g of 5% alpha acids)
0.50 oz. (14 g) Amarillo hops (0 mins)
Fermentis Safale S-04 dried ale yeast
0.75 cups corn sugar (for priming)

**Step By Step**

Malt 6.0 lbs. (2.7 kg) of white sorghum. Toast 1.0 lb. (0.45 kg) of this malt. Perform a triple decoction mash, then heat mash to 180 °F (82 °C) and stir in amylase enzymes. Collect wort, add syrup and boil wort for 60 minutes. Ferment at 70 °F (21 °C).

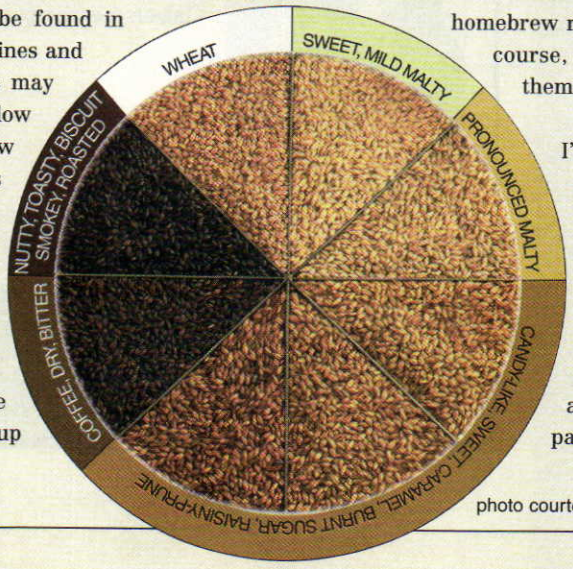
# BALANCED RECIPE

by **CHRIS COLBY**

creating a **BEER RECIPE** takes knowledge and experience. and, the recipe needs to go beyond just listing the **HOPS, MALT** and **YEAST.**

Many, perhaps most, homebrewers begin brewing by following existing homebrew recipes. Most homebrew shops have a notebook full of beer recipes or a shelf full of kit beers. Likewise, thousands of homebrew recipes can be found in homebrew books, magazines and internet forums. Recipes may also be obtained from fellow homebrewers. Even though homebrew recipes abound, many homebrewers eventually want to start formulating their own recipes.

The advantage of writing your own recipes is that a well-thought out recipe will incorporate the ingredients available to you, the techniques you are familiar with and the quirks of your homebrewery to come up with a beer that is "all you." The only real disadvantage to formulating your own recipes is that it takes time. Of course, if saving time were a homebrewer's primary concern, we'd just buy our beer instead of brewing it. To me, formulating a homebrew recipe is almost as fun as brewing. (Of course, drinking homebrew beats both of them.)




As the previous paragraph hints at, I'll take the wide view of recipe formulation. This will include not only coming up with an ingredient list — although this is the main focus of the article — but options you have with regards to the techniques you use. I also view brewing and tasting the beer, applying what you've learned and rebrewing the tweaked beer as a part of recipe formulation. It may seem

photo courtesy of Briess

# FORMULATION

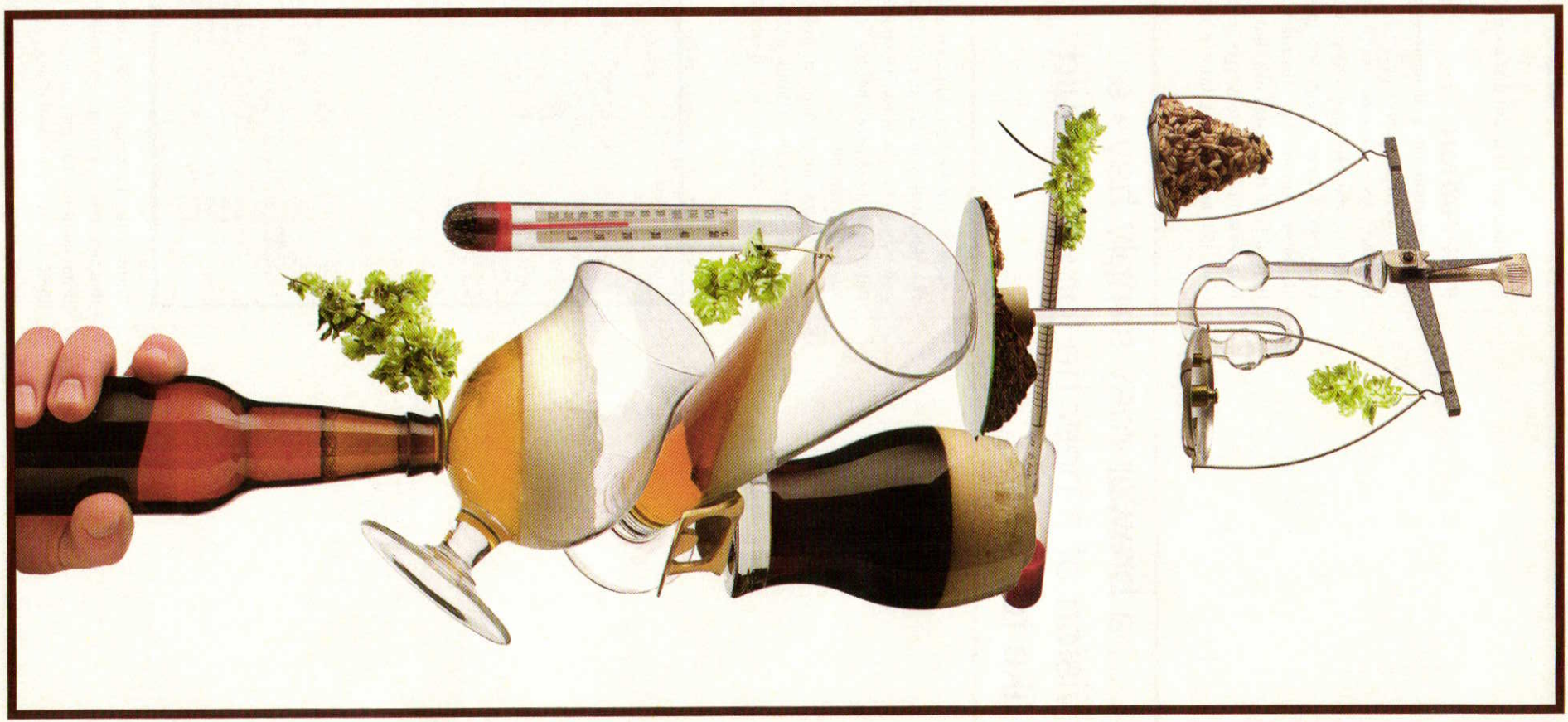


photo by Charles A. Parker/Images Plus

intimidating at first, but that soon passes.

## INSPIRATION

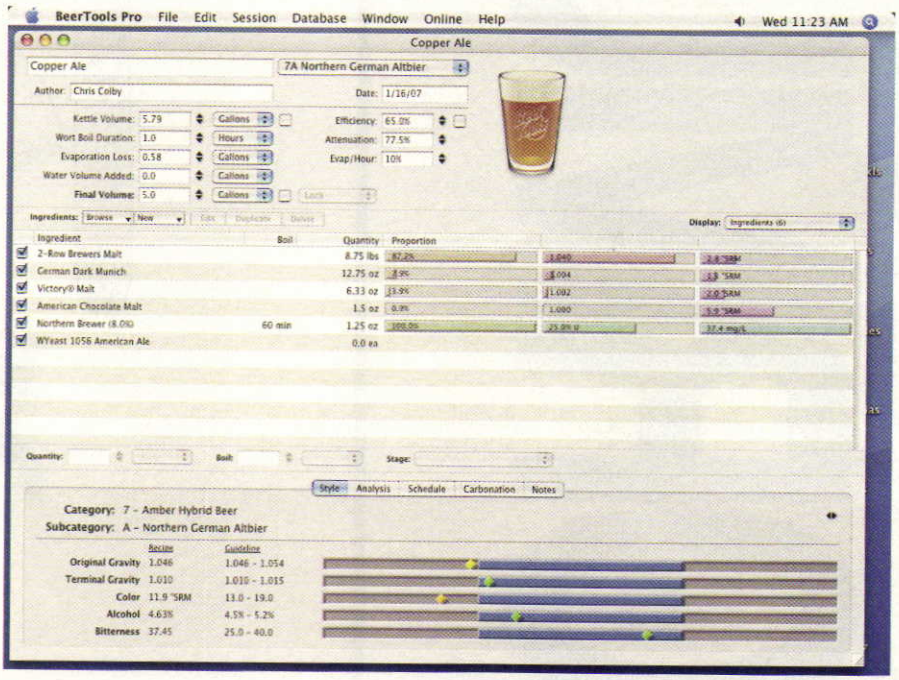
Inspiration for a homebrew recipe can come from many sources. Many homebrewers want to be able to emulate a commercial beer they enjoy. A beginning homebrewer might, for example, like Sierra Nevada Pale Ale and want to brew a beer that tastes like that. Others may want to formulate a type or style of beer. Perhaps the new brewer not only enjoys Sierra Nevada, but also Full Sail Pale Ale, Red Seal Ale and Red Tail Ale and wants to make a beer reminiscent of these beers in general, but not a copy of any one specifically.

> . . . a brewer may simply have a vision of a beer he (or she) would like to brew.

Brewers interested in homebrew contests may wish to brew a beer "to style," as defined by Beer Judge Certification Program (BJCP), the group that sets the rules adopted by most homebrew contests. (In that case, our hypothetical new brewer will discover that the beers above are categorized in two different subcategories.) And finally, a brewer may simply have a vision of a beer he (or she) would like to brew. The vision may be of a beer that is a modification of an existing beer or style, or it may be different than any existing beer. Many homebrewers have one or more "house brews" — beers that they brew solely because they like how the beers taste. They may or may not bear any resemblance to any commercial beer or fall within any style guidelines.

For example, I've brewed a beer I call my copper ale four times. It's just an average-strength ale made with two base malts and two specialty malts. The beer is moderately malty, slightly biscuit-like and with just enough darkly-roasted malt to turn it copper colored and lend a very mild roast character. I hop it moderately and ferment it with American ale yeast. I didn't model this beer on any commercial beer, nor does fit into any BJCP category — it's just a combination of malt, hops water and yeast that I happen to like.

In this article, I'll use my copper ale recipe as an example of how to put together a recipe. (In doing so, I'm not saying that this is the best beer recipe of all time or that I'm the best beer recipe




A screen in BeerTools, a recipe calculation program. Programs such as this one make recipe formulation easier.

formulator. It isn't and I'm not. But, I do recall the beer turning out well and many people enjoying it. Also, it illustrates many of the points I would like to make.)

Recipe formulation does take some knowledge and experience, but it's not "brain surgery." And, although getting a recipe to taste exactly as you want it may take some time, coming up with a truly horrible recipe is actually fairly difficult.

If you are a beginning brewer, hopefully this article will bring you to the point that you feel comfortable formulating a recipe of your own and brewing it. If you are an experienced brewer, but you have always used existing recipes, your experience will be a big plus.

## KNOWLEDGE AND EXPERIENCE

Being able to formulate a beer recipe takes knowledge and experience. If you are trying to formulate a recipe for a popular style of beer, there will be plenty of existing homebrew recipes that you can consult. (Why not use other people's experience, when possible?) Reviewing existing recipes is a quick path to formulating your first recipe.

It is fairly easy to compile a "consensus" recipe — one in which the homebrewer selects the most common ingredients found in representative recipes and uses an average or median amount of each. You can then brew the beer and use your tasting notes as the jumping off point to making the beer your own.

If you have an idea for a unique beer, you will need to know a little more about the ingredients homebrewers use in order to get to your first draft of your recipe. The good news is, all you need to do to start gaining this knowledge is to jump in and start formulating, brewing and tweaking your own recipes. The beer perfectly suited to your taste buds may be only a couple brew sessions away.

## WHAT YOU NEED

The only tools you need to formulate a recipe are a pencil and a piece of paper. However, the process can be made a whole lot easier if you use commercial brewing software or a homemade brewing spreadsheet. Software packages such as ProMash, BeerTools, BeerSmith, StrangeBrew and others allow you to

# COPPER ALE

## Copper Ale

**(5 gallons/19 L, all-grain)**

OG = 1.048 FG = 1.010
IBU = 30 SRM = 13 ABV = 4.9%

**Ingredients**

8.75 lb. (4.0 kg) domestic 2-row pale malt
12.75 oz. (0.36 kg) Munich malt
6.33 oz. (0.18 kg) Victory malt
1.5 oz. (43 g) chocolate malt
1 tsp. Irish moss
8 AAU Northern Brewer hops (0.89 oz./25 g of 9% alpha acids)
Wyeast 1056 (American Ale) or White Labs WLP001 (California Ale) yeast (2 qt./~2 L yeast starter)
1 cup corn sugar (for priming)

**Step by Step**

Use water with carbonates under 50 ppm and calcium around 50 ppm. Heat 12.5 quarts (12 L) of water to 163 °F (73 °C) and mash grains at 152 °F (67 °C) for 60 minutes. Stir in boiling water to mash out to 168 °F (76 °C). Recirculate wort until clear. Run off wort and begin sparging. Keep sparge water heated to the point that the grain bed temperature remains around 168 °F (76 °C). Collect 6 gallons (23 L) of wort. Bring wort to a boil. Once hot break forms, add hops and boil for 60 minutes. Add Irish moss with 15 minutes left in boil. Cool wort to 68 °F (20 °C), aerate and pitch yeast. Ferment at 68 °F (20 °C).

## Copper Ale

**(5 gallons/19 L, countertop partial mash)**

OG = 1.048 FG = 1.010
IBU = 30 SRM = 13 ABV = 4.9%

**Ingredients**

2 lb. 11.33 oz. (1.2 kg) pale malt
12.75 oz. (0.36 kg) Munich malt
6.33 oz. (0.18 kg) Victory malt
1.5 oz. (43 g) chocolate malt
9.0 oz. (0.26 kg) light dried malt extract
3 lb. 10 oz. (1.6 kg) light liquid malt extract
1 tsp. Irish moss
8 AAU Northern Brewer hops (0.89 oz./25 g of 9% alpha acids)
Wyeast 1056 (American Ale) or White Labs WLP001 (California Ale) yeast (2 qt./~2 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) and pour it into a 2-gallon (7.6-L) beverage cooler. Add crushed grains to a large steeping bag and slowly submerge in cooler. Open bag and stir grains with a large spoon. Note the level of water in the cooler after the grains are added. Let partial mash rest, starting at 152 °F (67 °C), for 45 minutes. While mash is resting, bring 0.75 gallons (2.8 L) of water to a boil in your brewpot. Also, bring 5.5 qts. (5.2 L) of water to 180 °F (82 °C) in another pot. Open spigot on cooler and collect first wort. Add it to the boiling water in your brewpot. Begin heating this wort to a boil. Add 180 °F (82 °C) water to cooler until liquid level is the same as before. Stir grains and let sit for 5 minutes, then collect second wort and add it to your brewpot. Add dried malt extract and bring wort to a boil. Add hops and boil for 60 minutes. Stir in liquid malt extract and Irish moss for final 15 minutes of the boil. Cool wort and transfer to fermenter. Add water to fermenter to make 5 gallons (19 L). Aerate, pitch yeast and let ferment at 68 °F (20 °C).

## Copper Ale

**(5 gallons/19 L, extract w/grains)**

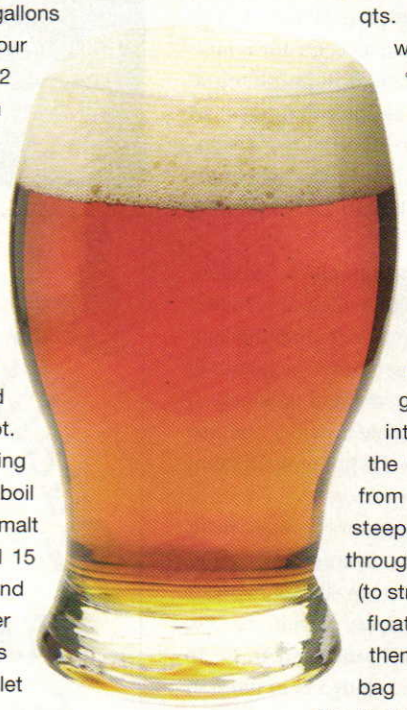
OG = 1.048 FG = 1.010
IBU = 30 SRM = 13 ABV = 4.9%

**Ingredients**

11.33 oz. (0.32 kg) domestic 2-row pale malt
12.75 oz. (0.36 kg) Munich malt
6.33 oz. (0.18 kg) Victory malt
1.5 oz. (43 g) chocolate malt
1 lb. 14 oz. (0.85 kg) light dried malt extract
3.3 lbs. (1.5 kg) light liquid malt extract
1 tsp. Irish moss
8 AAU Northern Brewer hops (0.89 oz./25 g of 9% alpha acids)
Wyeast 1056 (American Ale) or White Labs WLP001 (California Ale) yeast (2 qt./~2 L yeast starter)
1 cup corn sugar (for priming)

**Step by Step**

In a large kitchen pot, heat 3.0 qts. (2.8 L) of water to 163 °F (73 °C). Add crushed grains to a large steeping bag and steep them in this pot, at 152 °F (67 °C), for 45 minutes. While grains are steeping, heat 1.5 gallons (5.7 L) of water to a boil in your brewpot. Also, heat 1.5 qts. (1.4 L) of water to 170 °F (77 °C) in another kitchen pot. After steep, place a colander over your brewpot and lift grain bag into it. Pour the "grain tea" from the steeped grains through the bag (to strain out any floating bits), then rinse the bag with 1.5 qts. (1.4 L) of 170 °F (77 °C) water. Add dried malt extract to liquid mixture and bring to a boil. Add hops and boil your wort for 60 minutes. Stir in Irish moss for final 15 minutes of the boil. Stir in liquid malt extract at end of boil and let wort sit — with the lid on your brewpot — for 15 minutes before cooling. Cool wort and transfer to fermenter. Add water to fermenter to make 5 gallons (19 L). Aerate, pitch yeast and let ferment at 68 °F (20 °C).



input your ingredients (and some details about your brewing system) and will calculate all the relevant numbers for you. For example, if you enter an ingredient list, your extract efficiency and hop utilization rate, the program will calculate the original gravity (in specific gravity or °Plato), final gravity, bitterness (in IBUs) color (in SRM or EBC) and alcohol content (usually in percent alcohol by volume (ABV)). These software packages calculate a lot of other things, too.

Likewise, it is not hard to develop your own spreadsheet to do the calculations that are important to you. (See the May-June 2005 issue of *BYO* for more on this, and download two homemade spreadsheets — one by story author James Azotea and one by me — at www.byo.com/feature/1315.html.)

One thing homebrewers should understand about these tools is that they provide estimates of how your beer may turn out, not guaranteed forecasts or actual measured results. The program may predict that your original gravity

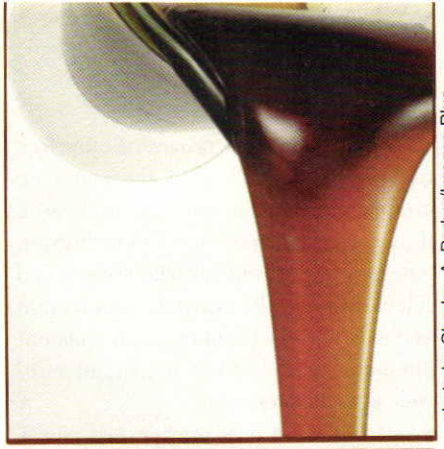


photo by Charles A. Parker/Images Plus

Most modern extract brewers make their wort from a pale malt extract base, flavored with steeped specialty grains.

(OG) will be, say, 1.048, but the actual OG you achieve depends on a lot of variables, including your extract efficiency for that brew session, the actual extract potential of your malt (which may differ from the presets in the program), that you hit your target volumes and other factors.

As homebrewers, we can measure specific gravity easily with a hydrometer. However, measuring other beer characteristics, such as bitterness (in IBUs) or alcohol content (in percent ABV) require equipment that most of us don't have access to. Just keep in mind that adding a certain amount of hops with 60 minutes in the boil remaining does not guarantee your beer will have any specific IBU value. Likewise, a gravity drop of a certain number of "gravity points" does not guarantee a specific alcohol content. These are both just calculations and, like the calculations for original gravity, many variables will determine how close your actual beer matches the estimates.

Another thing to note is that every homebrew calculator returns slightly different results for the same recipe. In fact, in most programs, you can switch among different ways different parameters are calculated. So, the same program can yield many different sets of results from the same recipe. This has caused many homebrewers to ask, "What settings should I use to get the right results?"

In fact, there are no right or wrong results among these different estimates, at least not universally. The numbers are just estimates. How close they come to

the reality of your beer depends on your equipment, technique and ingredients.

In the case of original gravity, you can see how close the estimate was to your actual original gravity. Using this information, you can adjust the extract efficiency used by the calculator so that it matches for that brew session. And — if you brew repeatably — your measured extract efficiency can be used as a fairly accurate predictor of your original gravity for future brews.

For variables you can't measure, like IBUs, it's best to simply pick one calculator (or method of calculation) and stick with it. Your program and spreadsheet may predict that your beer will have, say, 35 IBUs. After brewing the beer, however, you can't measure bitterness directly (unless you have access to a machine called a spectrophotometer), to know if that estimate was accurate. However, you can know from experience how bitter 35 IBU beers were when estimated by your preferred method of calculation and brewed on your system.

Many homebrew programs offer free trial downloads. If you are shopping around, you might as well try out several. If you are an experienced homebrewer, type in a few of your favorite recipes and select among the various calculation methods until you find one that spits out numbers that seem representative of your actual beers.

If you are a new brewer, just pick a program that seems like it will suit your needs. Then, use that program (and the same settings) consistently every time you formulate a recipe. If you take good tasting notes to compare the numbers to, you will soon have a good feel for what those numbers mean.

Once you've got your program fired up, a good place to start when compiling your recipe list is with your base malt.

## BASE MALTS

For all-grain brewers, most of a recipe's grain bill will consist of the base malt. Base malts supply most of the extract (fermentable carbohydrates) and most or all of the enzymes required to degrade the starches in the grain bill. Some beers are brewed using only base malt. It is possible, for example, to brew an Octoberfest from only Vienna malt. Most recipes however, contain one or more base malts and one or more specialty malts or adjuncts.

There are a variety of types of base malts. The most commonly used base malts by homebrewers are those made from 2-row barley, such as 2-row pale malt, 2-row brewers malt and Pilsner malt. These are the most lightly-kilned base malts, usually between 1.5 and 2 °L. There are also base malts that are more darkly kilned, such as pale ale malts (~3 °L), Vienna malts (4–6 °L) and light Munich malts (8–10 °L). Darker base malts impart a more malty flavor to beer, but also exhibit less diastatic power (the ability to convert starches), although any base malt should be able to convert all its own starches. The lightest base malts can convert all their own starches, plus some from other sources. Base malts may also

be made from 6-row barley, wheat, rye and other grains.

In addition to the degree of kilning they receive, base malts may be malted in different countries, or from different strains of malting barley (or wheat or other grains) within a country. Maris Otter, for example, is a variety of malting barley popular among English maltsters. Likewise, Golden Promise is a Scottish barley variety.

Different base malts do taste different, even if they are labeled similarly. Although two bags of malt may both be labeled as "2-row pale ale malt," they may be malted in different countries, by different maltsters, from different varieties of barley — and taste tests have shown that these differences are detectable by beer drinkers.

## CHOOSING BASE MALTS

Geography is often a good indication of what base malt may be right for a beer. If you are planning to brew an English-style ale, for example, an English base malt will likely be a good choice. However, this "rule" can be and is routinely broken by brewers, often with good results. It just depends on the beer. Beyond geography, you just need to have some experience brewing with different base malts, or tasting beers made from different base malts.

For my copper ale, I wanted a beer that showed a little more malt than a typical brewpub ale. So, I went with a mix of mostly domestic 2-row pale malt — used by a lot of brewpubs — and a smaller amount of Munich malt, for a little bit of a malty edge. The first three times I brewed the beer, I used a light Munich malt, kilned to around 8 °L. The last time, for a bit more Munich malt character, I used a dark Munich malt, with a color around 20 °L.

The technique you use for mashing the base malt depends on a lot of variables — the style of beer, whether you're using adjuncts, etc. One important fact, however, is that all modern base malts can be mashed with a single infusion mash. The one exception is undermodified malt, which needs to be step or decoction mashed. When selecting a mash program for your recipe, ask yourself if a mash more complex than a single infusion is really going to add anything to your beer.

## MALT EXTRACTS

If you are an extract brewer, malt extract will form the backbone of your beers. Just as different base malts differ, so do different malt extracts, as they will be made from different base malts. In addition, amber or dark malt extracts will be made from mixtures of base malts and (usually unspecified) specialty grains. Some extra-light malt extracts may be a mixture of a base barley malt and adjunct. The approach most "modern" extract homebrewers take is to use a light or pale malt extract — one made from a single base malt — and add other grains to their recipe by steeping them or by performing a partial mash. When choosing a malt extract for a base, the geography "rule" works well, but — as with base

# Techniques and Equipment

If you handed identical bags of ingredients to 100 homebrewers, they would brew 100 similar, but distinctly different beers with them. When selecting the ingredients for a beer recipe, you aren't simply selecting a bunch of flavors to be mixed together. Your techniques and your equipment greatly affect the final product. In brewing, the amount of flavor you extract from some ingredients depends on how you handle them. For example, a finer crush may yield more "husky" flavors in your beer. Reactions between components of your ingredients can create flavors during the brewing process. Maillard products, for example, can be formed depending on how hard you boil. How you brew, and condition your brew, determines how some flavors and aromas are created or suppressed. Weak cooling can lead to DMS. Weak fermentation can lead to an overly high final gravity, Early racking can leave diacetyl. Splashing during racking leads to oxidation. In fact, many of the key flavors, aromas and other characteristics of a beer do not come directly from the ingredients list, but from how the beer was made or handled.

A short list of flavors, aroma and characteristics that come more from your technique than your ingredient list includes: DMS, diacetyl, acetaldehyde, esters, higher alcohols (fusels), oxidized aromas (including cardboard-like and sherry-like), foam stand, attenuation, carbonation (if force carbonating or retaining carbonation). And, even if you've honed your techniques to the point that obvious flaws don't show up, there are the "intangibles" — the things, many of which don't have a convenient name or description, that separates average beer from awesome beer.

In a homebrewery, the impact of equipment comes mostly from using something that is not adequate for the job. At our small scale relative to commercial breweries, much of our equipment is overkill. Homebrew wort chillers generally cool wort much faster than commercial chillers do. But, other pieces may be lacking. The most common deficit may be inadequate heat for the boil. If you are chained to your stove, and are trying to boil a full 5-gallon (19-L) batch, you should consider a bigger, badder burner.

All the flavors and aromas created or influenced by your technique or equipment are just as real — and just as important — as those that come directly from your ingredients. So, when you are thinking about improving the formulation of a recipe, your best move may not be adding a little more or less of an ingredient. Instead, it may be focusing on your techniques or getting a key piece of equipment for your brewery.

malts — can sometimes be broken. (See the October 2006 issue of *Brew Your Own* for a full list of all malt extracts sold in North America.)

## SPECIALTY MALTS

There are numerous kinds of specialty malts available to the homebrewer. These specialty malts are combined with the base malt (or malt extract) chosen by the brewer to alter the flavor and color of the beer. Popular specialty malts include crystal and caramel malts, biscuit malts, melanoidin malts and darkly roasted malts — including coffee malts, chocolate malts and black roasted malts.

Most specialty malts are made from barley malt, but some wheat malts and rye malts are available. For example, there are chocolate wheat and chocolate rye malts. There are also dark roasted grains made from unmalted barley.

Crystal malt is a popular specialty malt, providing the amber hue, caramel flavor and extra body to many English-style ales. Crystal malt comes in various colors, from 10 °L up to around 150 °L. The different colors of crystal malt also have different flavors. Sometimes a new brewer will ask if he can, for example, substitute half a pound of crystal malt (60 °L) for a pound of crystal malt (30 °L) in a recipe. If he made that substitution, the color of the beer would remain the same, but the flavor would change. Light crystal malts have a light caramel flavor while more darkly colored grains have a more caramelized character and some hints of roast. Using more than one color of crystal malt can add a nice layer of subtle complexity to a beer.

Darkly roasted grains, such as chocolate malt, roasted barley, roasted malt and black (or black patent) malt are all fairly common in dark beer recipes. When you add dark grains to a recipe, you may also need to add some carbonates to your water, to balance the acidity they bring. (Conversely, in a very light beer, you will probably want to minimize the level of carbonates in your water. See the article, "It's the Water" in the May-June 2005 issue of *BYO* for more on matching your water to your grain bill.)

When selecting dark malts, keep in mind that sometimes the descriptions of these malts don't quite do them justice.

Some brewers, for example, will hear that black patent malt tastes "burnt" or "acrid" and avoid it, seeking to find a "smoother" dark grain. Black patent is highly roasted, but describing it as simply "burnt" is missing some of the subtleties of the malt. Keep in mind that descriptions of ingredients don't always capture what the ingredient is all about.

In addition, sometimes an ingredient with an aggressive edge to it can keep a beer from being too boring. Black patent works nicely in robust porter recipes to keep the beer from being too rounded and wimpy. In a smooth malty beer, however, it would be out of place.

Typically, all-grain brewers mash their specialty grains (along with their base malt) and extract brewers steep them. All-grain brewers should be aware that they also have the option of steeping their specialty malts and adding them to their wort during the boil. In some cases, this may yield a slightly different flavor compared to mashing. One practice some homebrewers use is cold steeping. In cold steeping, specialty grains — often dark roasted malts — are steeped in cool water, often overnight, then added to the wort. The theory is that this makes the grain character "more rounded." (On the other hand, cold steeping may simply extract less flavor from the grain.) Finally, another unusual specialty grain technique is to wait and stir the specialty grains — often dark grains — into the top of the mash near the end of the rest. The way you use your specialty grains can affect the flavor they impart to your beer.

When brewing an established beer style, you can review existing recipes to get an idea of what specialty grains are appropriate for that style, and how much of each of them to add. When brewing a unique beer, you just need to know your ingredients. For my copper ale recipe, I chose Victory malt and chocolate malt. Victory malt is Briess' version of biscuit malt. It adds a little bit of "English" biscuit flavor. When I first brewed the copper ale, I had no real idea how much to add, so I just took a guess. After the first brewing, I scaled back on this malt a bit.

I chose the chocolate malt mostly for the color it lends to my beer, but the small amount in my recipe also adds just a hint of roast.

## ADJUNCTS

Adjuncts such as corn, rice or sugar are used in some beers. Adjuncts add extract (fermentables) to the wort, but relatively little flavor. They dry out a beer and decrease the body. If you like your beers on the dry side, adding some adjunct will do this for you. If you like full-bodied beers, avoid adding adjunct.

Some adjuncts require special techniques to use. Corn grits or rice require a cereal mash, for example. Other adjuncts can just be stirred into the mash or kettle. Knowing how to use different forms of adjunct can lead you to experiment with unusual ingredients. For example, I've made several beers using potatoes and sweet potatoes as adjunct.

For my copper ale, I wanted a moderate-bodied ale. To get there, I didn't use any adjunct in the recipe and used my technique (low mashing temperature) to get the amount of body I was looking for.

> . . . sometimes an ingredient with an aggressive edge to it can keep a beer from being too boring.

The amount of body you end up with in your beer depends both on the ingredients and your techniques. Sometimes, the two can be at cross purposes. You may, for example, wish to brew a beer with a decent amount of crystal malt flavor, but with a dry finish. In this case, you would either have to adjust your mash schedule to favor fermentability or add a little adjunct to the recipe (or both).

If I were to make a "summer" version of the copper ale, I could scale back on the Munich, Victory and chocolate malts slightly, and add some flaked maize to the recipe (about 10–20%).

## COMPLEXITY VS. SIMPLICITY

Once you've decided on which base grains (or malt extracts), specialty grains and adjuncts will be in your ingredient list, it's a good time to pause and think about complexity and simplicity in the recipe. A common rookie mistake in formulating a beer recipe is to throw every grain imaginable into a recipe.

Complexity in a beer can be great if it's done well. If all the flavors and aromas of a complex brew work together to produce a unified and harmonious drinking experience, the beer "works." On the other hand, a beer with too many "random" ingredients can easily end up being a muddled mess.

On the other other hand, a relatively simple beer — one that mainly relies on the interplay of only a couple ingredients — can also be great. (And, when you think of it, how many all-time classic beers are formulated along very simple lines? Most of them, by my reckoning.) However, there's also a fine line between an elegantly simple beer and one that is just boring.

One way to think about complexity and simplicity is to mentally take or add ingredients from your list and think about what that would do for your beer. If you have a long list of malts, pick one malt and think about what would happen if you got rid of it. Did the beer get better of worse? See how many ingredients you can get rid of and still be in the ballpark of what you were shooting for.

If you've formulated a simple beer, try the opposite. Think about what malts are commonly added to a similar beer and see if there is something you could add to improve the beer. See how many ingredients you can load the beer up with before you stray from your goal.

If you go through a recipe mentally taking away and adding malts, you should be able to hit a nice balance between complexity and simplicity. Of course, the other ingredients in your beer will also play a role.

Another potential rookie mistake in recipe formulation is to search for a unique or unusual ingredient to set your beer apart. If you are trying to brew a known style of beer and are looking for an unusual ingredient to make it stand out in a crowd, be aware that this approach usually backfires. Most established beer styles taste good because their flavors work well together. A new ingredient is more likely to clash than to blend with the original set of ingredients.

This is not to say that this approach never works — see this issue's "Tips from the Pros" column for how a couple breweries spiced up their pale ales with a hint of rye — just that you should think hard before trying this. In my opinion, when brewing an established beer style, brewing the beer well will set it apart in a much more positive way than tacking on a "random" ingredient.

One final point to consider is the use of wheat malt or CaraPils® malt in a recipe. Some brewers add one or both of these to every recipe they brew as a matter of course. A small amount of wheat malt is supposed to make for better foam and a small amount of CaraPils® is added to boost the body.

If you brew your beer correctly, you shouldn't need to add wheat to help out your head. Likewise, in an all-malt beer, you should be able to adjust your mash schedule to hit the proper amount of body. (On the other hand, if you need to offset some loss of body in a beer that

contains adjuncts, then by all means add some CaraPils®.)

Adding wheat or CaraPils® dilutes the "primary" flavors in your recipe and adds a small amount of wheat or CaraPils® flavor — which may or may not be appropriate, depending on the beer. Don't use these malts as a crutch. If you are having trouble with foam or body in your beer, fix the problem by addressing the flaws in your technique.

Once your malt bill is set, it's time to think about hops.

## HOPS

In one respect, choosing which hops to use in a recipe is a lot simpler than choosing your grain bill. The overall amount of variation in flavor in hops is much less than in grains. (The difference between Saaz hops and Amarillo hops, for example, is less than the difference between Pilsner malt and black patent.)

On the other hand, hops are used in a wider variety of ways. Hops can be added before the boil (first wort hopping), at the beginning of the boil (for bittering), near the middle (for flavor) or near the end (for aroma). They can also be added after the boil (in the whirlpool), via a hopjack, in the fermenter or keg (dry hopping) or immediately before the tap, as in an "organoleptic hops transducer."

When choosing hop varieties for established beer styles, review existing recipes and remember that, in general, classic beer styles are hopped with varieties from their country of origin. (In other words, English beer uses English hops. German beers use German hops and so on.) When selecting a hop variety for my copper ale, I picked Northern Brewer because I like their slightly minty character.

When discussing the interplay of hops and malt in a beer, the word that gets used most often is "balance." In brewing, balance does not necessarily mean that the malt and hop character are equally prominent. Beer can be weighted towards malt or hops and still said to be balanced. A balanced beer is one that either has enough malt to complement the hops or enough hops to complement the malt or somewhere in between. For my copper ale, I wanted the malt and hops to contribute roughly equally to the character of beer, so I shot for an IBU level that — for me — was fairly moderate.

Balance can also apply to every element of the beer. The malt, hops, overall flavor intensity, body, sweetness, carbonation and other characters should all complement each other. Getting into balance for most recipes will involve using existing recipes (or your own knowledge of the ingredients) to get fairly close to your target on the first brewing. Then, your tasting notes will be used to tweak the beer closer to the target — hopefully into the "bullseye."

One final note on choosing hops: one measure of a hop's character is its cohumulone content. Cohumulone is one of the three forms of alpha acids found in hops. Hops with high percentage of cohumulone are often said to yield a

"harsh" bitterness, compared to low cohumulone varieties. As with the case of very dark, "burnt" malts, the word "harsh" does not really do justice to high cohumulone hops. Hops with lots of cohumulone do have a biting, aggressive bitterness, but this isn't always a bad thing. In big, aggressively-hopped beers, a little cohumulone bite can keep the beer from being "flabby." In a beer where the hop character should be mellow or "rounded," avoiding high cohumulone hops makes sense.

## SPICES AND FRUITS

When winter rolls around, many homebrewers think about brewing a spiced beer. One common problem with spiced homebrews is too many spices in the mix. When making a spiced beer, you don't need to empty the spice cabinet into your kettle. A single spice beer — made from fresh, beer-friendly spice — is much better than a spiced beer with a crowd of clashing spices. If you want to make a multi-spiced beer, a good place to look for established spice blends is a cookbook. Of course, it also pays to think about what flavors your beer has — biscuit? caramel? chocolate? roast? — and match the spice (or spice blend) to it. When spring rolls around, and the keg of winter warmer kicks, many homebrewers think about brewing a fruit beer. When it comes to fruit beers, however, many homebrewers seem stuck in the single fruit mode. Although a single fruit beer can be great, consider that many berries blend together well and there are plenty of established fruit combinations (many of which can be found in mead recipes) that work well together. As with spices, getting the fruit to work with some character in the beer is what you want.

## YEAST

Last, but certainly not least, comes your choice of yeast. All the ingredients so far have been chosen to make your wort. The addition of yeast will make the beer. As with the malt and hops, existing recipes — or your own knowledge of different strains — can lead you to your initial yeast choice. After your intial brewing, you will need to decide whether to stay with your initial strain, or switch to a new one. Keep in mind that you can ferment with more than one yeast strain, although the results can be unpredictable.

Once you've settled on an ingredient list, enter the ingredients into your recipe calculator. I like to type in my expected amounts of specialty grains first, then bring the beer up to my target OG with base malt or extract. Likewise, I'll enter late-boil hop additions first, then bring the beer up to my target IBU value with bittering hops. Once all the ingredients are input, a quick check of all the calculated statistics will tell you if you're on the right track. (For contest beers, compare your beer to the BJCP style guidelines.)

Most importantly, you can't tweak your beer until you brew it — so fire up those burners and get your own personal recipe brewed!

# Malt Your Own

## Make an essential brewing ingredient yourself

story and photos by Jon Stika

Although this column is typically devoted to techniques for making beer, this time we're taking a step back and looking at making one of beer's essential ingredients, the malt itself. Malt is simply barley that has been sprouted to the point where enzymes are produced that will convert its starchy interior to sugar. If a barley seed is carefully halted in its quest to grow, the result will be a starch-packed kernel with enzymes at the ready for mashing. Additionally, the kilning (heating) that occurs during malting develops color and flavor in the husks.

There are four basic steps to making malt: steeping, germination, drying and kilning. Now before you think this process is too difficult or complicated to do yourself, the only really specialized piece of equipment you may find particularly helpful is a food dehydrator. With a little planning and a few minutes of work a day for several days, a home malt-works is in the reach of most homebrewers.

From a practical standpoint, I make malt in 4.0 lb. (1.8 kg) batches because that's how much grain fits on the big roasting pans and racks of the food dehydrator that I use. How many pounds you produce at a time will depend on the capacity of your set-up.

While malt could be made from practically any variety of barley (or any number of different starchy grains), there are several varieties that have been bred for making quality brewing malt. Some major malting varieties of barley grown here in the U.S. include six-row types: Drummond, Excel, Robust, Stander, Foster, Lacey, Legacy, Tradition and Stellar, and two-row types: Conlon, Harrington, Merit, AC Metcalfe and B1202. The designation of six-row and two-row comes from the habit of how the florets are arranged on the pedicel, creating the appearance of six-rows or two-rows of seeds in each head. Barley seed can be ordered from Howe Seeds (www.howeseeds.com), Johnny's Selected Seeds (www.johnnyseeds.com), or if you live in an agricultural part of the country, ask your local county extension agent for sources. Purchasing seed retail can be expensive, but if you have a place to grow your own barley, a pound (0.45 kg) of seed can produce about 30 lbs. (14 kg) of grain for malting.

### Steeping

The first step in malting is steeping. In this stage, the moisture content of the barley is increased from the 12–13% moisture present in barley seed to the 42–46% required for germination to proceed. Steeping has two components, wet steeping and air rests.

Since the barley kernels being malted are alive and respiring, they need air. Therefore, too long of a steep and the seeds will drown and die. Too short of a steep and the seeds will not take on enough water to successfully sprout.

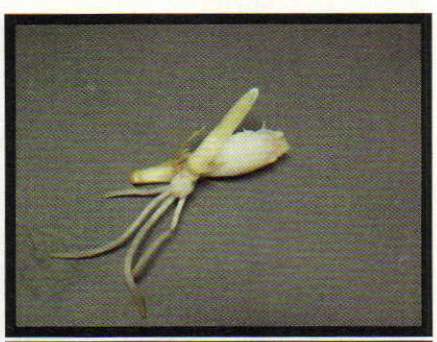
For the initial wet steep, the barley should be steeped in cool (50–60 °F/10–15 °C), hard (or at least not softened) water for about eight hours, but no more than sixteen hours unless vigorous aeration is supplied. If you have an aquarium aerator or a trickle of water running to replenish oxygen, this will help supply oxygen to the kernels during the steeping period. I just use an ordinary 3 to 5 gallon (11–19 L) plastic pail.

After a period of steeping, excess water should be drained off and the grain allowed to rest for eight to ten hours in a cool (50–70 °F/10–21°C) place. The initial steeping water will carry away dirt from the outside of the barley kernel as well as dissolved husk components that would yield unpleasant flavors in your beer. This step is called an air rest. After the resting period, the barley needs to be steeped again for another eight hours. After the second steep, the water is drained off and the moisture content checked to make sure the barley has taken on an appropriate amount of water. After being properly steeped, the barley should contain about 42–46% moisture by weight. Shoot

STEEPING BARLEY IN WATER WITH AERATION.

STEEPED BARLEY BEGINNING TO SPROUT.

STIR MALT TO KEEP IT LOOSE AND AERATED.

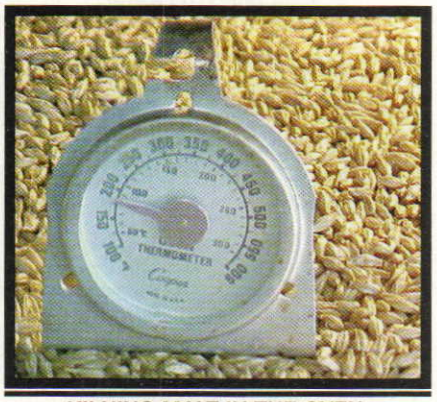


FULLY MODIFIED MALT WITH HUSK PEELED.

RAW MALT IN THE FOOD DEHYDRATOR.

DRIED MALT WITH ROOTLETS STILL INTACT.

SIEVING TO REMOTE ROOTLETS FROM DRY MALT.



KILNING MALT IN THE OVEN.

for the lower end of the range if you are trying to make a pale base malt, such as Pilsner malt. For a darker malt, like Munich malt, aim for the high end of the moisture range.

I aim for 45% moisture. This translates to 20 oz. (0.58 g) of wet barley for each pound (0.45 kg) of "dry" barley (12 % moisture) used at the start. I weigh out 4.0 lb. (1.8 kg) of barley seed before steeping. Then after steeping, I can check to see that it weighs about 5.1 lbs. (2.3 kg) to be sure it has taken on the proper amount of water. If the barley has imbibed the necessary amount of water, it will begin to sprout (or chit, in maltster lingo) and begin the process of germination.

In most modern malting plants, the duration of wet steeps are shorter (4–6 hours) and more water changes and air rests are employed. The above method, however, which is based on more traditional English malting methods, works well at home.

If you are malting sorghum for a gluten-free beer, your steeping temperature should be significantly higher (80–86 °F/27-30 °C). Use several short (4–6 hour) wet steeps, with air rests in between, until the moisture percentage reaches 52–58%.

## Germination

During the second stage of malting, germination, the roots and shoot emerge from the kernel. Inside the kernel, the production of enzymes proceeds and the hard interior endosperm of the grain is broken down. The degree to which this is accomplished is called modification. Properly modified barley will have undergone changes to also modify the gums and proteins in the kernel. Good malt should have the enzymatic power to be able to convert not only the starch from its own kernels, but also that of other adjuncts in the mash.

Once steeping is complete, the germinated grains need to be spread out and allowed to sprout. Sprouting grain is obviously very much alive, and as such undergoes respiration, which produces heat. The sprouting grain must be kept cool and moist, but not wet and cold. Grain that is too wet and warm may encourage the growth of mold. Grain that is too dry or cold may not continue to sprout properly. If sprouting barley is kept moist and cool (55–64 °F/13–18 °C) the modification process should proceed smoothly. You can let the temperature rise up to 71 °F (22 °C) towards the end of the germination step. For darker malts, your germination temperature can be slightly higher — 73–77 °F (23–25 °C.)

Uniformity of modification is the goal during germination. All the barley should sprout and modify at the same pace so when the time comes to end the germination phase, every kernel will be properly modified. In order to achieve uniformity, it is necessary to turn the malt at least twice daily. Turning the malt by hand — using your fingers to untangle the rootlets — will make sure that as the grain is misted with water it is all moistened the same. Turning also allows heat to be dissipated, keeping all the grain at the same temperature.

A small-scale approach to the germination process is to lay the steeped grain about ¼ in. (1.9 cm) deep over a single layer of paper towels on shallow roasting pans or cookie sheets. The pans can then be slid into plastic trash bags and the end folded under the pan to hold in moisture. When the grain needs to be turned, the pan can be removed from the bag, the grain turned and moistened with a little spray bottle filled with water. Then the pan of grain is returned to the bag again to continue sprouting.

Each time the grain is turned and moistened, it should be carefully inspected to monitor its progress. The shoot or acrospire will grow underneath the husk starting from the root-end of each grain (where the rootlets will begin to emerge and grow). The shoot is the part of the sprout that will become the above-ground part of the barley plant. The growing shoot is not easily observed under the husk. To monitor shoot development, take a kernel and cut it open with a razor-sharp blade. This will expose the shoot to determine its progress.

The sprouting process will usually take 3–5 days from when the steeped barley was spread out after steeping. Modification is complete when the shoot is almost the full length of the kernel of grain. By the time the first white shoot tips poke out of the husk, most of the

remaining kernels should be fully modified. By this stage, there will also be 4 or 5 rootlets of various lengths protruding from the other end of the kernel. For darker malts, germination is allowed to proceed slightly farther than for malts destined to become pale malts.

If you are making sorghum malt, germination needs to proceed to the point that the shoots extend about 1.5–2 kernel lengths to ensure that adequate enzymatic power is developed.

A simple test for modification can be performed by biting a few kernels to see if they are crumbly inside. The modification process typically proceeds from the base of the kernel where the roots appear, and works toward the tip. To test for modification, put a kernel between your incisor teeth and bite down starting at the root end and working your way to the tip. The modified portion of the kernel will give way and be crumbly. Any unmodified part of the kernel will still be hard and "steely," and resist being crushed by your teeth.

### Drying and Kilning

Once the malt is fully modified, it is dried immediately and then cured at high temperatures. These are the final two steps of malting — drying and kilning.

Drying stops the sprouting process at the point where the endosperm has been converted to starch granules and the enzymes to convert starch to sugar have been produced.

Initial drying must be done with care. If the malt is dried at too high a temperature, the enzymes may be denatured (inactivated). Moist malted barley (called green malt) fresh from modification should be dried at temperatures less than 125 °F (52 °C) until it has dried down to 10–12% moisture or less. Below this level, the malt can be dried at higher temperature without affecting the enzymes.

With this in mind, it is most practical to dry malt at a temperature of 100–125 °F (38–52°C) in a food dehydrator or some similar arrangement where a good air flow and proper temperature control can be maintained. At 10% moisture, the malt should weigh about 0.5 oz. (14 g) less per pound (0.45 kg) than your starting weight. After 10% moisture is reached, the temperature should be

increased to 140–160 °F (60–71 °C) until the malt is at or below 6% moisture — 3–5% is the target for most malts. This will be a little less than 13 oz. (376 g) for each original pound (0.45 kg) of seed barley. There are various types of electronic grain moisture testing meters, but they are fairly expensive ($200 to $2,000), so unless you know a farmer or grain elevator manager you can borrow one from, you'll just have to weigh your malt and do the math. The entire drying process typically takes six to eight hours in a food dehydrator. After the malt is dried, it should be sieved to remove the dried rootlets, which may cause problems during kilning, storage, or milling.

Kilning (roasting) the dried malt develops the final desired character and flavor. Unkilned malt will produce a "green" tasting wort and resulting beer. To produce standard pale malt, the dried malt should be kilned for three to five hours at 176–185 °F (80–85 °C). This can typically be achieved in your home oven with an inexpensive oven thermometer.

However, as we all know, there are a wide variety of brewing malts available in many different colors and flavors. Malt can be kilned at temperatures between 220–400 °F (104–204 °C) for various periods of time to produce darker or more aromatic malts. For example, try 220 °F (105 °C) for 4 hours for a Munich-style malt. Any malt kilned at temperatures over 194 °F (90 °C) will develop melanoidins, the "malty" flavor found in Munich and other dark malts. During the kilning process, occasional stirring will result in a more uniform final product. More highly kilned malts will have little or no enzymatic power.

Crystal malt is produced by "stewing," rather than kilning, green malt. This approach is simply mashing within the kernel, by heating the green malt to mashing temperatures without letting it dry. Crystal malt can be produced by putting green malt in a covered dish and holding it between 150–170 °F (66–77 °C) for a couple hours then spreading it out on an open pan at 250 °F (121 °C) until it achieves the desired color. The longer it kilns, the darker and more caramelized the sugars will become.

After malt has been kilned sufficiently, the malt should be allowed to cool to room temperature then stored in a cool, dry place in a closed container. With some basic equipment and a little care, producing malt is within reach of any homebrewer who would like to add the technique of malt-making to their repertoire, and homemade malt to their next batch of homebrew.

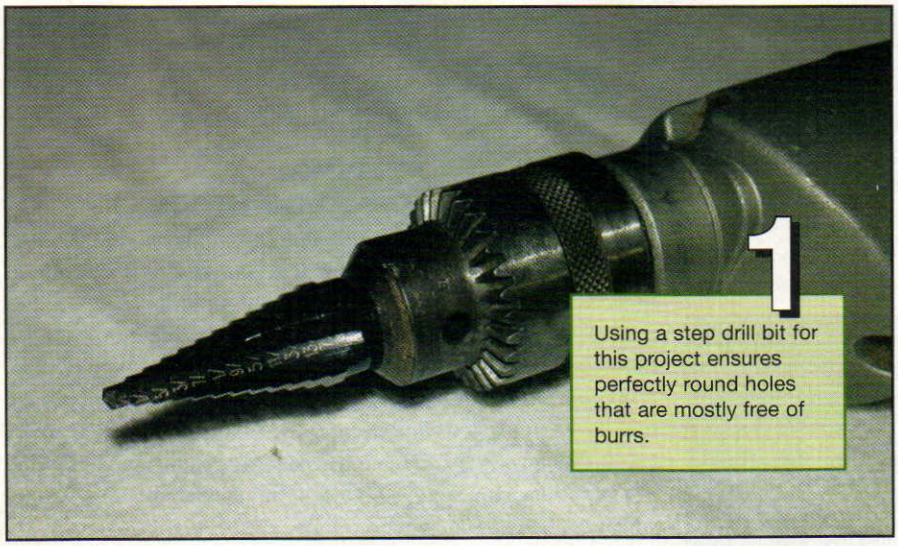
Finally, there is one possible health and safety issue associated with malting your own grain. If your malting grain is infected with *Fusarium* mold, it will produce beer that may be unhealthy to drink. Fortunately, affected beer will also gush when opened, so you will know if you need to discard it. If you buy your grain, rather than grow it yourself, ask if it has been tested for *Fusarium*.

*Jon Stika is* Brew Your Own's *new "Techniques" columnist.*

# The Thrill of the Drill

## Convert your brew pot to a brew kettle

Story and photos by Forrest Whitesides



1 Using a step drill bit for this project ensures perfectly round holes that are mostly free of burrs.

Modifying an existing aluminum or stainless kettle by adding a valve, thermometer, and hop/trub straining screen is not so difficult, and it's cheaper than buying a new kettle with the upgrades included. Just imagine feeding your counterflow chiller by simply opening a valve. No more siphoning boiling wort!

Use a step drill bit for this project, although a hole saw (for the ⅞-inch hole) and ½-inch twist bit will suffice. The step drill (Fig. 1) will be easier to use and makes perfectly round, clean holes that are mostly free of burrs.

### PARTS

For this project, we'll be using weldless kettle fittings. This means we're going to need to drill some holes in the kettle. Drilling metal doesn't have to difficult ... if you have a few essential tools. Here's what you'll need:

- Drill — a corded drill or a 14.4-V cordless drill
- Bits — ⅞-inch step drill bit (Fig. 1) and a ¾₆-inch twist bit
- Lube — cutting oil or other lubricant like 3-in-1 Oil for drilling stainless, or liquid dish soap for drilling aluminum
- Metal file
- Adjustable wrench
- Teflon pipe tape

### WELDLESS FITTINGS

The drilling can be difficult, but the fittings are very easy to install. You'll need the following:

* Zymico Weldless Kettle Conversion Kit — there are several models available and all will work for this project
* Blichmann Weldless Brewmometer
* Zymico Bazooka Screen

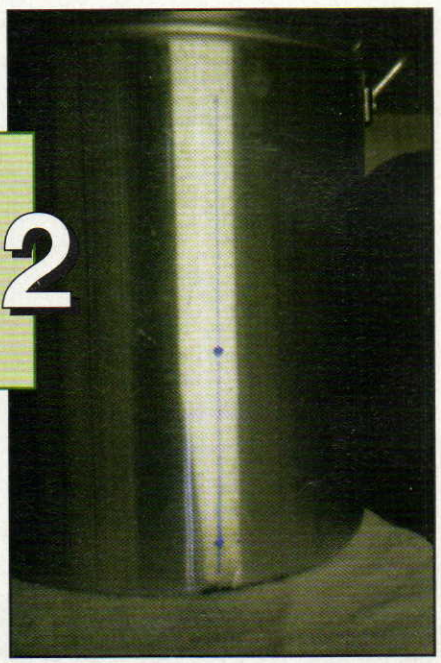
### MEASURE TWICE, DRILL ONCE

To have the valve and thermometer face 90 degrees from the handles, use a tape measure to find the distance between the kettle's two handles, divide by 2 to find the half-way point, and mark it with a Sharpie or grease pencil. Draw a line from the mark down to the bottom of the kettle.

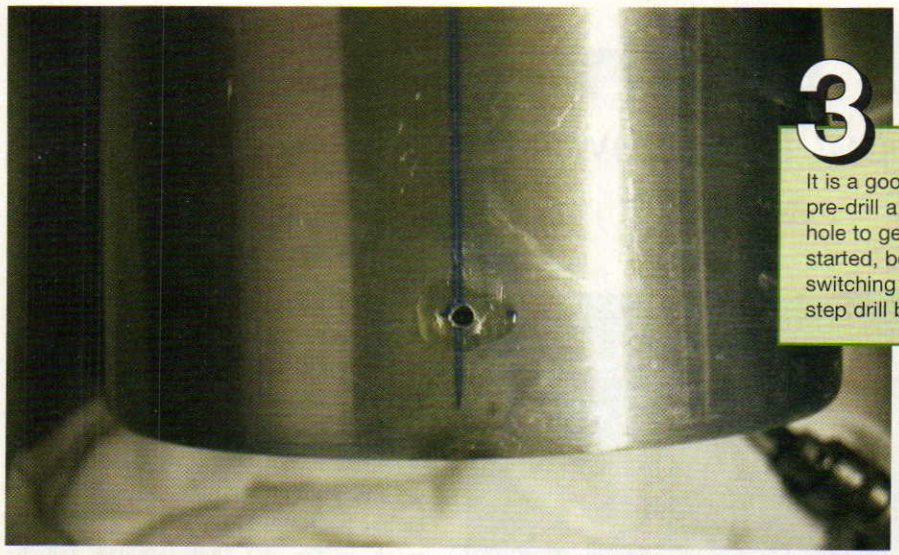
Make one mark on the line about 1.5 in. (3.8 cm) up from the bottom of the kettle and another about 7 in. (18 cm) or higher from the bottom (Fig. 2). The top mark is for the thermometer, which, according to the manufacturer, should be at least 6 in. (15 cm) from the kettle bottom to protect it from the heat of propane burners.

### DRILLING: ALUMINUM

For aluminum, the easier of the two materials to work with (by far), common dish detergent is an excellent drill lubricant. Apply a small amount to the areas on the kettles marked for drilling. Also rub some detergent on the drill bits for good measure. It's a good idea to pre-drill a small pilot hole to get things started (Fig. 3). The smallest hole size on the ⅞-inch step drill is ¾₆ inch, so begin here for the pilot hole. Drill a pilot hole on both marks.



2 Find the kettle center point and draw a line top to bottom. Make two drilling marks — one for the thermometer and one for the spigot.



3

It is a good idea to pre-drill a small hole to get things started, before switching to the step drill bit.

Next, use the step drill to widen the pilot holes to their proper sizes. The bottom hole for the valve should be ⅞ inch (Fig. 4). The top hole for the thermometer should be ½ inch, which is the fifth step on the step drill. Keep drilling until you feel the bit drop down five times. It's a good idea to check the diameter of the hole every couple of steps to make sure the hole doesn't get too big — there are no do-overs.

## DRILLING: STAINLESS STEEL

The general toughness of stainless steel makes it a superior material for a brew kettle. This also makes it difficult to drill. As with aluminum, lubricant is needed to facilitate the drilling process. In this case, use either a commercial cutting oil or something like 3-in-1 oil. It is critical not to get the metal too hot. If it gets too hot, the steel hardens and becomes virtually impossible to drill. Use the oil liberally, and reapply as necessary during the drilling process. When you see the oil evaporate in a small puff of white smoke it's time to apply more.

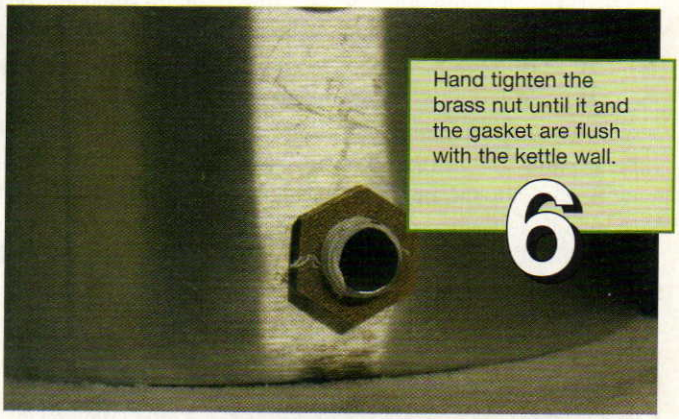
Keep the drill on medium or low speed and use lots of pressure. This, along with the lubricant, will help keep the steel at

Use the step drill to widen the pilot holes to their appropriate sizes.

4

Once the holes are the right sizes, use a metal file to smooth the edges.

5



Hand tighten the brass nut until it and the gasket are flush with the kettle wall.

6

Apply some Teflon tape to the exposed threads and screw in the ball valve.

7


8 The dial is already marked with several important brewing temps.

low temperature while drilling. Because stainless steel is so hard, start out with a really small pilot hole (1/16-inch or 1/8-inch) and work it up to 3/16-inch. Be aware that small-diameter bits will easily break under the pressure needed to drill through stainless steel. Go slow.

Once the pilot holes are 3/16-inch, lube up the step drill and start drilling. Again, use a medium speed and lots of pressure. Follow the same procedure as above for widening the pilot holes.

From here on out, the project steps are the same for either aluminum or stainless steel.

## SMOOTH OPERATOR

Once both holes are the appropriate sizes (Fig. 5), use a metal file to smooth the edges and remove any sharp burrs. A Dremel Tool with the appropriate metal grinding bit also works well. The holes should be smooth inside and out to prevent burrs from damaging the rubber gaskets used in the weldless fittings. Wash the kettle inside and out to remove any lubricant.

## INSTALLING THE BALL VALVE

Remove the brass nut and rubber gasket from the weldless bulkhead fitting. (Note: the bulkhead comes with two rubber gaskets, but only one is used in installation — the other's a spare). From the inside, put the bulkhead's threaded pipe nipple through the bottom hole. The metal washer should be on the inside. On the outside push the rubber gasket over the pipe nipple and then hand-tighten the brass nut until both it and the gasket are flush with the exterior kettle wall (Fig. 6). Be sure that the milled-out side of the nut faces the gasket. Use an adjustable wrench to hold the nut steady and hand-tighten from the inside. Over-tightening can damage the gasket. Apply some Teflon pipe tape to the exposed threads on the outside and screw in the ball valve (Fig. 7).

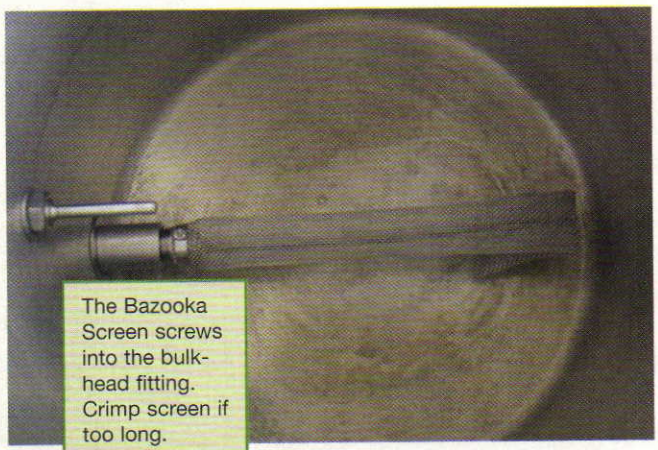
## INSTALLING THE THERMOMETER

First, calibrate the thermometer following the manufacturer's instructions. The Blichmann Brewmometer dial reads from 60–220 °F (16–104 °C) with several important brewing temperatures marked, making it ideal for use for both boiling wort and mashing and sparging grain (Fig. 8).

After calibrating, loosen and remove the thermometer nut. From the outside, put the thermometer stem through the hole. Make sure that the rubber o-ring is seated flush against the kettle wall, followed by the metal washer. Hand-tighten the nut on the inside of the kettle. Use an adjustable wrench on both sides of the thermometer simultaneously to tighten the fitting. Do not turn the dial to tighten. Over-tightening can damage the rubber o-ring.

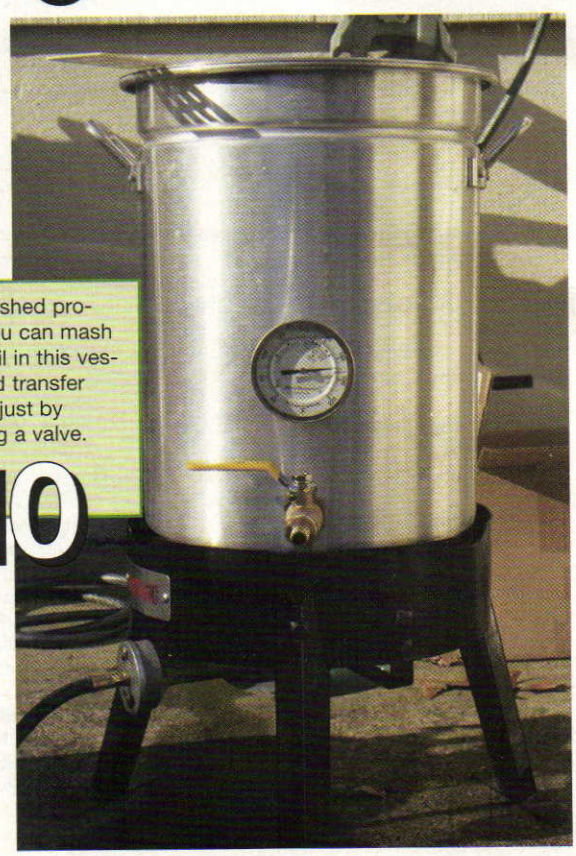
Finally, the Bazooka Screen screws simply into the bulkhead fitting. If the screen is too long, the end can be crimped (Fig. 9).

*Forrest Whitesides write the "Projects" column in every issue of* Brew Your Own.



The Bazooka Screen screws into the bulkhead fitting. Crimp screen if too long.

9



The finished project. You can mash and boil in this vessel, and transfer liquids just by opening a valve.

10

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### Brew Infuser

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### BrewDome Fermenter

Toledo Metal Spinning has recently released its stainless steel BrewDome fermenter. The BrewDome features a 12-gallon (45 L) capacity with a mirror finish exterior and threadless fittings for easy cleaning. The conical racking port and dump feature Tassalini butterfly valves used extensively by the Italian wine industry, however, ball valves are also available. Visit www.brewdome.com for more information.

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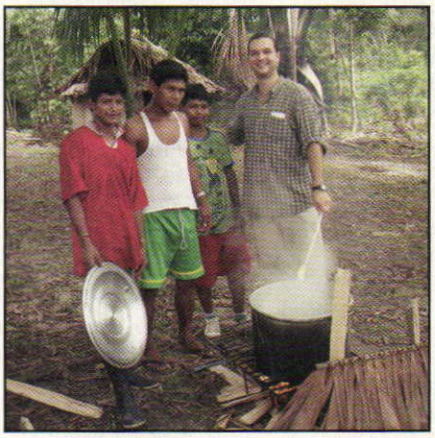
Last Call

# Amazon Ale

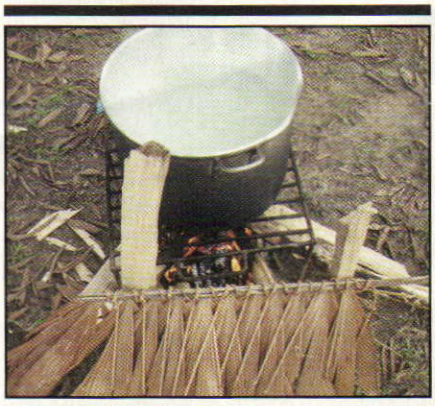
## It takes a village to raise a beer

by Chris Rauschuber • Austin, Texas

"You want to make what???" At first I thought maybe my meager Spanish wasn't good enough to get the point across. It turned out that I did a sufficient job explaining, but it was such a ridiculous thing to do that she couldn't comprehend it. For some reason it didn't seem that strange to me that I was asking a woman in a village in the middle of the Peruvian Amazon if I could hire her sons to build a cooking fire for me so that I could brew beer. After spending a month in the jungle doing volunteer work, it didn't take long before I was trying to think of a way that I could brew beer there. I already had dry malt extract, dry yeast, sanitizer, and hop pellets and could purchase a kettle and plastic bucket in the city of Iquitos before heading upriver to the village. With this plan in mind, I carefully packed up my dry malt extract, hops, sanitizer, thermometer, spoon, airlock, and rubber seal and headed to Iquitos, Peru, the largest city in the world that can only be reached by boat or plane. There I was able to buy a kettle and a large plastic bucket to use as a fermenter. Once in the village, I looked into procuring the brewing necessities: fire and water. The people in the village cook on wood fires, so I was able to hire a couple of kids to make one for me and loan me their metal grate. Water is readily available there, but it has to be retrieved from the well and includes a healthy amount of moss. After hauling up several gallons of water, we got the fire going. While waiting for the water to boil I used a colander to get out as much of the moss as I could. My assistant brewers did a great job on the fire and the water started boiling surprisingly quickly. Once I added the dry malt extract, it started boiling over, so they pulled some wood from the fire and it went down almost immediately. The one hour boil was pretty boring for the people that came around to see what the crazy foreigner was doing. I think they were expecting something more exciting than a pot of brownish-green boiling liquid. The hardest part turned out to be chilling the wort. Unfortunately, I didn't come up with a plan for this beforehand, so I had to simply let it air cool. Cooling the kettle in the river would have been a better solution, but it was too far away from the spot where I was brewing and carrying the kettle that far would have been a risky endeavor. The wort didn't get down to pitching temperature for several hours, so it had to sit out overnight. I put a colander on top of the fermentation vessel to strain out the moss, poured the wort in, and pitched the yeast. Then all I could do was seal it up and hope for the best. The bucket also turned out to be a few gallons too big. A smaller bucket with a tight seal would have probably yielded better results. I cut a hole in the lid of the bucket and put in a rubber seal and an airlock, which turned out to be a mistake. The lid didn't fit tightly enough on the bucket even with the tape I put around the edge and the hole for the airlock didn't seal well. Therefore, I didn't see any airlock activity at all, so I wasn't sure if the yeast were at work or not. And with sanitation being such a challenge in the jungle, opening it to check was completely out of the question. I didn't even take a hydrometer with me since I didn't want to add risk of infection and wasn't concerned about gravity anyway. Luckily the bucket had a spigot at the bottom, so I was able to take a sample without taking off the lid. It didn't taste good, but it did taste fermented, so I knew that things were progressing. I let fermentation go for about two weeks, during which time I was constantly asked how the beer was going. The people there make a fermented drink from yucca, but to them beer is something that comes in bottles. The fact that someone was making it in their village was very interesting, so when I invited everyone over for a tasting they happily accepted. It had a bit of skunkiness to it, but it was certainly the best that I had ever had in the jungle and everyone that tried it seemed quite pleased. I felt that I had accomplished a great feat by merely producing drinkable beer. We sat around outside drinking my homebrew and listening to stories until the rain started, then moved the party indoors. The five gallon batch was gone in just a few hours and I was asked many times when I was going to come back and make beer again. I hope that I will have the opportunity to go back again someday and do just that.



Chris and his "assistant brewers" — Nils, Miguel and Jackson — get a batch boiling in the Peruvian Amazon.



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**Amazon Ale Recipe:**

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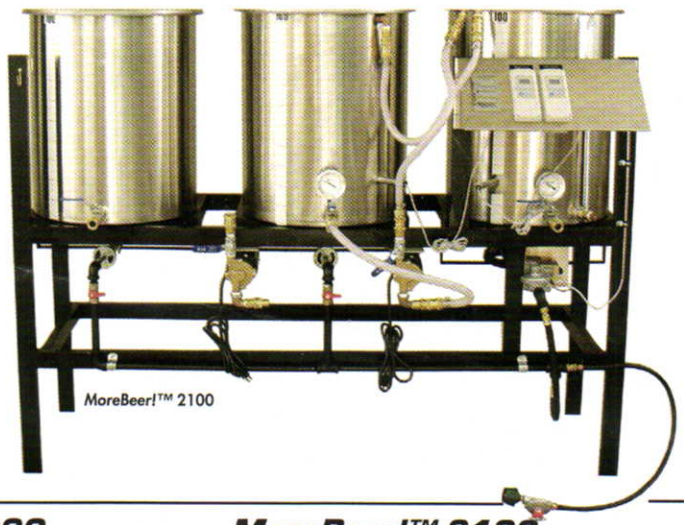

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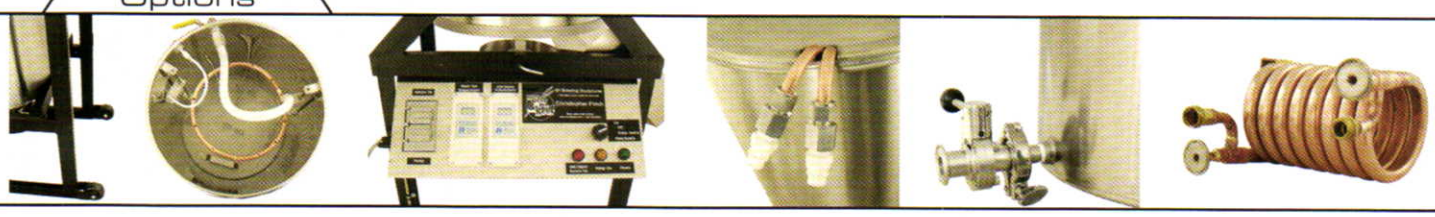

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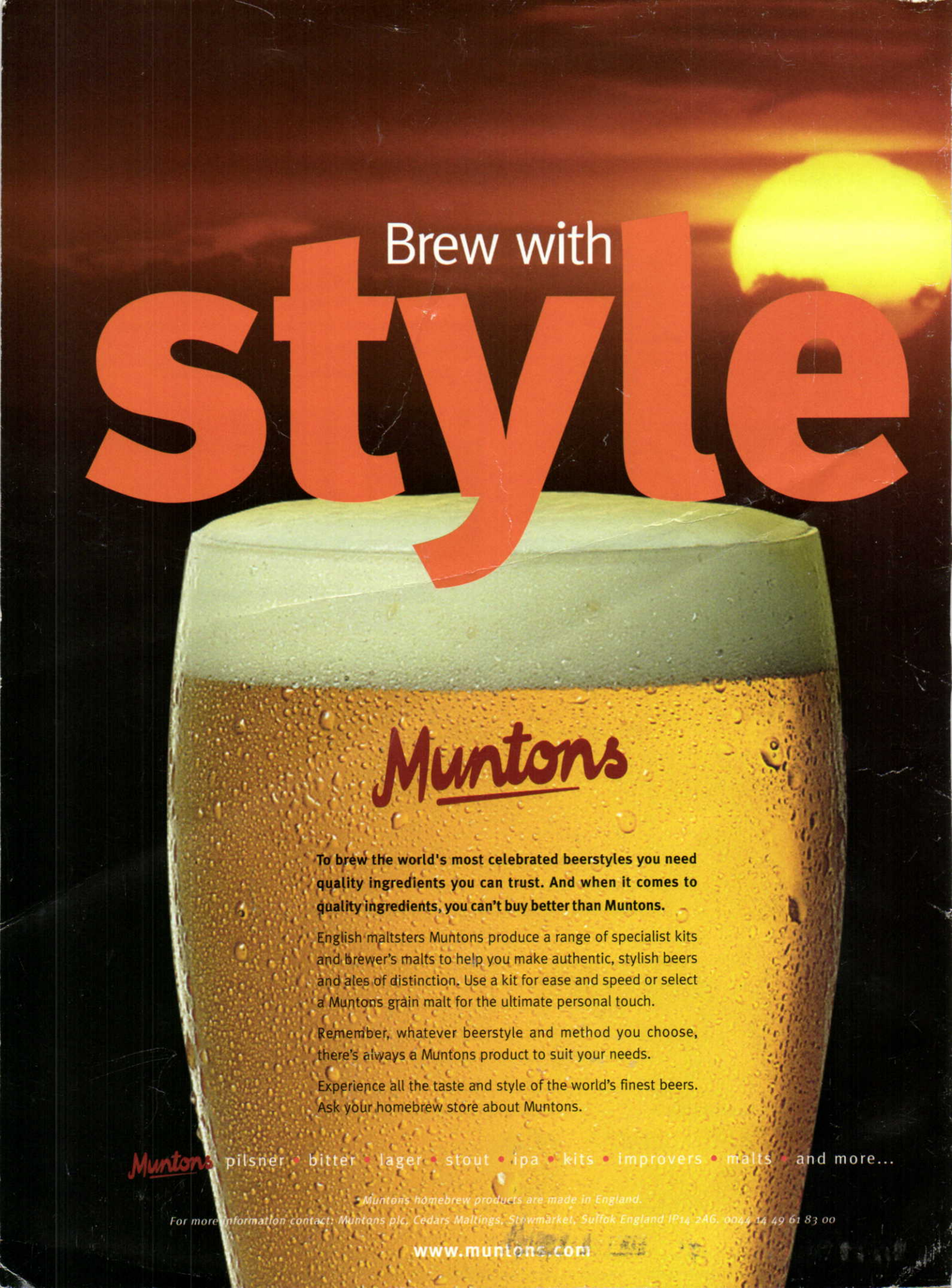
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