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MAY-JUNE 2002, VOL.8, NO.3

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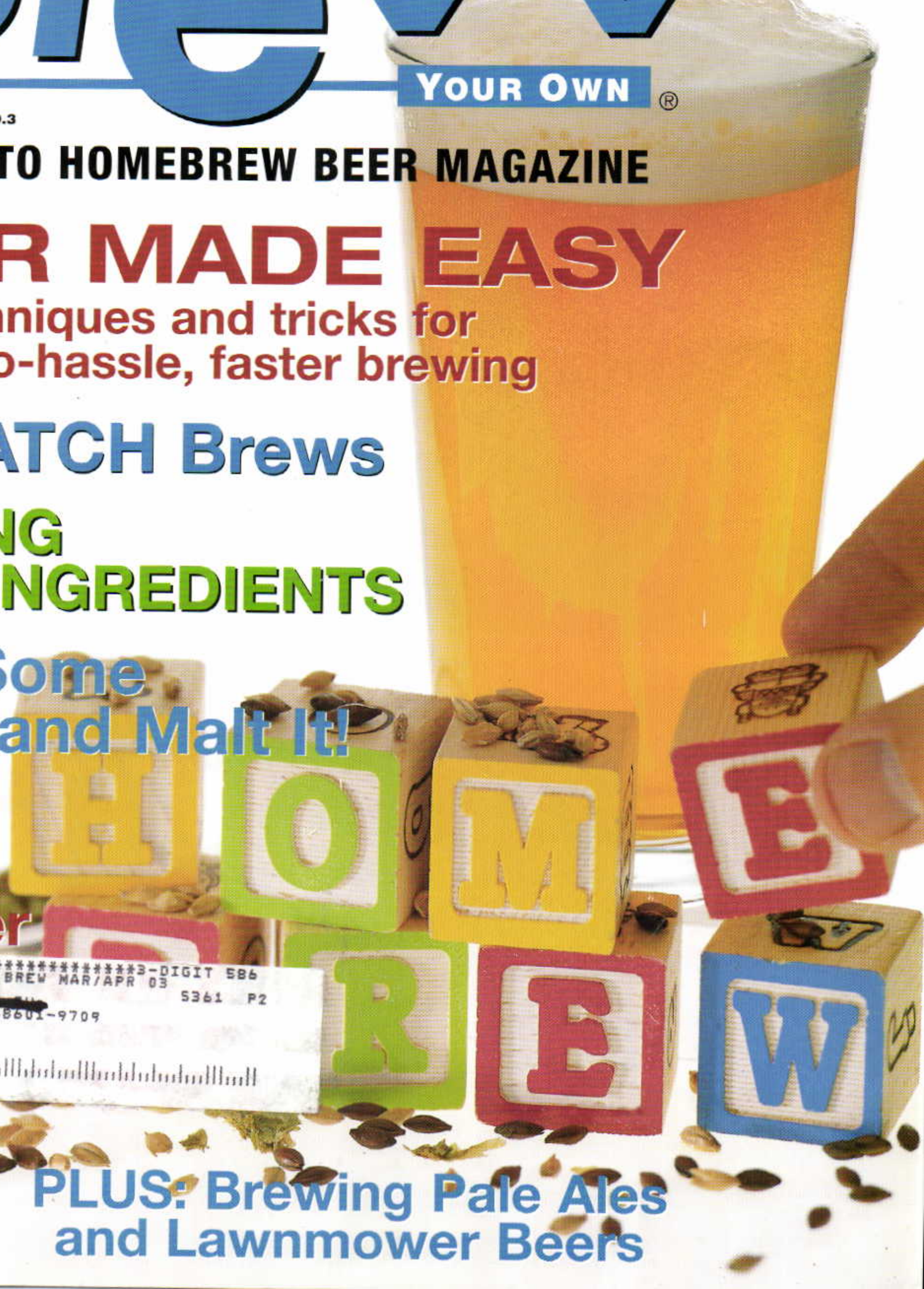

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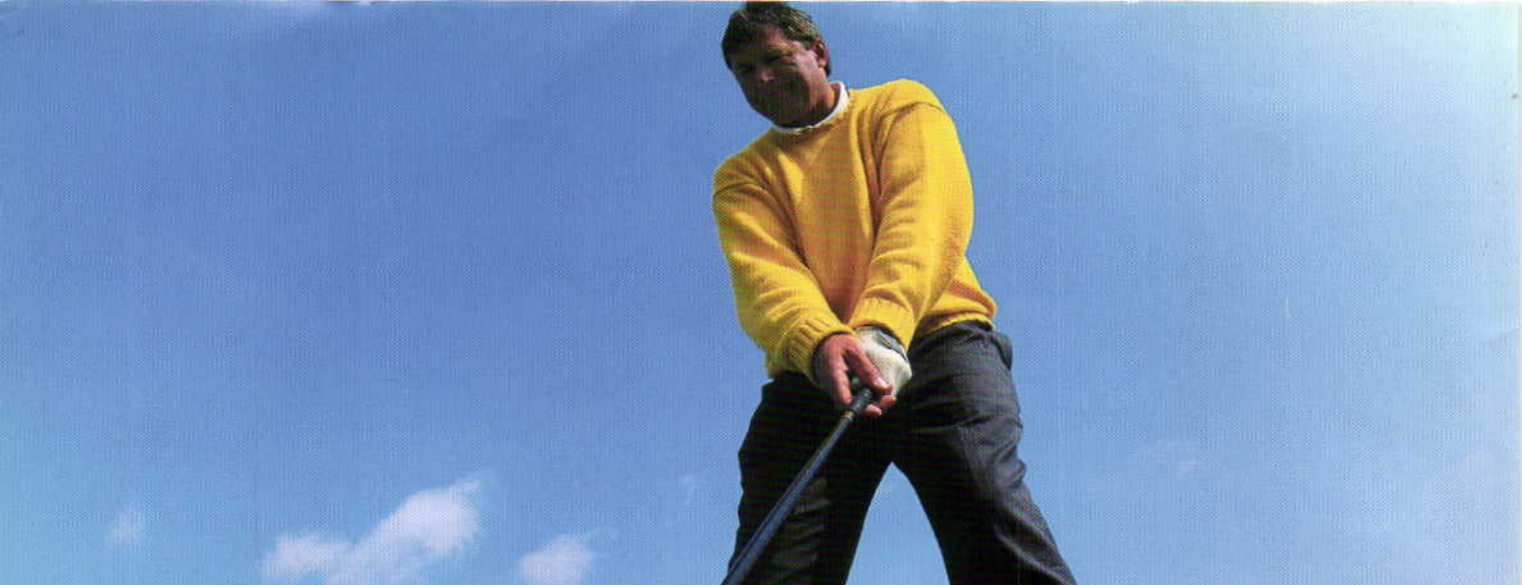

"I wouldn't have believed that a kit beer could be so good"

Roy Bailey - Beer Correspondent
CAMRA's 'What's Brewing' magazine (April 2000)

In Roy Bailey's local Good Beer Guide Pub, the customers' reaction was *"uniformly complimentary"* and *"most of them thought it was a full-mash ale"*

"I'm really impressed! This is better than many pints I've had in the pub"

BBC Radio 4 food & drink programme (July 2000)

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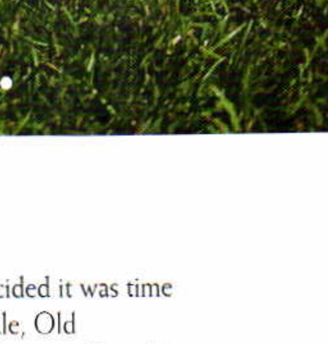

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MAY-JUNE Volume 8 Number 3

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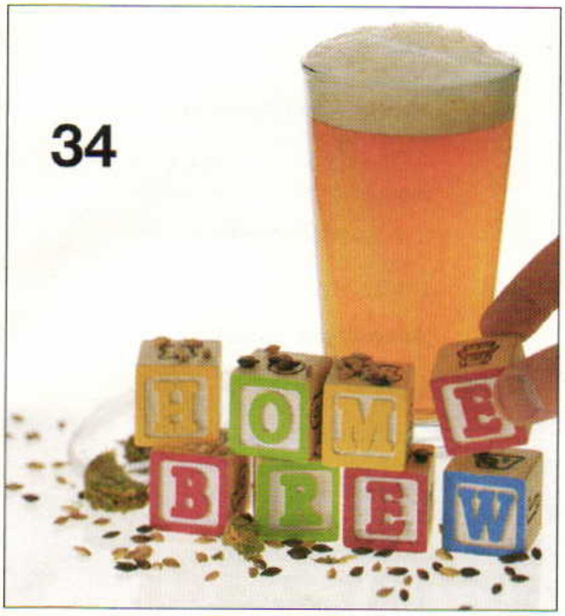

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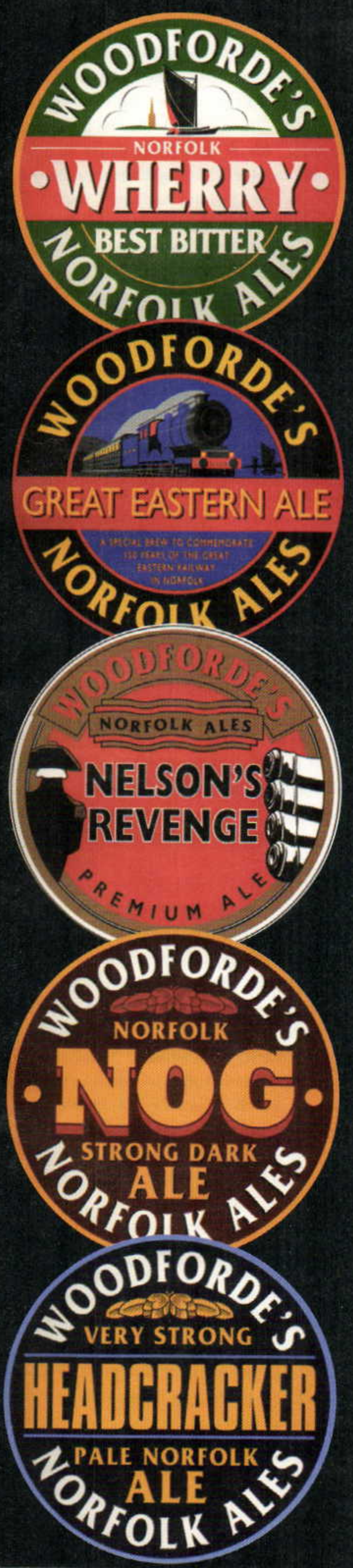

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Contributors

John Palmer is author of "How to Brew." The first edition of this book is available to read on the Internet (for free!) at www.howtobrew.com. A hard copy of the book, updated and revised, was published in 2001. John shares his procedure for no-sparge mashing on page 44.

Homebrew-shop owner Steve Bader writes "The Replicator" column in every issue of BYO. For this issue, he also contributed an article on how to store homebrewing ingredients (page 26) and a selection of easy no-boil recipes (page 37).

Marty Nachel is the author of "Homebrewing for Dummies" and "Beer for Dummies" (IDG Books). In this issue, he gives his insight into how to simplify your brewing procedures. You'd be a dummy not to read his story, which starts on page 34.

Mail

Limit . . . or Goal?

A buddy of mine says that the ATF limits the amount of beer and wine you can make at home for personal use to 200 gallons per year. I say the limit is 300 gallons.

James Arthur
Camden, South Carolina

We checked with the Legal Information Institute (affiliated with the Cornell University Law School) at www.law.cornell.edu. Under Title 26, Section 5053, the federal legal limit is 200 gallons of beer per year for any adult, provided there are at least two adults in the household. A lone adult may produce only 100 gallons of beer per year. Put in perspective, if you made a five-gallon batch of beer 40 out of the 52 weekends in a year, you'd have 200 gallons of beer. If you bottled this beer in 12-ounce bottles, you'd have 2,133 bottles (roughly 89 cases) of beer. You could enjoy roughly 5.8 homebrews per day at that rate, 2.9 if the other adult in your household is drinking beer at the same rate as you. Whether you take this law as an affront to your personal freedoms or a goal to be achieved is up to you.

Avalanche Ale Error

I have had a few customers make the Avalanche Ale recipe in your January-February 2002 issue. The recipe calls for $1/2$ cup of corn sugar for priming and these customers have come back complaining of flat beer. Normally, most recipes call for $3/4$–$7/8$ of a cup. Is this a typo?

Joel Curran
Hayden Lake, Indiana

Yep, it's a typo. It should be $3/4$ cup of corn sugar for priming. BYO regrets the error.

A Fishy Solution

I read "Chill Out! Cool Weather Brewing Tips," by Glenn BurnSilver, in the January-February issue of *Brew Your Own* and thought I'd share a method that I use to keep my fermenter warm. I use an aquarium heater! The heater I use is a Junior Heater. It's a small aquarium heater from WalMart ($7) that's for aquariums two to five gallons and only uses 7.5 watts. There is no temperature control, it's completely submersible and made of plastic. My basement stays at about 58–60° F during the winter and my five-gallon fermenter stays at 68–70° F with no insulation. The temperature stays very stable. If you need more heat, just wrap the fermenter in a hooded sweatshirt or blanket. I haven't tried controlling the unit using a rheostat, so I don't know whether you can get less heat from the heater.

To use this heater, you need to drill a second hole through your stopper and make a slit from the hole to the side of the stopper to insert the cord. The heater needs to be sanitized before use. Place the heater near the bottom of your fermenter or the temperature gets too stratified. (Ignore the water-level mark on the heater; it's for aquariums.) I would recommend using a GFCI outlet whenever you're using electricity in or around water.

Mike Schwartz
Brown Deer, Wisconsin

The Reptilian Remedy

I enjoyed Glenn BurnSilver's article on cold-weather brewing, as I had faced similar problems while living in southeast Alaska from 1998–2000. Purely by chance I found a wonderful heating unit in a Seattle pet store that sold lizards and snakes. The ZooMed Ceramic Heat Emitter unit is rugged, small, rated at 100 or 150 watts, does not put out any hop-degrading visible light and is nearly indestructible. Glenn's idea for using a timer to control the temperature is ingenious, however, I initially used an inexpensive rheostat and later upgraded to a digital thermal controller. Both of these controllers worked flawlessly with the ZooMed unit. I moved to southeast Texas two years ago and now have a different thermal brewing challenge: the temperature of our tap water during summer can reach 90° F!

Bruce Ross
Spring, Texas

Thanks for the tips. It's always interesting to see how homebrewers independently solve brewing problems. If you're new to Texas, your next piece of brewing equipment should be a "pre-chiller." That will solve your hot tap-water problems. (Check out "Make Me Sweat" in the Summer 2001 BYO for other ways to deal with warm-weather brewing. It's available on-line at www.byo.com/feature/13.html.)

RIMS question

In your December 2001 issue, the RIMS article by Thom Cannell was great and I plan on building such a system. My only question is, did he use a five-gallon or 10-gallon cooler? For a standard five-gallon brew is a 10-gallon cooler necessary?

Chip Town
Jackson, New Jersey

Thom used a five-gallon cooler for his project, but you can make either a five or 10-gallon version. You can single-infusion mash approximately 12 pounds of grain in a five-gallon cooler. This is enough to make a five-gallon batch with a specific gravity up to about 1.070, depending on your extract efficiency.

If you perform step-mashes, or brew high-gravity beers, go with a 10-gallon cooler. The only drawback to a larger cooler is slower heating times.

I Call It . . . Mini Mead

In the March-April issue you published a very good article on mead. I've never made mead and was wondering if it is possible to reduce the size of the recipes from five gallons to one or 2.5 gallons. I can do the math but mostly I was wondering if other subtle changes would need to be made.

Ronald Hodges
St. Meinrad, Indiana

You should be able to scale the recipes by size without any secondary considerations.

Kilncoffee Killed

In your November 2000 issue you had a recipe for a Belgian beer called Corsendonk Monk's brown ale. I'm having trouble finding the kilncoffee malt listed in the recipe. One supplier tells me that no one in this country has carried that grain for two or three years. Can you tell me where to get it or a suitable substitute?

Alan Piotrowski
Jacksonville, Florida

Kilncoffee was a malt from DeWolf-Cosyns. DeWolf was bought out by another malting company, and their line recently has been discontinued. There may still be some kilncoffee in stores as it was a slow seller. Kilncoffee was a light chocolate malt (170° L), not a dark crystal like Special B. It was a dry-kilned malt that was then roasted. So chocolate malt (350° L) is an acceptable substitute. To keep the color constant, replace the kilncoffee with 1/2 the amount of chocolate malt. ■

brewer profile

The Kennywood Brewing Co. • Robert R. Heinlein • Crown Point, Indiana

PHOTOS COURTESY OF ROBERT R. HEINLEIN

Robert pours a beer from the fridge at his Kennywood brewery.

In September 1998, the year I turned 40, I received a homebrew kit from my father. At first, I thought brewing would be kind of fun since I had always liked beer. However, I had no idea of the enormity that this hobby would become.

My first homebrewing book started me soaring. It was "Beer for Dummies" by Marty Nachel. I read it cover to cover, then started over. Now — nearly four years later — homebrewing engulfs the greater part of what I once knew as my spare time.

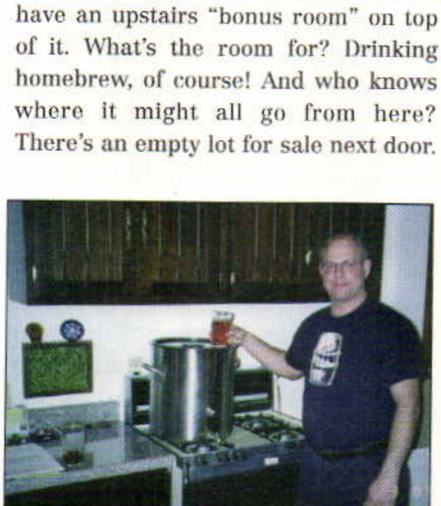
My first brew was a Glenbrew Bavarian Pilsner, a kit beer from the UK. I brewed the beer with somewhat limited equipment and I strictly followed the included instructions. It was fermented in an open pail with only a tea towel for a cover. The day the beer was ready, I arrived home from work and ran straight to the fridge. I decanted it slowly into a Pilsner glass, watching it sparkle. How did it turn so bright and clear? My wife and son looked at me like the cats who ate the canary. I took a taste. The flavor was lame, but it really looked good. Then my son Mike, 14 years old at the time, confessed. He had taken a bottle of O'Douls, poured it into one of my bottles and capped it!

After brewing in the kitchen a couple of years, the wheels started to turn. What if I had an area where everything had its place and everything would be within arm's reach every time I brewed? What if I had an area that I could call my home brewery? Our house is on a hill, so a walkout basement would be the natural choice. But that meant there would be an upper level — what would we do with that? Our house was already big enough. (Or was it? It didn't have a brewery!)

After a year of planning and construction, it was finally complete: In October 2001, the Kennywood Brewing Company was born. Kennywood is named after a deer-hunting camp, which was in turn named after an amusement park. One of the beers I make at Kennywood is my Clermont Scottish Ale. (See the recipe at right.)

Construction didn't go quite as smoothly as it might sound. When the contractor asked me why I was putting an addition on my house, I told him it was going to be my brewery. He didn't think I was serious! Also, the basement had to be smaller than I had planned because the contractors couldn't dig too close to the house. Thanks to a local ornamental ironworker named Fritz, I had a space-saving set of spiral stairs made and installed.

My new brewery is 15' x 18' and I have an upstairs "bonus room" on top of it. What's the room for? Drinking homebrew, of course! And who knows where it might all go from here? There's an empty lot for sale next door.



Robert brews many different beers, but Scottish ales are among his favorites.

reader recipe

Clermont Scottish Ale

(5 gallons, all-grain)
OG = 1.032 FG = 1.008 IBUs = 23

This Scottish beer is named after the Clermont Sportsmen Club, of which I am a member. The club is located in the mountains of Clermont, Pennsylvania.

Robert R. Heinlein

Ingredients

2 lbs. Pilsner malt
5 lbs. pale ale malt
1 lb. flaked wheat
0.5 lb. crystal malt (120° L)
0.5 lb. crystal malt (60° L)
1.5 AAU Tettnang hops
(0.38 oz. of 4% alpha acid)
3.5 AAU Northern Brewer hops
(0.39 oz. of 9% alpha acid)
3 AAU Tettnang hops
(0.75 oz. of 4% alpha acid)
1.5 AAU Tettnang hops
(0.38 oz. of 4% alpha acid)
3/4 tsp Irish moss
Wyeast 1056 (American Ale) yeast
(1000 mL starter at 78° F)

Step by Step

Mash the base grains at 149° F for 90 minutes. Sparge with three gallons of water at 168° F. Add 2.5 gallons water to brew kettle. In separate sparge bags, add the crystal malts. Allow these grains to soak, without applying heat, while you conduct the mash. Remove specialty grains before the wort from the mash is added. Boil the wort for 90 minutes. Add the first Tettnang hops at the beginning of the boil. Add the Northern Brewer hops halfway through the boil. Add the final two additions of Tettnang with 30 and 15 minutes left in the boil, respectively. Primary fermentation lasts for three days at 67° F. Rack beer to secondary for 11 days at 45° F. Keg, carbonate and serve.

homebrew festival

Southern California Homebrewers Festival • Temecula, California

PHOTO COURTESY OF STEPHEN BOHN

A surfboard is made into a portable suds dispenser for this California bash.

Twelve and a half years ago, some southern California brewers got a great idea: Why not have a festival where homebrew clubs could get together, share ideas, share beer and share a good time?

So members from the Maltose Falcons, Barley Bandits, Inland Empire Brewers and three other clubs organized the first Southern California Homebrewers Festival. The first festival was held at the Cilurzo Winery in Temecula, California. Cilurzo Winery was chosen because Vinny Cilurzo, son of the winery's founder and owner, was a wonderful homebrewer and donated the site. (I say "was" since Vinny turned pro several years ago!)

Six clubs participated that first year. The festival attracted 300 participants and three food vendors. There were four featured speakers, including George Fix *(see page 64)* and Fred Eckhart. The Maltose Falcons Jazz Band provided entertainment and homebrew stores gave items to raffle.

That first year established a pattern that has proved very successful. The first Saturday in May each club brings at least 10 batches of homebrew to share at their expense. Paying customers get a tasting glass and a security band. The organizing committee solicits workers from the clubs to give two hours of work in return for free admission, and guest speakers get all their travel and lodging expenses paid.

After five years, the festival outgrew the Cilurzo winery and moved down the road to Lake Skinner, a reservoir and county campground ideally suited for the expanded event. Lake Skinner has ample space for the two huge catering tents, food vendors, 40 porta-potties, and parking. In addition, there are three large campgrounds with hook-ups and showers! Several years ago, a group of brewers from northern California who participate in the festival began their own festival, which occurs in the fall.

This year, the 12th annual Southern California Homebrewers Festival will attract about 1,500 visitors; 26 clubs from four states will serve more than 400 different beers, dispensing two-ounce tastes from booths the clubs have crafted and modified in the last seven years. Some of the booths are designed to look like bars, others resemble tiki huts or the set of M.A.S.H. All of them have interesting beers that the brewers crafted just for the festival. I am a member of the Barley Bandits, and our booth replicates a small, Western saloon, but on the side we serve mead snow cones!

During the course of the festival, a shuttle will run every half hour from the festival grounds to hotels in the city of Temecula, 15 minutes away from Lake Skinner. Some of the participants or their spouses will visit the golf courses, wineries and antique stores in Temecula. But the best feature for many of us is the chance to camp, feast and get together once a year in a safe and supportive environment. Hey — it's beer heaven! (See the Homebrew Calendar sidebar for more information on this year's festival.)

—Sam Piper

homebrew calendar

MAY 4
Zymurgist Borealis National Homebrew Day Celebration
Fairbanks, Alaska

Held at the Fairbanks Craft and Homebrew Supply. Email stihlerunits@mosquitonet.com for more information.

MAY 4
Southern California Homebrewers Festival
Temecula, California

The 12th annual Southern California Homebrewers Festival will be held at Lake Skinner, near Temecula, on May 4th. Tickets are $30 in advance and $50 at the door. This year's featured speakers are Charlie Papazian and Chris White. For more info, see the story on this page or go to www.calhomebrewers.org.

MAY 18-19
Spirit of Free Beer Homebrew Competition
Washington, DC

The Brewers United for Real Potables (BURP) announce that the 10th annual Spirit of Free Beer homebrew competition will be held at the Old Dominion Brewery. Homebrew entries, in all BJCP categories, will be accepted April 27th through May 11th. A minimum of two BJCP judges will evaluate each entry. For more information visit the BURP website at www.burp.org.

Join the Homebrew Nation! Send your homebrewing stories, tips, recipes and events to edit@byo.com. If we publish your tale, we'll send you our groovy Euro-style BYO bumper sticker and a special new White Labs yeast Homebrew Nation baseball hat!

Lawnmower Beer

Thirst-quenching beers for summer drinking

by Thomas J. Miller

If the thought of mowing the lawn makes your mouth water for a cold brew, then it's probably time to break out the kettles and make some "lawnmower beer." Typically defined as America's light-bodied, modestly-hopped, mass-appeal beers, there are plenty of other tradition-rich beer styles that ease the heat of summer. This month's "Tips from the Pros" provides many great brewing ideas and some great recipes for summer!

Brewer: Alan Taylor is the brewmaster at Spanish Peaks Brewing Company, in their Monterey County, California brewery. He trained and studied in Berlin, Germany, where he received his Braumeister, VLB degree in 1998.

The average American rarely thinks of a German beer as a "lawnmower beer." However, many German brews can fill the "lawnmower beer" bill, including the weizen, Berliner weisse and the beer I prefer on a hot summer day — the kölsch.

Kölsch has a crisp malt and hop flavor. It has an SRM of 3.5–5 with a soft, rounded palate, light hop fruitiness and a delicate dryness in the finish. The aroma shows light noble hops — German noble or Czech Saaz — leaving a light fruitiness. Maltiness is none to low. It is quite refreshing without being anything close to boring.

The basic kölsch recipe uses Pilsener malt as its base with up to 20 percent malted wheat. I recommend using German Tradition, Perle or Northern Brewer as a bittering hop. Use Hersbrucker or Hallertauer hops in the whirlpool.

Kölsch yeast strains — such as Wyeast's 2565 (Kölsch) yeast or White Labs WLP029 (German Ale/Kölsch) yeast — produce good results. Primary fermentation traditionally takes place for three to four days at 57–64° F, then the beer is cooled to 45–50° F degrees before being racked into a secondary fermenter. It is lagered for two to five weeks at 32–34° F.

Homebrewers should keep temperatures around 60° F until you hit final gravity, then add your priming sugars and bottle. After about a week at 60° F, toss some bottles in the fridge for a few weeks for conditioning.

Sebago Brewing Company

Brewer: Tom Abercrombie is one of two brewers for Sebago Brewing Company's three Maine-based brewpubs. He joined Sea Dog Brewing Company in Camden, Maine in 1995 and later moved to Sea Dog's Bangor location from 1998 to 1999. He became head brewer for Sebago Brewing Company in 2000.

Summer beers should be light in body, refreshing and less hoppy than other year-round styles. Anything goes in the summer beer spectrum, but clean and cold is the goal. Nothing should linger in the flavor profile other than subtle hints of maltiness and hoppiness.

In our brewhouse we produce predominantly American-style beers using single-step infusion mashes, American two-row malts and California Ale yeast from White Labs. Most of our beers are boiled for an hour with three hop additions. Fermentation temperatures are kept between 68–70° F.

Our Northern Light Ale is a crisp, all-malt, straw-colored beer that is especially appealing in the summer months. This ale uses all two-row pale malt with only about five percent Munich malt for a slight increase in color and body. The color comes in around 4.5 SRM.

The one-hour boil gets three hop additions of both imported and domestic hops. The beer is bittered with Czech Saaz and finished with Cascades and Mount Hood hops. The bitterness level is 20 IBUs.

One of our two summer seasonals, the Sha Wheat is an unfiltered wheat ale that is roughly modeled after a hefeweizen. However, there are no spices or tangy esters to be found, due to our house ale yeast. This beer has a low hop profile that comes from equal additions of domestic Hallertau, totaling just under 11 IBUs. The grain bill is half two-row and half malted wheat. The beer ends up at around 3 SRM.

The second seasonal that we produce is our only fruit offering. BassAckwards BerryBlue Ale uses a total of 240 pounds of Maine blueberries per 10 barrels. This is equivalent to 3.9 pounds of berries per 5 gallons.

The grain bill is a two-row pale malt base with about five percent Munich and seven percent crystal malt (60° L). BassAckwards BerryBlue is relatively lightly hopped at 16 IBUs. We do not add finishing hops as that would interfere with the fruit aroma.

We lightly mash most of the blueberries by hand and then add them to the fermenter in dry-hop bags. The final 30 pounds of berries are added to the serving vessel prior to carbonation. The color winds up around 13 SRM, not counting the color that derives from the blueberries.

When the beer is first served, the head has a very slight purple hue. The purple color diminishes, however, as the beer clarifies in the serving tanks. A fruit-style beer such as this is best when it is served cold.

Brewer: Darron Welch began homebrewing in 1987 and started brewing professionally in 1995. He is now the head brewer at the Pelican Pub & Brewery in Pacific City, Oregon. The Pelican Pub & Brewery has won seven medals at the GABF in the last four years.

In the summer there's nothing like a crisp, snappy beer. Among my standard line-up is Kiwanda Cream Ale, a pre-Prohibition style cream ale that has won gold and bronze medals at the GABF in the golden ale category. And every summer I brew an American-style wit beer called Heiferweizen, as there are a lot of dairies near Pacific City, Oregon.

I recommend using Mount Hood, Liberty, Ultra or almost any of the many Hallertauer-seedling American-aroma hops for the Kiwanda Cream Ale. These hops have very nice floral, perfume-like aromas, clean and snappy flavors and low co-humulone content for a smooth bitterness.

The simple malt bill is a neutral backdrop for your hop aromas and flavors, providing a smooth, clean sweetness to interplay with all the lovely hop characteristics. The malted wheat in this recipe should be soft, white wheat. Malted red wheat is more likely to cause chill haze.

Use the same yeast strain on the Heiferweizen as for the cream ale. Don't lager the wit, since that will cause the yeast and chill haze to precipitate out. You want this beer to stay hazy. For the same reason, skip the Irish moss or other kettle finings on this beer. Also, use malted red wheat and flaked red wheat in the mash.

Yeast flavor is also an important component. Instead of lagering the beer, give the beer seven to 10 days to carbonate at 60–65° F and then begin serving. Try to store and serve this beer at 40–45° F. The CO_2 target is a little lower than in the cream ale, at 2.2–2.3 volumes of gas.

Make sure to use Sterling hops in this beer to get that subtle spicy character. I think that the interplay of the dry graininess of the flaked wheat and barley with the spicy aspect of the Sterling hops does a good job of giving the overall impression of a very lightly spiced beer without actually using any spices in the beer. ■

Taylor Kölsch
(5 gallons, all-grain)

OG 1.044 FG 1.010
IBU 20 ABV 4.5%

Ingredients

6.5 lbs. Pilsener malt
1.5 lbs. wheat malt
5 AAU German Tradition hops (bittering)
(1 oz. of 5% alpha acid)
3 AAU German Hallertauer hops (flavor)
(1/2 oz. of 6% alpha acid)
3 AAU German Hallertauer hops (aroma)
(1/2 oz. of 6% alpha acid)
Wyeast 2565 or
White Labs WLP029 yeast
0.75 cup corn sugar

Step by Step

Mash in at 145° F for 30 minutes, raise to 160° F for 30 minutes, then raise to 170° F and start lautering. Boil wort for one hour. Add bittering hops with 45 minutes left in the boil. Add flavor hops with 10 minutes left and add aroma hops at the end of the boil.

Cool wort, aerate and pitch yeast. Ferment for one week at 60° F. Rack to secondary and let clear for one week. Bottle, condition and serve.

Extract option

Replace grains with:
4 lbs. Northwestern Gold dry malt extract
0.75 lbs. Muntons dry wheat extract

Welch Kiwanda Cream Ale
(5 gallons, all-grain)

OG 1.048–1.050 FG 1.009–1.011
IBU 25–30 ABV 4.9–5.1%

Ingredients

6.5 lbs. two-row malt (2° L or lighter)
0.5 lbs. CaraPils (2° L or lighter)
0.5 lbs. malted wheat (2.5° L or lighter)
3 AAU Mount Hood hops (flavor)
(0.6 oz. at 5% alpha acid)
8 AAU Mt. Hood hops (aroma)
(1.6 oz. at 5% alpha acid)
Wyeast 1056 or
White Labs WLP001 yeast
1 tsp Irish moss
1.0 cup corn sugar

Step by Step

Mash at 150° F for 90 minutes. Recirculate until bright, then sparge at 170° F, stopping when run-off gravity drops below 1.010 SG. Boil for 90 minutes. Add flavor hops last 15 minutes.

Whirlpool the kettle, add aroma hops and let stand for 20–30 minutes to separate hot break and most of the hop fragments. The whirlpooling and stand time will allow some of the alpha acids in the aroma hops to isomerize, and should give you adequate bitterness. Chill, aerate well, and ferment at 65° F.

Carbonate to 2.4–2.5 volumes of carbon dioxide. Lager the beer for two weeks at 33-40° F.

Welch Heiferweizen
(5 gallons, all-grain)

OG 1.044–1.046 FG 1.008–1.010
IBU: 20–25 ABV 4.5–4.7%

Ingredients

2.7 lbs. Pilsener malt
2.7 lbs. red wheat malt
14 oz. flaked barley
14 oz. flaked red wheat
1.2 AAU Sterling hops (bittering)
(0.18 oz. at 7% alpha acid)
2.5 AAU Sterling hops (flavor)
(0.35 oz. at 7% alpha acid)
4.2 AAU Sterling hops (aroma)
(0.60 oz. at 7% alpha acid)
Wyeast 1056 or
White Labs WLP001 yeast
0.75 cup corn sugar

Step by Step

You want to mash this beer with a water ratio of 1.25 quarts of water per pound of grain. Mash at 152° F for 90 minutes. It should still attenuate very well, even with a higher mash temperature than the Kiwanda Cream Ale.

Boil the wort for 90 minutes. Boil the bittering hops for the last 60 minutes; boil the flavor hops for the last 30 minutes. Add the aroma hops at knock-out.

Cool the wort, aerate and pitch yeast. Ferment at 68° F for one week, then rack to secondary. Bottle after one week with three-quarters cup of corn sugar.

Hot-Side Aeration

"Help Me, Mr. Wizard"

Re-using yeast, storing hops and sanitizing bottles

Hot-Side Aeration

When do you need to worry about hot-side aeration (HSA)? I realize that after the boil one needs to be careful not to aerate the wort until it is cool, but do you need to be concerned while mashing your grains? If so, at what temperature does HSA become an issue?

Gregory Probst
Minooka, Illinois

Hot-side aeration is a loose term referring to oxygen pickup in the "hot side" operations of brewing. These include mashing, lautering, wort boiling and hop separation at temperatures ranging from about 120–212° F. Over about the last 15 years, researchers have presented evidence that hot-side aeration — especially prior to wort boiling — decreases the shelf-life of beer by increasing the concentration of oxidized fatty acids. These compounds are carried forward into the beer and impart classic stale flavors such as the infamous "wet cardboard" type of oxidation.

I am a skeptic by nature, but I find that the data demonstrating the negative affects of hot-side aeration during mashing and lautering are convincing. I am still skeptical that deleterious HSA occurs in the boil, however. The temperature range during mashing and lautering is low enough that oxygen can indeed dissolve into the liquid and cause oxidation. In contrast, boiling wort (and wort immediately after boiling) is so hot that very little oxygen can be dissolved in it.

Enzymes are present in lightly-kilned malts that oxidize lipids and form staling compounds when oxygen and lipids are present. (Lipoxygenase enzymes are one example of these enzymes.) There has also been data presented demonstrating the presence of non-enzymatic lipid oxidation during mashing. This oxidation forms staling compounds and free radicals that carry on this cycle of fat oxidation, commonly known as rancidity.

Hot-side aeration can be demonstrated in medium and large commercial breweries because the brewing equipment is so big that splashing is a really dramatic event. Think of liquid flowing through a six-inch pipe at 400 gallons per minute and cascading 12 feet through the air before hitting the bottom of a tank. *This* — not roughly stirring a five-gallon mash with a wooden spoon — is what commercial brewers are trying to minimize.

Some of the things commercial brewers are doing to minimize splashing include mixing malt and mash water in a small mixing vessel and then pumping the mash into the bottom of the mash mixer. This replaces the practice of blending the two ingredients together in a grist hydrator and allowing the hydrated malt to cascade into the mash mixer. Key pieces of equipment might also be introduced. New mixing paddles are low-shear, low-splash agitators that work well without baffles in the tank. These paddles minimize splashing during the stirred, heated steps of the mash. When the mash is transferred to the lauter tun, it enters right at the false bottom level instead of being dropped in from the top of the vessel, as was common some 25 years ago. Kettles are also bottom-filled for similar reasons.

For a homebrewer, the most likely time for aeration to occur during mashing is while you are mashing in. One procedure to address this concern is the following: Add 2.5 quarts of water out of 10 to the mash tun, then carefully add two pounds of malt out of eight and gently mix malt into water. Add 2.5 more quarts of water and three pounds of malt and gently mix, then 2.5 quarts water and three pounds malt and mix, and finally add the last 2.5 quarts of water. As this process may take longer than your usual mash-in, it is important to make sure that your water stays hot enough during this suggested procedure.

If you use a separate vessel for wort collection and transfer your mash from the mash tun to a lauter tun, develop a procedure to minimize splashing. This is not always easy and the solution to this concern may be to mash and lauter in the same vessel. (Sometimes the solution is found by subtracting steps and pieces of equipment rather than always adding that new tool.)

I think the thing to remember about hot-side aeration is that it is not that hard to avoid at home. The real question that will probably spark heated debates for years to come is this: How good is good enough when it comes to warding off potential risks of hot-side aeration? There are some commercial brewers who have addressed all the obvious issues and now are looking at purging their mills and brewhouse vessels with nitrogen. I am anxious to hear if these aggressive methods improve the beer.

It must be remembered that oxygen pick-up after fermentation (e.g., from racking, filtering and bottling) also causes oxidation and staling of beer. In fact, the effects of oxygen pick-up after fermentation are more apparent and severe than the effects of hot-side aeration. This is partly because there are a wider variety of compounds in beer susceptible to oxidation than there are in wort. The point here is that, if you are thinking about changing your brewing procedure to avoid oxidation, you should begin addressing oxygen pick-up from the end of the process and work your way forward toward mashing.

Harvesting Yeast

I am an all-grain brewer who will start using the Fermentap system (the upside-down carboy with racking cane as the CO_2 exit). At what point should I remove the trub and the yeast? Should I start removing the yeast as it falls or wait until after fermentation?

Juan Carlos Gutierrez
Ocean Beach, California

The Fermentap system of fermentation is similar to the tall, skinny cylindro-conical fermenting tanks used by most commercial brewers these days. And, like everything else about brewing, there are many ways brewers use the cone on the tank. One method — not necessarily the most common one — goes a bit like this: Yeast and wort are added to the fermenter and fermentation begins. When this happens, yeast begin zooming around in the fermenter; some trub solids remain on the fermenter bottom and some trub solids are suspended by the fermentation. (Trub is the proteinaceous precipitate that forms in the wort. Hot trub precipitates during wort boiling. Cold trub precipitates when the wort is cooled.) Some brewers briefly open the valve to remove the trub solids on the bottom of the fermenter at this time. They may repeat this step a few times during fermentation.

The next phase of the operation happens when fermentation slows and the yeast begins to flocculate and fall to the bottom of the fermenter. Brewers hold off on purging trub during this phase because a lot of the stuff in the cone is good yeast. If they cool the fermenter for secondary fermentation, they do so before harvesting the yeast because more yeast will settle out when the beer is cooled.

When I harvest yeast, I usually have multiple cleaned and sanitized containers handy. The first container is used to contain the trub-laden bit intended for the sink. This portion looks like hummus with tiny chunks of chocolate. The second container is for the good yeast I plan on using. The third, if needed, is used for the last bit of yeast, after about 500 mL of good yeast is collected. Good yeast looks like plain hummus (without the chunks). Usually my second container has plenty of yeast for another batch.

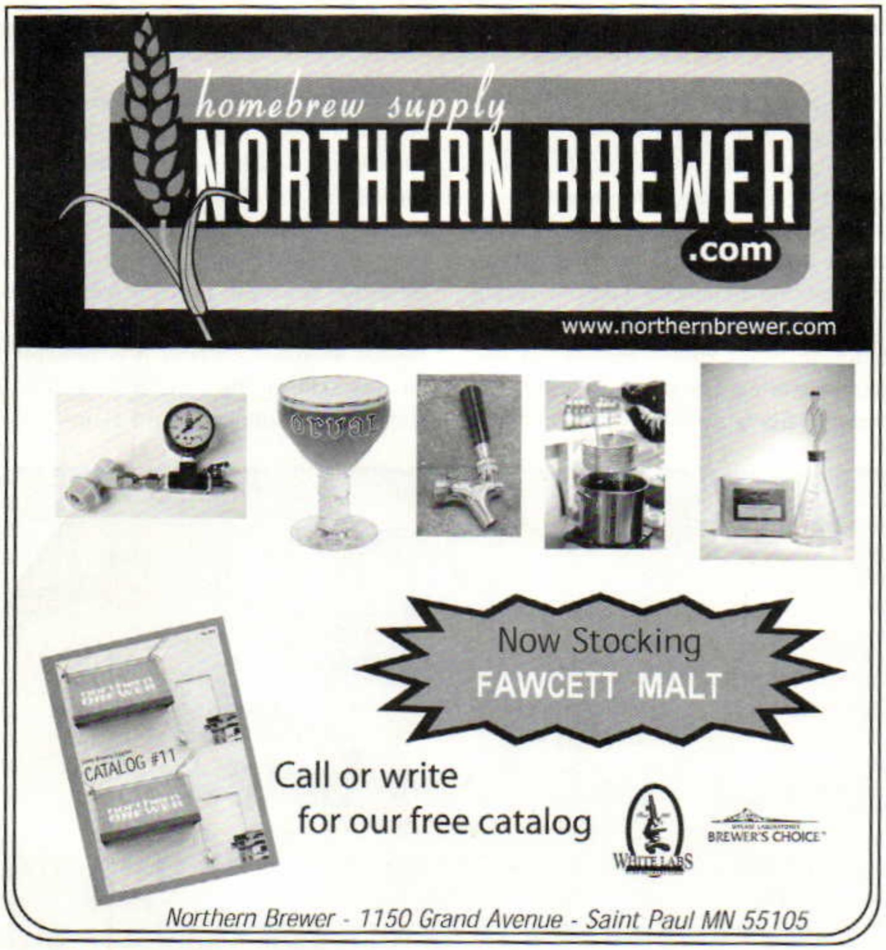
Typically I end up pouring the contents of container one and three over my hands. I observe the color of the yeast and the amount of trub mixed in with the yeast. I also smell and taste the yeast. (Obviously, this yeast is not used for brewing after I've touched it.) Fresh yeast smells very bread-like and does not have "off" aromas. I want fresh-smelling yeast that is trub-free and has a creamy white or tan appearance. Autolyzed yeast is usually darker and more liquid-like than really fresh and healthy yeast.

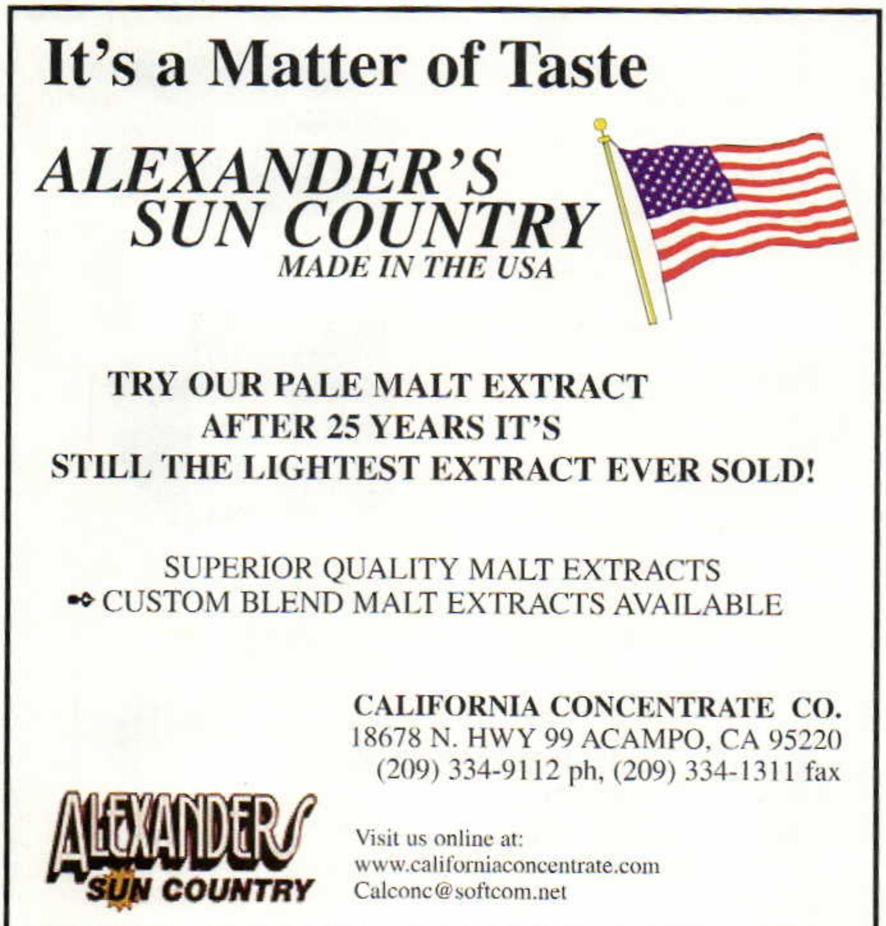
What I am most keyed into are the signs of yeast autolysis, which can be detected from soy sauce or Vegemite-type aromas. If I pick up autolyzed aromas — especially if the aroma is present in both containers — I become concerned about the quality of the yeast in the second container. If the yeast in the first sample is slightly autolyzed and the third sample has no detectable autolysis, I usually don't worry. The very bottom of a cone bottom fermenter does not circulate and has the greatest likelihood of harboring a small amount of decaying yeast.

The yeast intended for pitching should be used as soon as possible at a rate of about eight ounces of yeast to five gallons of wort. If you have to store the yeast, keep it in the refrigerator for no longer than a few days prior to use. I prefer storing the yeast in a glass container with an "S-style" airlock.

I also like to know the history of the yeast. I really don't like using yeast that doesn't meet the following profiles. Lager yeast should be: less than seven generations old; only used in normal-gravity fermentations for paler worts; harvested from a fast to normal-length primary fermentation (usually seven to 10 days); and without detectable off-flavors. The time span between the brew day and the harvest day should also be less than three weeks. The ale yeast profile is similar, except that I will use ale yeast up to ten generations. The normal time span for primary fermentation should be three to four days and the span between brew day and harvesting should be less than two weeks. These numbers work for me in my brewpub. Homebrewers are less likely to use yeast for this many generations simply because the frequency of brewing is usually less at home, except for you guys who brew twice a month no matter what!

My last uninvited comment relates to safety. The Fermentap system is a nice system, but lacks any type of pressure-relief valve. It is possible for the gas exit tube to become blocked during fermentation and for the pressure to build up inside the carboy. When this happens in an upright carboy, the airlock usually launches off the top like a missile because the stopper gives way before the carboy breaks. In the Fermentap system, the assembly is clamped to the neck of the carboy and cannot break free. This is necessary since the carboy is inverted and the assembly prevents leaks. However, if the racking cane allowing gas to escape becomes clogged it is possible for this set-up to turn into a little bomb. Unfortunately, there is no way





to equip this system with a relief valve because the relief valve needs to be located in the headspace of the fermenter and glass carboys cannot be cut into like a plastic or metal container. (Chris Graham from Fermentap points out that the carboy comes with a special fitting; it acts as a screen to help keep the vent tube from getting clogged. "Since taking over the company three years ago, there have been no reported cases of this," he adds. "Nor am I aware of any incidents before we bought the company.")

Storing Hops

I have been brewing for a little over a year and usually buy my ingredients by the batch, meaning I only buy what I'm going to brew for every batch I make. I have been thinking about buying ingredients in greater quantity and storing them. I know that hop pellets don't age as fast as whole hops, but can or should you freeze hop pellets to extend their life? If you can or should, how long would they keep?

Sean Faires
Springfield, Illinois

This is a good question with a very straightforward answer — storing hops at freezer temperatures does extend their life and will not damage the hops. How can I be so definitive, one may ask? Because when hop processors store hops, they store them at temperatures ranging from 20–30° F and keep them in this temperature range until they are sold. If the hop variety has good storage properties, and if it is packaged properly, hops will remain fresh for two to three years. Most pellets are vacuum packed to minimize oxygen in the package. This is key since oxygen is the primary concern during hop storage. The other two concerns are time and temperature. Storage time can be maximized whenever exposure to oxygen and temperature are minimized.

There are a few points I want to make about this question. For starters, hops are not frozen during cold storage because hop pellets and compressed cones have very little moisture. The small quantity of water in processed hops is called bound water and does not freeze or crystallize like free water. (Free water is removed from the hops when they are kiln dried.) This is an important distinction because freezer burn occurs when frozen free water sublimes — changes state from solid to gas without passing through the aqueous state. Freezer burn is a real problem when foods containing free water are stored in freezers. Freezer burn can be minimized by using wrappings with excellent barrier properties and by eliminating gas spaces between the wrapping and the food. This can be a real challenge, but we don't have to worry about this issue with hops.

The other point is that commercial freezers are much different than the types most of us have at home. The main difference is that they don't have a refrigerator full of smelly food sharing the same air. If hops are not stored in an air-tight container — something that does not allow gas migration, like glass or a foil bag — the hops can pick up flavors from other items stored in your refrigerator or freezer. If you happen to have one of those vacuum sealers laying around, you could split up your hops into small bags of some convenient weight — one-ounce packs, for example— vacuum seal the bags, and then place them in a big glass jar with a metal lid. The jar will prevent any stink from touching the hop bags and the vacuum-packed hops would have little oxygen to damage them.

If you don't have a vacuum sealer you can get handy foil bags from coffee shops that are fitted with a zipper lock and check valve. Just fill it up with your hops, zip the bag closed and squeeze the air out through the check valve. I am sure that if you found a coffee shop with this type of bag, they would sell the bags to you for a reasonable price.

I would err on the safe side and put this bag into a jar just in case some particularly persistent molecules are emanating from the freshly-sliced onion stored in the neighboring refrigerator. If the hops remain sealed in their original package, they can just be stored in the fridge or freezer. The bag should keep oxygen and odors out.

Sanitizing Bottles

I have a question concerning sterilizing bottles. I was told by a homebrew shop owner that as long as the bottles were clean and free of residue they could be sterilized in the oven. His method was to stack the bottles in a cold oven, bring it to near 500 degrees and then let it cool gradually, removing the bottles when completely cool. Have you ever heard of this method and does it produce have good results? I have tried it once with no spoiled beer but wanted another opinion.

Victor Russo
Cranston, Rhode Island

Dry heat, like that of an oven, is not as effective as moist heat when it comes to killing microorganisms. Sterilizing devices, like autoclaves and pressure cookers, use steam for heating and are vented during the heat-up phase to eliminate air. Air acts as an insulator in steam sterilizers and slows down heat transfer from the steam to the item being sterilized. Twenty minutes in a pressure cooker or autoclave held at 15 psi is sufficient to render items — such as surgical instruments or lab waste — sterile.

The method you describe can be used, but the sterilization time required is longer than if you used steam. Unfortunately, I cannot find any solid numbers for how long of a time is required, since all of my references related to heat sterilization are based upon moist heat. I would guess that 30–45 minutes of dry heat exposure would be pretty effective at killing beer spoilage bacteria and yeast.

There is a practical problem to heating beer bottles — glass fatigue. At one time in my brewing career I sterilized bottles in a steam cabinet (basically an unpressurized steaming device similar to a big seafood steamer). After several cycles the bottles became weak and one day, while counter-pressure filling bottles, several exploded. Luckily, I was wearing a face shield. After that experience I quit using heat to sterilize bottles.

My advice about bottle cleaning and sterilization is to begin with clean bottles. If you re-use your bottles, make sure to thoroughly rinse them immediately after use. This makes cleaning much easier when you need to clean a batch. Some dishwashers are designed to easily accommodate bottles and do a good job of cleaning them. An alternate method is to soak the bottles in a hot, dilute solution of a heavy-duty cleaner such as sodium hydroxide or sodium metasilicate. If the bottles are pretty clean to begin with, hot dish soap will work fine. The idea with cleaning is to remove organic soils since they interfere with the activity of most sanitizers.

After cleaning and rinsing, I prefer using a liquid sanitizer instead of heat. One way to do this is to soak the bottles in your sanitizer of choice. Chlorine bleach and iodine solutions are two popular sanitizing solutions for homebrewers. If soaking is too much of a hassle, this month's "Projects" column (on page 55) explains how to build a simple mechanical device to spray sanitizer into bottles. ■

Do you have a question for Mister Wizard? Write to him c/o 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 to questions personally. Sorry!

Beers Cloned

Wisdom Cream Ale & Fredericksburg Porter

by Steve Bader

Dear Replicator,

We have a top-notch brewery in Belgrade, Montana called Big Hole Brewing. They make my favorite beer of all, Wisdom Cream Ale. I would sure be interested in a clone recipe for this beer, as I have had slim luck brewing cream ales.

Kevin Brownlee
Bozeman, Montana

I talked to the head brewer at Big Hole, Doug Frey, about Wisdom. This cream ale is a relatively new addition for them, with production starting last fall, so he was pleased to hear that you love it. The name "Wisdom" reflects the Native American theme that all their beers share.

Doug said they produced this beer for the "lighter" crowd and described this ale as an easy drinker. They use only two-row pale malt in the grain bill and keep the hopping level low to give the beer a balance that tilts toward the malty side. If this were a lager beer, you would probably compare it to a German-style Pilsner.

This is a great beer to make for warm-weather drinking. The cream-ale style is a light-colored beer with subdued maltiness and low hop bitterness to give it a light, balanced flavor.

Doug suggested keeping a close eye on fermentation temperatures. You want to avoid temperatures above 70° F to keep down the fruitiness from esters. He also mentioned that they have fairly hard water in Belgrade, so if you have soft water you may want to add some gypsum or "Burton" style brewing salts.

I suggest that you use dry malt extract, since the dry malt extract tends to give you a lighter beer color than liquid malt extracts.

You can get more information about Big Hole Brewing and their beers at (406) 388-7953.

Wisdom Cream Ale
(5 gallons, extract)
OG = 1.053 FG = 1.014 IBUs = 14–16 ABV = 5.1%

Ingredients

6.0 lbs. Coopers Light dry malt extract
4.0 AAU Tettnanger hops (bittering) (0.9 oz. of 4.5% alpha acid)
7.4 AAU Saaz hops (aroma) (2.1 oz. of 3.5% alpha acid)
1 tsp Irish moss
White Labs WLP002 (English Ale) yeast or Wyeast 1968 (Special London) yeast
0.75 cup of corn sugar for priming

Step by Step

Since there are no grains in this recipe, it is simple to make. Add the malt extract to three gallons of hot water and bring to a boil. Add the Tettnanger (bittering) hops and Irish moss and boil for 60 minutes. Add the Saaz (aroma) hops for the last two minutes of the boil.

When you are done boiling, strain out the hops. Add the wort to two gallons of cool water in a sanitized fermenter and top off with cool water to 5.5 gallons. Cool the wort to 80° F, aerate the beer and pitch your yeast. Allow the beer to cool over the next few hours to 68–70° F and ferment for 10–14 days. Bottle your beer, age for a minimum of two to three weeks and enjoy!

All-grain option

Replace the light malt extract with 10 lbs. of two-row pale malt (2° L). Mash all your grains at 155° F for 45 minutes. Collect enough wort to boil for 90 minutes and have a 5.5-gallon yield.

Decrease the amount of bittering hops to 0.75 oz. of Tettnanger to account for increased hop extraction efficiency in a full-wort boil. Chill the wort, aerate and pitch yeast. Bottle and condition as explained in the extract recipe.

Dear Replicator,

I have now tasted the best porter ever. This porter alone has thrust my wife and I deep into the world of homebrewing. I am hoping you can give me a hint as to the recipe used at The Fredericksburg Brewing Company in Fredericksburg, Texas.

Lonnie and Yvonne McAllister
Highlands, Texas

Porter has always been my favorite style of beer and this one sounds great! Every homebrewer needs some inspiration and it appears that this porter is your inspiration.

Rick Green, the head brewer at Fredericksburg Brewing Co., told me it was one of their more popular beers. Rick was also generous enough to take some time during brew day to tell me how they make this porter, including giving out the full recipe.

This beer would fit into the brown porter style category due to its lower volume of specialty malts. This means that it is more on the mellow side than the assertive side, in comparison to a robust porter. Robust porters have a higher alcohol content, more dark grain flavor and greater hop bitterness.

The malt bill has six different grains in it, which lend the beer some nice, complex flavors. They hop to a low bitterness level. At about 15 IBUs, this beer is below the suggested minimum (20 IBUs) for the style. The low level of bitterness helps the maltiness come out even more. Northern Brewer hops are a neutral-tasting bittering hop, which further allows the maltiness to come to the forefront of this rich, dark beer.

As in many breweries, Rick limits the number of yeast strains used. He uses White Labs California Ale yeast on this beer because it is a neutral-flavored yeast able to make a large variety of beer styles. This yeast gives the beer a clean flavor that helps keep the beer well-balanced. ■

For more information on this beer and the Fredericksburg brewery, you can visit their home on the Internet at http://www.mybrewery.com, or call them at (830) 997-1646.

WRITE THE REPLICATOR

Got a beer you'd like cloned? Write the Replicator!

You can send your Replicator requests to edit@byo.com or mail a letter to: The Replicator, c/o Brew Your Own magazine, 5053 Main Street, Suite A, Manchester Center, Vermont 05255.

The Replicator gets a lot of requests, so unfortunately he can't respond personally to each one.

Fredericksburg Porter
(5 gallons, extract with grains)
OG = 1.054 FG = 1.012 IBUs = 14–16 ABV = 5.5%

Ingredients

6.6 lbs. Northwestern Gold malt extract syrup
10 oz. Hugh Baird Carastan malt
10 oz. Munich malt
7 oz. chocolate malt
5 oz. crystal malt (120° L)
1 oz. roasted black barley
3 AAU Northern Brewer hops (0.33 oz. of 9.0% alpha acid)
2.5 AAU Willamette hops (flavor) (0.5 oz. of 5.0% alpha acid)
2.4 AAU Goldings hops (aroma) (0.5 oz. of 4.8% alpha acid)
1 tsp Irish moss
White Labs WLP001 (California Ale) yeast or Wyeast 1056 (American Ale)
0.75 cup of corn sugar for priming

Step by Step

Steep the crushed grains in three gallons of water at 150° F for 30 minutes. Remove the grains from the wort, add the malt syrup and bring to a boil.

Add the Northern Brewer (bittering) hops and the Irish moss and boil for 60 minutes. Add Willamette (flavor) hops for the last 20 minutes of the boil. Add the Goldings hops (aroma) for the last two minutes of the boil.

When you are done boiling, strain out the hops and add the wort to two gallons of cool water in a sanitized fermenter. Top off with cool water to 5.5 gallons. Cool the wort to 80° F, aerate the beer and pitch your yeast. Allow the beer to cool over the next few hours to 68–70° F and ferment for 10–14 days. Bottle your beer, let it age for two to three weeks and enjoy!

All-grain option

Replace the light malt syrup with 8.25 lbs. of pale malt. Mash all your grains at 155° F for 45 minutes. Collect enough wort to boil for 90 minutes and have a 5.5-gallon yield. Decrease the amount of bittering hops to 0.25 oz. of Northern Brewer to account for the increased hop extraction efficiency that comes with a full-wort boil. The remainder of the all-grain recipe is the same as the extract recipe.

Pale Ale

From 17th century England to your carboy

by Horst D. Dornbusch

PALE ALE by the numbers

OG . . . . .often 11–12° P (1.044–1.048 SG)
FG . . . . .2.5–2.9° P (1.010–1.012 SG)
SRM . . . . . . .11–14 (sometimes less)
IBU . . . . . . .generally 30 (often more)
ABV . . . . . . .generally 4.3–4.8%

Pale ale originated in England about two hundred years ago when some brewers started to use cleaner, but more expensive, coke — instead of coal or wood — to dry their malted barley. The higher-priced grain led to higher-priced brews. This helped to foster the British notion that pale beers are for the upper classes, while darker beers are for the toiling masses. Most of this new ale came from just one city — Burton-on-Trent.

British breweries have only been maintaining reliable brewing records since the beginning of the twentieth century, so we do not have the recipe of the original brew. From the perspective of authenticity, we have only a few vague hints as to what the original pale ale might have looked or tasted like. It ought not to come as a surprise, therefore, that pale ale has one of the broadest style definitions you can find in the world of brewing.

Early English beers brewed with these paler grains were mostly amber to copper in color. Today we might not even consider them pale, because we compare them to modern beers such as the golden-blond Pilsners, the brilliant Munich helles, and even American light lagers. By the standards of the staple brown ales and porters of two hundred years ago, however, these new beers were pale indeed.

The "paleness" of pale ale got a real boost in the 1820s with the introduction of new malting methods that relied on heated air, instead of hot, smoky combustion gasses, to dry the malted grain. From then on, brewers had a bona-fide pale malt. From this grain they could finally make a truly pale ale.

Originally, in cask-conditioned "real" pale ales, the turbidity from the yeast was taken out of the drink with various finings. But in regular "running" beer — as draft beer was often called then — this was not the case. It was not until the invention of beer filtration in 1878 that pale ales could sparkle, too.

Nowadays, the finest "classic" pale ales have a delicious balance between earthy, peppery English hops and clean, sweet malts. These ales have a gentle undercurrent of butterscotch and some sulfur notes. The finish is polished and may have a note of apple. Many modern pale ales, by contrast, sport an aggressive bitterness that stems from the use of pungent hop varieties from the Pacific Northwest.

What's in a Name?

The name "pale ale" is not without ambiguity, or even confusion. Initially, the beer was known as India Pale Ale (IPA) because it was being made mostly for shipment to the administrators, merchants and soldiers of the British Empire in India. This beer faced a six-week long, often rough, ocean voyage through the tropics and around the tip of Africa. To ensure that the beer would survive the trip without spoiling, Burton brewers made it almost twice as strong and twice as bitter as the standard ales of the day.

This India Pale Ale acquired a domestic British market only by accident when, after a shipwreck off Liverpool in 1827, casks of IPA were salvaged and sold for local consumption. Once the Liverpudlians had tasted the hoppy export ale, they clamored for more and the Burton brewers obliged. Because of the beer's bittering levels, it became known domestically as "bitter." However, because plenty of alco-

British Nineteenth-Century Best Bitter

(5-gallon, all grain)
OG = 1.044 FG = 1.010
SRM = 11–13 IBU = 30

Ingredients

7.0 lbs. two-row pale ale malt (3° L)
1.0 lb. crystal malt (40° L)
6.75 AAU East Kent Goldings hops (bittering)
(1.35 oz. of 5% alpha acid)
0.5 oz. Fuggles hops (flavor)
0.5 oz. East Kent Goldings (aroma)
Wyeast 1028 (London Ale) or White Labs WLP026 (Premium Bitter Ale) yeast
0.75 cup corn sugar (for bottling)

American Twentieth-Century Pale Ale

(5-gallon, all grain)
OG = 1.048 FG = 1.012
SRM = 12–14 IBU = 30

Ingredients

8.6 lbs. two-row pale ale malt (3° L)
0.9 lbs. crystal malt (40° L)
6.72 AAU Galena or Columbus hops (bittering)
(0.56 oz. of 12% alpha acid)
0.25 oz. Willamette hops (flavor)
0.5 oz. Willamette hops (aroma)
Wyeast 1056 (American Ale) or White Labs WLP001 (California Ale) yeast
0.75 cup corn sugar (for bottling)

Step by Step

Mash the grains using a single-infusion mash. Mash in at 152° F and let the mash rest for 60 minutes. Recirculate the wort for 20 minutes or until wort runs bright. Then sparge for about 90 minutes while raising the temperature of the mash gradually to 170° F.

Boil the wort for 90 minutes. Add bittering hops 15 minutes into the boil, flavor hops 75 minutes into the boil, and aroma hops at shut down.

Chill the wort to 68° F, aerate and pitch yeast. Ferment at 68–72° F for one week. Rack to secondary for two weeks. Bottle, condition for one week and serve at 50–55° F.

British Nineteenth-Century Best Bitter

(5-gallon, partial mash)
OG = 1.044 FG = 1.010
SRM = 11–13 IBU = 30

Ingredients
5.6 lbs. plain light malt extract (such as Coopers, Muntons or John Bull) or Edme Maris Otter malt extract
1.0 lb. crystal (40° L)
6.75 AAU East Kent Goldings hops (bittering) (1.35 oz. of 5% alpha acid)
0.5 oz. Fuggles hops (flavor)
0.5 oz. East Kent Goldings (aroma)
Wyeast 1098 (British Ale) or White Labs WLP006 (Bedford British Ale) yeast
0.75 cup corn sugar (for bottling)

American Twentieth-Century Pale Ale

(5-gallon, partial mash)
OG = 1.048 FG = 1.012
SRM = 12–14IBU = 30

Ingredients
6.9 lbs. plain light malt extract (such as Alexander's)
0.9 lbs. crystal malt (40° L)
6.72 AAU Galena or Columbus hops (bittering) (0.56 oz. of 12% alpha acid)
0.25 oz. Willamette hops (flavor)
0.5 oz. Willamette hops (aroma)
Wyeast 1056 (American Ale) or White Labs WLP001 (California Ale) yeast
0.75 cup corn sugar (for bottling)

Step by Step

Crack the crystal malt. Avoid milling the grain finely, because you want to avoid phenols and unconverted starches in your brewing liquor. Immerse the cracked grain in a muslin bag in about two gallons of cold water. Heat the water slowly for about half an hour until the brewing liquor is at 170–190° F. Then lift the bag out of the kettle and rinse it with a cup or so of cold water. Because unconverted starches become water soluble at 176° F, do not squeeze the bag. This can add milky starch residues to your wort.

Bring the steeping water to a boil, turn off the heat and add the malt extract. Stir thoroughly and resume heating. Boil wort for 90 minutes. From this point forward, follow the instructions given for the all-grain recipe.

British Nineteenth-Century Best Bitter

(5-gallon, extract only)
OG = 1.044 FG = 1.010
SRM = 11–13 IBU = 30

Ingredients
6.2 lbs. plain light malt extract (such as Coopers, Muntons or John Bull) or Edme Maris Otter malt extract
6.75 AAU East Kent Goldings hops (bittering) (1.35 oz. of 5% alpha acid)
0.5 oz. Fuggles hops (flavor)
0.5 oz. East Kent Goldings (aroma)
Wyeast 1318 (London Ale III) or White Labs WLP023 (Burton Ale) yeast
0.75 cup corn sugar (for bottling)

Note: For a darker, more authentic beer color, substitute the 7.3 lbs. of plain light malt extract with 6.6 lbs. plain light plus 0.6 lbs. plain dark (30 °L) malt extract (such as Coopers, Muntons or John Bull).

American Twentieth-Century Pale Ale

(5-gallon, extract only)
OG = 1.048 FG = 1.012
SRM = 12–14 IBU = 30

Ingredients
7.3 lbs. plain light malt extract (such as Alexander's)
6.72 AAU Galena or Columbus hops (bittering) (0.56 oz. of 12% alpha acid)
0.25 oz. Willamette hops (flavor)
0.5 oz. Willamette hops (aroma)
Wyeast 1056 (American Ale) or White Labs WLP001 (California Ale) yeast
0.75 cup corn sugar (for bottling)

Step by Step

Bring between three and five gallons of water to a boil. Turn off heat and add malt extract. Stir thoroughly to mix malt extract with water, then turn the heat back on.

Boil wort for 90 minutes. Add the bittering hops with one hour in the boil. Add the flavor hops with 15 minutes left in the boil. Add the aroma hops at the end of the the boil.

Cool the wort either with a wort chiller or by adding cold water to make five gallons of wort. Follow the all-grain instructions for fermentation, conditioning and serving instructions.

hol as a preservative was no longer necessary on the short transport routes for domestic sales. Burton brewers made their bitter in three strengths. They brewed an ordinary bitter (with an average OG in the mid-1.030s), a best bitter (with an average OG in the mid-1.040s), and a strong bitter (with an average OG in the mid-1.050s). The strong bitter also became known as special or extra-special bitter (ESB). As beer bottles entered the British market from the 1860s onward, the bottled bitters came to once again be called pale ales to distinguish them from the bitters in casks. At this time, however, the "India" prefix was dropped.

As brewers, we may be comfortable with the thought that styles are something fixed and lasting. But in reality, styles are born as an expression of their times and tend to change with them, sometimes even radically. I find it curious that nowadays the designation "pale ale" has disappeared almost completely from British labels. Conversely, in North America the designation "bitter" is not very common. "Pale ale" has become the name for the most common homebrewed and craft-brewed beer in the New World.

In both Britain and North America, myriad IPAs, bitters and pale ales are now bottled and kegged, ignoring the traditional naming conventions that distinguished between the packaging of these beers. So, all the neat terms and categories that once upon a time seem to have had a very clear meaning are now just as likely to confuse us.

Pale Ale Style Guidelines

There are literally thousands of domestic and imported pale ales on the North American market today. Each ale emphasizes, it seems, a different characteristic of this far-ranging beer style. For generic specifications, see the "Pale Ale by the Numbers" box on the previous page, but also consider the following characteristics:

- The color of a typical pale ale is golden to medium-amber, rarely lighter.
- Its body is medium, as is its effervescence, though some British draft versions are almost flat. Other versions

now come with a very creamy head from dissolved nitrogen instead of carbon dioxide.

• The balance between maltiness and bitterness can vary greatly in a pale ale. Its up-front bitterness can range from very assertive in some versions from the American Northwest (with IBUs in the 40s) to mild and floral in some of the imported British versions (with IBUs in the 20s).

• The middle flavor is usually slightly fruity with malty rather than hop-bitter notes in evidence. It can also be downright estery and butterscotch-like, especially in some versions from the American Northeast.

• Old-style pale ales are fermented with fairly dusty — that is, not very flocculant — yeasts for a dry finish. But there are now also many modern pale ale yeasts that are very flocculant and clear easily.

• The finish is slightly to very strongly hop-aromatic, depending on the type and quantity of hops used for the last addition and whether or not the ale is dry-hopped.

•Depending on the orientation of the particular brewer, the alcohol level can be as low as 3.5 percent by volume, as is likely for an ordinary bitter. Or it can be as high as six percent, in which case the beer would probably be designated as an ESB or IPA. The alcohol level of most British pale ales is now around 4.4% and of most American pale ales around 4.8%.

Malt

All-grain brewers can use any domestic or imported pale malt of 3–4° L that is intended specifically for ales, such as Briess two-row pale ale malt or Maris Otter malt from such maltsters as Crisp Maltings, Hugh Baird, Beeston or Warminster. Maris Otter has been the traditional barley variety for the finest English ales. Such malts add a bit more residual sweetness and less graininess to the brew's flavor than do regular two-row pale malts. Do not use German-style pale Pils malts, incidentally, as they lack the heftiness needed in British-style brews. Here are a few hints for those who wish to experiment with their malt bill.

The grain bill of a typically English pale ale may contain five to ten percent crystal malt (40 °L). Other versions of pale ale — especially those from Scotland — tend to be brewed with a greater addition of darker, or even roasted, malts. These malts can give Scottish pale ales a rich, deep copper color as well as a slight toffee aroma. This aroma is especially evident because hops are used much more sparingly in Scotland (with IBUs in the low 20s). If you wish to imitate a Fuller's ESB from London, on the other hand, use about 7.5 percent crystal malt and 20 percent flaked maize in your grain bill.

Extract brewers might want to use British plain light malts, such as Edme Maris Otter malt extract, for the British pale ale recipes. Use plain light malts from the United States, such as Alexander's, for the American-style recipes. Most plain light extracts have a color rating of around 4° L. Avoid extra-pale extracts, though. Depending on your preference, use the extract as a replacement for the pale grist only and then steep the specialty malts as indicated in the partial-mash recipes. Alternately, use the malt extract as a replacement for the entire grain bill. Light extract-only ales, however, will have less depth of color and flavor than do all-grain or partial-mash ales, unless you add some dark extract.

Hops

For a beer style that is also known as "bitter," hops are important. As for the choice of hops, pale ale traditionalists prefer Fuggles and East Kent Goldings — in any combination — for bittering, flavor and aroma. For a uniquely American profile, though, you might want to substitute one or more of the hops listed in the recipes with Cascades hops.

Water

Pale ale — just like the pale Munich Helles or the Dortmund lager, but unlike the pale Pilsner lager — is not too fond of exceptionally soft water. In part, this is because soft water suppresses the perception of hop bitterness on the palate and would thus give the beer too much of a malty accent.

Burton has exceptionally hard water, in the range of 300–350 ppm calcium and magnesium. Without taking a cumbersome detour into water science, let's just remember that the hardness of your water affects — in a complicated chain of events — the alkalinity or acidity of your mash. The alkalinity or acidity (measured as the pH value) of the mash in turn affects the pH of your wort and of your beer. A mash pH of 5.2–5.4 is universally considered perfect for pale ales. The wort pH should be no higher than 5.9 at the beginning and not over 5.6 at the end of the boil. A pH in the range of 4.2–4.4 is the ideal for flavor and stability in the finished beer.

So check your pH value and find out how hard your water is for guidance. Call your municipal water department for this information. Or, if you have your own well, have your water analyzed by a commercial lab. Then make the needed corrections with gypsum (calcium sulfate, $CaSO_4$). One teaspoon of gypsum raises the hardness of one gallon of water by slightly more than 50 ppm. Equivalently, one teaspoon of gypsum raises the hardness of five gallons of water by about 10 ppm. Then brew your next batch and check your pH values to gauge your improvements. But do not be too finicky, unless your water is extremely soft and acidic. An acceptable target for your pale ale brewing water is about 150 to 200 ppm of calcium and magnesium ions, but I have made superb pale ales with brewing water with as little as 60 ppm of hardness.

Yeast

On the yeast front, any of the ale strains listed in the recipes are authentic and work well. Of note is Burton, which yields perhaps the most complex flavor. London gives you a fairly dry finish. Southwold yeast imparts a touch of citrus. Ringwood may give you the most butterscotch flavor, which can be overpowering, especially if your fermentation temperature slips above 70° F. ■

Horst Dornbusch writes the "Style Profile" column each month for BYO.

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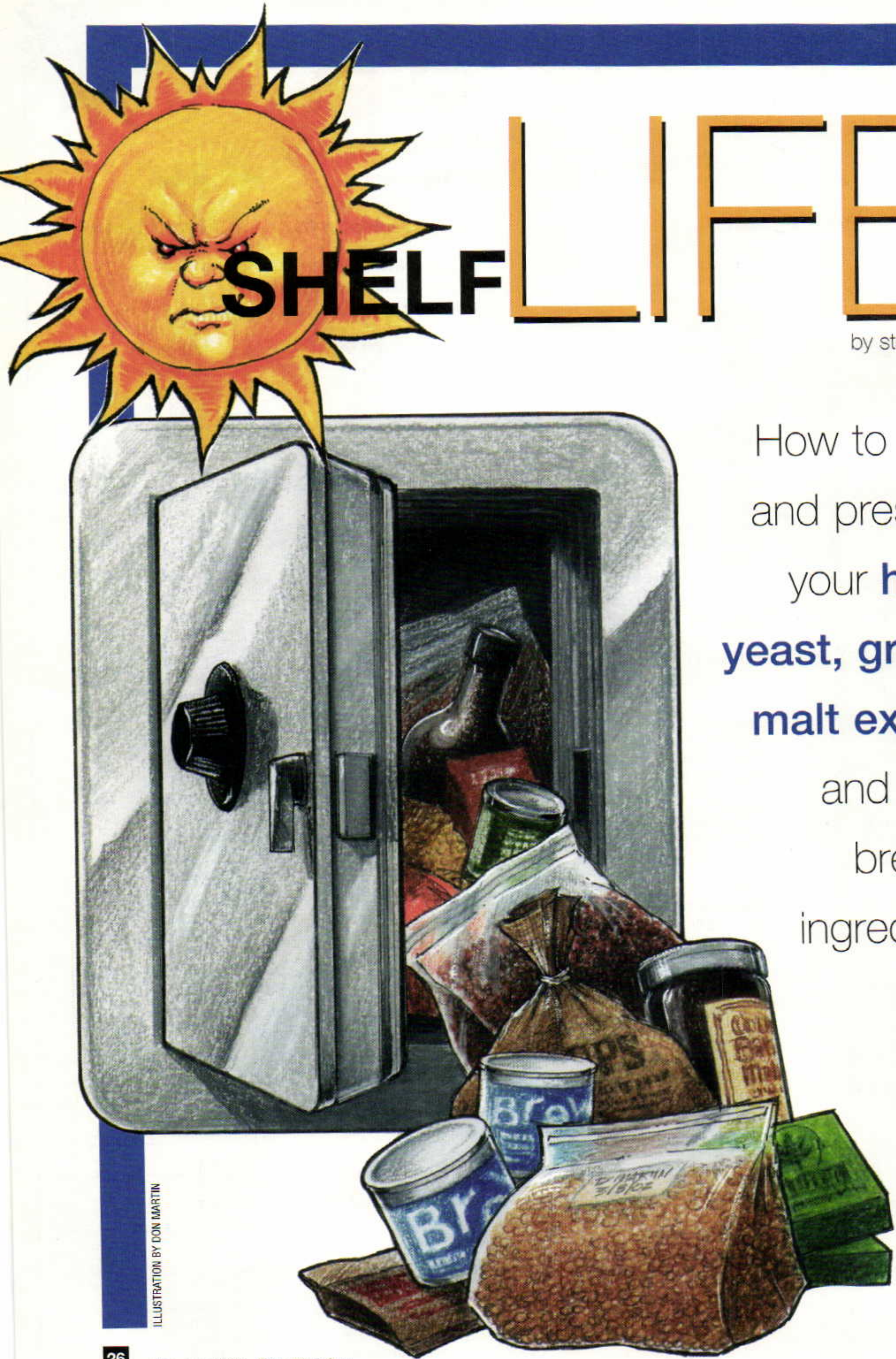


How to store and preserve your **hops, yeast, grains, malt extract** and other brewing ingredients

ILLUSTRATION BY DON MARTIN

SINCE BEER IS CONSIDERED a "fresh" beverage, keeping your brewing ingredients fresh is important to making great beer. Here are guidelines for storing your ingredients if you aren't going to use them for some time after you have purchased them. Maybe you grow your own hops, and need to store 4 or 5 pounds of them. Or perhaps you only visit the homebrew shop every few months, and need to buy ingredients for four or five beers at a time.

Like most other food ingredients, there are some basic rules that apply to storing your brewing ingredients. The three big enemies of your ingredients are heat, light and oxygen. Dry ingredients should also be kept in moisture-proof bags. If you control these factors, your ingredients will be ready when it's time to make that next kölsch or porter.

Grain

Malted barley should be protected from moisture and stored at temperatures between 50° and 70° F. Any quantity of malted barley, whether it's a 50-pound sack of two-row or a one-pound bag of crystal, should be stored in containers that keep the grains airtight and dry. And the container should be able to keep bugs out; I once had a customer bring in an opened 50-pound bag of pale malt that was about half full. He had stored it for six months out in his garage, and when we opened the bag, it was swarming with tiny flies. I grabbed the bag and ran for the door, to avoid contaminating the rest of the grain in my store.

Plastic bags you can seal (like a Ziploc) or rigid plastic 2- to 3-gallon containers with a sealing lid (like a trash can) are ideal for long-term storage. Uncrushed grain will store for a year in these conditions, and crushed grains will be good for two to three months. Big bags of grain usually come with a plastic lining inside. You can keep your grain in these or, to be extra careful, you can transfer the grain to airtight trash cans. This is recommended if you think you might have mice in your storage area.

Malt syrup and dry malt extract

Dry malt extract should be stored just like grains. As long as the DME is dry and sealed from oxygen, you can buy in bulk, and use it for up to about 1 year. This assumes you keep it away from sunlight and maintain the temperature between 50° and 70° F.

Liquid malt syrup is easy to store as long as it is in the original can. This is an ideal container that keeps the syrup safe from light and oxygen, and the malt is good for about two years before it starts to degrade. The manufacturer has normally also heated the syrup to pasteurize it before shipping, so it is void of bacteria, molds and yeast. Most cans have an expiration date that helps you know when it is getting old. The same temperature range (50° to 70° F) applies.

Liquid malt syrup that has been opened, or is sold in bulk plastic containers, has a much shorter shelf life. While buying malt syrup in this form is normally less expensive, it must be used in less than 3 months, or the syrup will degrade or even grow mold. If you have malt syrup in this form, the best way to store it is in the fridge. Pick the smallest possible container to eliminate airspace and avoid oxidation. While the extremely high sugar content inhibits yeast activity and molding, over a three- to four-month time period the syrup will lose its freshness.

I sell bulk malt syrup in my store, where we pour the syrup from the drum into plastic buckets. We use nitrogen to push the syrup out of the drum to prevent oxidation of the malt inside the drum, but once the syrup is in the plastic bucket it has about a three-month shelf life before it needs to be used. If you buy bulk syrup, store it in a cool location, and use in less that six weeks. If you brew on an irregular basis, I would definitely suggest buying malt syrup in the cans packed and sealed by the manufacturer.

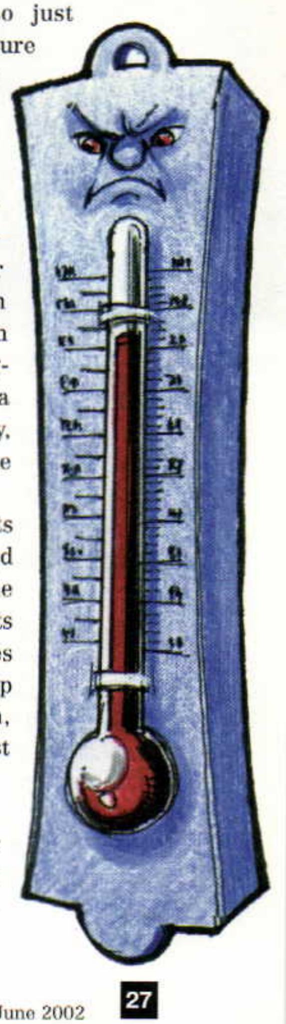
Hops

Hops are very delicate, and great care is needed to store them. After hops are picked, the hop companies store the hops at a below-freezing temperature. You should do the same if you grow your own.

Heat, light and oxygen are the big enemies of hop cones and pellets. I sell hops that are packed in oxygen- and light-barrier bags that are sealed under a vacuum. Hops stored in these bags are good for about a year if kept refrigerated. You should store your hops in your freezer to keep them fresh once opened. Try to seal them in an airtight bag, like a freezer-style Ziploc, that will effectively prevent them from absorbing any other food flavors in your freezer. I don't think hops that are freezer burned or have absorbed flavors from last month's leftovers will make good beer! You can tell your hops have freezer-burn if they smell stale.

Yeast

Yeast is probably the easiest of all ingredients to store. Simply leave the yeast in the refrigerator until a few hours before you use it. Virtually all manufacturers print an expiration date on their packages, so just watch the dates to ensure you are using yeast that will work for you.



Other ingredients

Dry ingredients like spices, Irish moss, gypsum and Burton water salts should be kept in airtight bags at room temperature. The refrigerator normally has a relatively high humidity, and is not a good place for dry ingredients.

Liquid ingredients normally are best stored in a cool dry place. The rest of your ingredients use the basic principles outlined here. If you keep your ingredients fresh, you will make the best beer possible. ■

Steve Bader owns Bader Beer and Wine Supply in Vancouver, Washington.

PHOTO COURTESY OF BRIESS

grow YOUR GRAINS

By Joe and Dennis Fisher

Barley is an easy crop. Like hops, it is ordinarily grown commercially, so it may seem strange to think of it in a garden. But barley, also like hops, is a great plant for small settings. A homebrewer can get a lot of satisfaction out of growing even a fraction of his own barley. Barley grows fast and well, is highly ornamental, and is useful in many ways. And there's nothing quite like handing someone a homebrew and casually mentioning, "Oh, and I grew the barley."

Malting barley comes in two varieties, two-row and six-row. This refers to the number of rows of grain on the barley head. It has pretty significant consequences for beer. Six-row barley tends to be smaller-grained, less starchy and more highly enzymatic than two-row. It is commonly used in making American-style high-adjunct beers, because it can easily convert unmalted starches in such ingredients as corn and rice. Two-row tends to be plump and starchy and more conducive to making all-malt brews.

In many parts of the country, including the East Coast, six-row barley varieties grow best. The Midwest mostly grows six-row. Commercial two-row production is limited to the milder climates of the Pacific Northwest and the Great Plains. However, more and more two-row barley is being grown around North America, with new cultivars being introduced to replace old standbys like Klages and Harrington.

Selecting the right barley variety

To find a local source of seed, talk to feed and seed stores, farmers, the Cooperative Extension, and your local land grant university. (These are all also good sources of information on successfully growing barley in your region). Also look at smaller, local seed companies, because many of these have started to carry barley, and these seeds may be especially well-adapted to your area. Many gardeners are now growing barleys as ornamentals or cover crops. The catalogs do not always say whether or not an offering is a malting barley, but you can always e-mail with questions or do some research on your own.

When we first got interested in growing our own barley, not that long ago, there were no retail sources of seed. We were also not in a barley-growing area (we live in Maine), so good seed was hard to find. That's all changed. In the last few years potato farmers in northern Maine have started to grow barley in rotation with their potatoes. Now some organic farmers have begun shipping barley to Fedco seeds along with their seed-potato shipments, so there's lots of organic barley to be had, though all of it is one cultivar, "Robust." This is not a problem because Robust is a good barley, well-adapted to our climate. A 1983 release from the University of Minnesota, this barley is fairly tall, fast-growing and very productive. It has excellent enzymes, making it a good malt to use with adjuncts.

You can also turn to seed-saving organizations to find old strains of barley that you can conserve yourself. A lot of these antique cultivars have worthy traits that have been bred out of the new hybrids. These organizations

A beginner's guide to raising a bit of barley in your own backyard.

usually offer only enough seed to get you started. You may have to grow out the seed for a few years to get enough for a full-blown crop.

If you live in a mild climate, you could try fall planting some of the traditional fall varieties, which are usually called "spring barley" since it's harvested the following spring. We've never done this, since no barley will survive the winter here. You should aim for the plants to make no more than a few inches of growth before they shut down for the winter.

As a last resort, the whole barley you find in bins at the health-food store will germinate. Just sow it thickly to allow for low germination rates.

Getting the ground ready

Only you can know how much of your garden you want to turn over to barley. We always favor starting small with any new project. But you should at least grow enough to make it worth your while, so shoot for at least a 10 by 10 foot bed or the equivalent in square feet, which may yield you 5 to 15 pounds of grain. This will give you plenty of grain to experiment with.

Barley likes a very fine seedbed, loamy soil and plenty of sunlight. It does not like acidic soil, that is, soil with a very low pH. If you have doubts, get your soil professionally tested. It should be 6.0 or higher. If not, amend the site with lime. Ideally, this should be done the fall before you plant. At the same time you can throw down some compost or well-rotted manure.

Barley will do well in poor soils but needs phosphorus and potassium. Adding rock phosphate and greensand will help improve these nutrients in the soil but they don't work very fast. Too much nitrogen in the soil will produce excessive protein in the seed and malting qualities will be poor. This is only really going to be a problem for people who use a lot of chemical fertilizers.

As soon as you can get on the ground in the spring, fork up the barley plot and get the soil prepared. Now you are ready for planting.

Planting the seeds

Planting should be done as soon as the ground can be worked in the spring, about the same time you plant your peas. Around here that means the end of April, for a late July harvest. This means that the whole growing cycle takes place in the relatively cool spring and early summer, which is what barley likes.

Barley is sown at a rate of 60 to 90 pounds per acre, which translates into about a half-pound to 3/4 pound per 10 x 10 foot plot. You can calculate how much you will need by pacing off the area and doing the math. Measure your own pace and multiply by the length times the width of your plot to get square footage, and divide by 100. For larger plots, use 3 pounds per 1,000 square feet.

The simplest way to plant grain is just to scatter it on the ground. Get a big coffee can, fill it with grain, and just walk along, pitching the grain ahead of you, using a twist of your fingers so the grain spreads in a nice pattern. You are aiming for about one kernel per inch. This is called broadcasting and it's a cheap, efficient method. We still plant this way sometimes. It's especially fun to get a half dozen people ranged across a field every ten feet or so, all with their bags of grain, each trying to outpitch the others. We also use a broadcast seeder, which has a hand crank and throws seed in a twenty-foot cloud.

After seeding, it's a good idea to rake in the grain, to get better soil contact and cover at least some of the seed so the birds won't find it.

Weeds

Weeds are the bane of any grain crop. It's difficult to stop weeds from competing with grain plants, especially when the grain has been broadcast. When the plants get large enough you can pull them out by the roots, but by then the damage is done. Weeds steal water, nutrients and space, and are a nuisance at harvest time. They not only effect the present crop, but they will spread seeds through the next one.

On a commercial scale, which is usually the only way grain is grown, weeds are stopped with herbicides. Organic farmers use flame weeders and crop rotations and aggressive cover cropping to kill weeds. There are also specialized mechanical cultivators that will work on grain crops. Needless to say, you probably can't or won't want to use any of these options. Luckily, barley is a pretty good competitor itself and given half a chance will outgrow most weeds.

Brad Hunter, a homebrewer from Appleton, Maine, has tried a few different strategies on his raised barley beds to thwart weeds. The first year he says he sowed "with a heavy hand. I used a broadcast strategy, hoping the aggressive barley growth and thick sowing would choke out weeds. This worked pretty well, but I still had some weed problems and it was difficult to hoe or hand-weed because of the density."

The following year he tried growing four different varieties in straight double rows, spaced six inches apart, hand-seeding the individual varieties in the rows. "Because of the row design and spacing, this time I was able to weed very effectively by hand and with a hoe," he says. "I kept the whole plot virtually weed-free all season." Brad also found that the crop was less likely to "lodge" (fall over) when planted the second way.

If we knew we were going to grow barley on a plot in a year's time, we would throw down lime, greensand and rock phosphate, and grow two heavy buckwheat cover crops to smother weeds, tilling the first one under at flowering time and then planting the second on the residues. You will get far fewer weeds this way, and the buckwheat will take up nutrients from the rock powders and hold them for your grain crop. Your barley crop the following summer should surpass all records.

Pests and diseases

We've never had much trouble with diseases or insect pests in our barley crops. There are maybe a half-dozen important barley diseases, the worst of which is smut. Rotate your crops frequently, feed your soil and watch the pH, and you should have few problems. If you suspect your barley is diseased, contact the local ag extension for advice.

On the other hand, birds may drive you nuts. In our area the reintroduced wild turkeys love grain and sometimes come forty strong, poults, hens and toms as big as armchairs. They can put away a lot of grain in a short time, and they're relentless. Yelling and waving your arms works pretty well — so does a dog that hates turkeys.

Barley is highly ornamental and grows fast and well. Plus, there's nothing like handing someone a beer and saying, "I grew the barley."

Irrigation

The variety we mainly grow, Robust, stands up well to drought. This is generally true of six-row types. You shouldn't have to water the plants at all, unless you are having a very dry spring. With two-row types, they tend to appreciate more water and may need irrigation as the heads emerge, to help the kernels plump out. This is why most two-row today is grown in irrigated plantations. Water is important because barley grown during a dry season will have higher-than-normal protein levels.

Harvest

About ninety days after planting, your barley will be ready to harvest. The straw will be brittle and golden in color. A peeled kernel should be a little difficult to dent with a fingernail. If you waited a little longer than this, there's no problem.

The best tool to cut grain on a very small scale is a sickle — not the kind of heavy bush sickle you can still find in some hardware stores, but an old-fashioned grain sickle. These have a narrow, wicked-looking blade like a bent metal ribbon. If you find one of these, buy it, no matter what the condition. We have also heard of people using Japanese hand sickles and European-style scythes to cut grain. As a last resort, a pair of garden shears will work, but won't be much fun.

As you cut the grain, lay it in bundles all going the same way, and then tie these into sheaths. When you have about eight or ten of these, stand them up into small piles called stooks, with most standing up and a couple laid across the top. Leave these out in the sun and wind for one or two weeks to thoroughly ripen and dry.

Threshing

Threshing is beating the grains off the straw with some kind of tool. It works better with some barley varieties than with others, and the riper the grain, the easier it threshes. Traditionally a flail was used, and you can easily make your own flail by using two 1-1/4 inch diameter sticks, a long one (4 feet) for the handle and a short one (2 feet) for the flail.

Drill a hole through each stick near one end. Tie them together with a loop of strong, new boot lace. We use a big piece of heavy army canvas for our threshing floor. We spread it on the ground, lay a sheath in the middle, and flail away.

Most people just beat the grain with an overhead smash. A more elegant method is to hold the handle with widespread hands and spin the flail section like a propeller, impacting the grain more lightly with each stroke. You can also use a plastic baseball bat as a flail. I've also heard of people using a clean garbage can as a threshing machine. Beat the sheath over the edge of the can so the heads come loose and fall into the can. Brad Hunter uses a broom handle and a sheet of plastic to do the job, and follows up with winnowing to get rid of the chaff. Just pick a windy day (or use a fan), and pour the grain back and forth between two pans until the unwanted awns, husks and bits of straw have blown away.

Grain can be stored in any cool, dry place, free from rodents. A grain bag makes good storage but rats or squirrels will make short work of it.

Malting

Home-grown barley is very easy to malt, especially on a small scale. One method we've used successfully is to soak a few pounds of grain in cool water overnight. Before you soak the grain, clean it and weigh it. You'll need to know this weight later.

After you've soaked the barley, drain it into a large steel colander and keep it covered with a damp cloth to keep it from drying out. Ideally, you should germinate your grain in a dark room at about 50° F. Stir the grain at least a few times a day. If you don't do this, heat and carbon dioxide will build up and suffocate the grain.

Expect white rootlets to form from the blunt end of the grain on the second or third day. The acrospire, or shoot, can be seen growing beneath the skin of the grain. (If you can't see the acrospire, simply slice open a few barley grains to see how germination is proceeding.) As the acrospire grows, starches in the grain endosperm become modified by enzymes for use as food by the barley plant.

When the acrospire is as long as the grain, it is fully modified. Now it's time to stop the acrospire growth by "couching" the grain. To do this, transfer the grain to a large bowl and keep it covered with a lid for a few days. This stops acrospire growth by limiting its access to oxygen. Be sure to turn the germinating grains once a day, otherwise the heat and carbon dioxide will kill the barley. When the grains have stopped growing, kiln them.

Kilning

Small amounts of finished malt can be kilned (or dried) in an oven at the lowest setting, in a food dehydrator, or in a specially constructed "oast." *(To learn how to build your own oast, check out the plans in our book, "The Homebrewer's Garden," published in 1998 by Storey Books.)* Ovens are convenient, but often lack the kind of exact temperature control needed to produce a high-quality pale malt. Still, an oven works perfectly well for a small amount of malt. A few pounds of malt will dry thoroughly in an oven in 12 to 24 hours. (The time it takes to dry a batch of malt depends on how wet the malt is, and how much grain you are malting.) Leave the oven door open a bit to allow air to circulate. You know the malt is dry when it weighs the same as it did before you started steeping it. *(For more specific instructions on malting, see "Make Your Own Malt" on page 32.)*

Roasting

Kilned malt can be roasted in a regular oven to produce various specialty malts *(see sidebar at right)*. Kilned malt can also be used in a pale, unroasted state, but don't expect the same results that you'd get from a commercial pale malt. You'll need to experiment to find the correct mashing temperatures and procedures that work best with your own malt.

Homemade malt should be roasted in a jelly roll pan, in a layer no more than 3/4-inch thick. Stir the malt often to prevent burning. Homemade malts should be kept in a sealed, airtight container for a few days before brewing, to let the grain mellow and prevent potential off-flavors. Once it's ready, fire up the brewpot and whip up your first batch of My Malt Ale! ■

Joe and Dennis Fisher are the authors of "The Homebrewer's Garden," "Brewing Made Easy" and "Great Beer from Kits" (all published by Storey Books). Their most recent articles for BYO include "Beyond Hops: Brewing with Herbs and Spices" (Summer 2001) and "Grow Your Own Hops" (April 2001).

A GOOD WAY TO GROW

Will Bonsall of Khadigar Farm in Industry, Maine, grows barley for his own use and also conserves 62 varieties for the Seed Savers Exchange and his own Scatterseed Project. His method of growing makes a lot of sense for small acreages. Will grows barley in 40 x 40 plots. He lays out the rows with string, about six inches apart, and does the planting with a Planet Jr. push seeder, about one seed per inch in the rows.

He cultivates between the rows with a hand hoe, and when the grain is a few inches tall he mulches the bed with ground-up leaves. These are stored dry the year before in bags. The mulching prevents weeds and water loss. The grain has no problems sending up tillers (shoots) through the mulch. Will minimizes weeds by rigorous cover cropping and never letting any weeds go to seed.

We've used a Planet Jr. to grow grain and the method works well. It's a lot slower than broadcasting, but the birds can't get to the seed (it's buried) and it all comes up. Germination is very consistent, because you get the kernels down into the moist earth. The cheaper Earthway seeder might also work, but none of the standard seed plates I've tried are suitable for barley. You would have to try modifying a plate (the spinach plate looks pretty promising) or else get the company to make you a barley plate.

ROASTING SPECIALTY MALTS

Toasted malt: Roast dry, kilned malt at 350° F for 10-15 minutes until golden and aromatic.

Munich malt: Roast dry, kilned malt at 350° F for 20-25 minutes.

Crystal malt: Start with "green" unkilned malt that is still wet. Kiln it at the lowest setting until almost dry. Raise the oven temperature to 200° F and roast for 1 hour. Raise the temperature to 350° F and roast 1.5 to 2 hours until the malt is dry and golden-brown in color.

Vienna: Roast dry, kilned malt at 220° F for 3 hours.

Roasted barley: Start with dry, unmalted barley. Roast it at 400° F about 1 hour and 10 minutes.

Black patent malt: Roast dry, kilned malt, spread in a thin layer, at 350° F for 1 hour and 20 minutes. Stir often. Expect some smoke!

MAKING MALT Step-by-step instructions for malting your own barley at home.

PHOTOS COURTESY OF JON STIKA

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.

I began homebrewing in 1992 with malt extract and a plastic bucket for a fermenter. I went through the typical progression of many homebrewers: steeping grains to add to my extract, mashing all-grain batches and even growing my own hops. But brewing is not just a hobby for me — it is a passion. I am also a born do-it-yourselfer. I could not rest until I had covered the brewing process from the ground up. I just had to make my own malt.

Growing barley is obviously the first step in making malt. I have planted, weeded, cultivated, irrigated and harvested any number of crops (including barley) on the farm. I'm sure one could make serviceable malt from practically any barley, but there are several varieties that are particularly suited to making quality malt. Some of the more prominent varieties include Klages, Excel, Robust, Harrington and Stander. I make my malt from Robust six-row barley grown by friends who farm here in North Dakota.

I usually make malt in four-pound batches because that's how much grain fits on my two big roasting pans and then fills all the trays in my food dehydrator. After considerable study and experimentation, what follows is my low-tech but successful approach for making malt at home.

Steeping the Barley

Start by steeping barley in cool (50° F), hard (or at least not softened) water for eight hours, preferably with an aquarium aerator or trickle of water running in the bucket to replenish oxygen. (One traditional method of steeping barley was to put the grain in a coarse-woven bag and hang it by a rope in a cold-running stream.) Drain off the water and let the grain rest in the bucket for eight hours in a cool (50° to 70° F) place.

Steep the barley again for eight more hours, then drain off the water and check the moisture content. After steeping, the barley should be about 45% moisture (23 ounces of wet barley for each starting pound of dry).

Spread the grain about 3/4-inch deep over a single layer of paper towels on shallow roasting pans or cookie sheets. Place the pans inside black plastic trash bags with the end folded under the pan to hold in moisture.

Germinating the Barley

"Modification" is the term maltsters use to describe the process of barley germinating and releasing enzymes that begin to break down the hard interior endosperm into starch molecules. Well-modified barley with good enzymatic power is our goal.

Once the steeped grain is spread on the pans and tucked in bags, let it begin to sprout in a 45° F to 50° F place. The grain will be generating some heat as it comes to life and respires at a much higher rate than when it was dry and dormant. This is why it should be kept cool. The layer of grain should be approximately 55° F.

The shoot or acrospire will grow under 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.

You may not be able to see the shoot growing under the husk unless you take a kernel and cut it open with a razor-sharp blade. I do this once or twice daily to check how the sprouting process is coming along. The sprouting (malting) process will usually take 3-5 days after the steeped barley is spread on the pans. This is a very important thing to monitor.

During the time the barley is sprouting it is important to stir the grain twice daily for aeration (to deter mold) and to loosen tangled rootlets. It is also important to moisten the grain as needed to keep the roots tender and germination proceeding.

I usually do the moistening with a hand-operated spray bottle filled with cool tap water. Remember that we want moist grain, not soggy grain. Do not keep the germinating grain so wet that mold develops. The idea is to replace water lost to evaporation and water consumed by the growing seed, not to increase the moisture content over the initial post-steep level.

Modification is complete when the shoot is between 3/4 and the full length of the kernel of grain. By the time you see the first white shoot tips poking out of the end — the end opposite that where the rootlets have already grown to considerable length — most of the remaining kernels will be fully modified. By this stage, there will probably be four or five rootlets.

I test for adequate modification by biting a few kernels to see if they are crumbly inside, from the base of the kernel where the roots appear, all the way to the opposite tip. To do this, 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. An unmodified part of the kernel will still be hard and resist crushing.

Drying the Barley

Drying stops the sprouting process at the critical point when the endosperm has been converted to starch and the enzymes necessary for converting starch to sugar (maltose) have been produced.

Initial drying must be done with care. If you dry the malt at too high a temperature you will deactivate the enzymes (and therefore the starch won't convert to sugar during mashing). Don't dry the moist, malted barley at a temperature no higher than 125° F until it has dried down to 10% moisture or less. At less than 10% moisture, the enzymes are preserved because there is not enough water for them to be compromised. Remember, we want the enzymes intact for use in the mash later on.

With this in mind, dry your malt at a temperature of 100° F to 125° F in a food dehydrator, or in pillowcases tied shut and run in a clothes dryer. My dryer set on "delicate" runs at about 125° F. Dry the malt until it contains 10% moisture. You can tell the moisture content is 10 percent when the malt weighs about 17.5 ounces for every pound of barley you started with.

If you plan on making malt more than just a time or two, I strongly suggest investing in a large food dehydrator with a temperature control. In an early attempt at drying malt, I had a pillow case develop a hole in a seam and had to disassemble the clothes dryer to clean up the resulting mess!

After 10% moisture is reached, continue the drying process at 140° F to 160° F until the malt is at or below 6% moisture. This will be a little less than 17 ounces for each pound of barley you started with. The entire drying process will take six to eight hours in a food dehydrator or several cycles in a clothes dryer.

Kilning the Malt

Kilning your dried malt develops the final character and flavor before you use it to make beer. Kiln your malt at 170° F to 190° F for four hours for basic pale malt. I usually do this by spreading the malt on roasting pans or cookie sheets and putting them in the oven on "warm." If your oven runs a little too hot even on the "warm" setting, you may have to prop the oven door open slightly with a wooden spoon to prevent overheating. An oven thermometer can be placed on the pan of malt to monitor the temperature.

After kilning, allow the malt to cool, then shake it on a sieve that will retain the malt and allow the dried rootlets to fall through. (The dried rootlets tend to clog the narrow opening of my malt mill and can also give the resulting beer a funky taste.) Store the finished malt in a cool dry place until you are ready to crush it for your first batch of homebrewed beer made with homemade malt! ■

Jon Stika is an agronomist and soil quality instructor with the Natural Resources Conservation Service, serving western North Dakota from Dickinson. This is his first BYO article.

Raw malt in the food dehydrator.

Dried malt with rootlets still intact.

Sieving to remove rootlets from dry malt.

Kilning malt in the oven.

Like tinkerers endlessly attempting to build a better mousetrap, homebrewers are on a boundless quest to brew better beer. Not just to brew better beer, mind you, but to brew that beer quicker, easier and cheaper. Borrowing a page from the Olympics, whose official motto exhorts athletes' efforts to achieve "Citius, Altius, Fortius" (swifter, higher, stronger), I am proposing a new motto that homebrewers can adopt as their own: "Rapidius, Facilius, Frugalius."

This article is designed to provide tips and ideas and to suggest gadgets and methods to help brewers save time — and a little bit of money. These goals can't always be accomplished simultaneously; you often have to find a happy medium. Sometimes it takes time and effort to save money and sometimes it takes money to save time and effort. Each individual brewer has to decide which of these takes a higher priority.

In my experience, homebrewers tend to be a thrifty lot. Some may be this way out of fiscal necessity, but an equal number seem to enjoy the sheer joy of frugality. Who hasn't experienced the "thrill of the hunt" when browsing for useful brewing items at garage sales or thrift shops?

Likewise, homebrewers tend to be an inventive lot. I know many brewers who have become electricians, welders, mechanical engineers — even microbiologists — in their unceasing quest for better beer. An untold number of erstwhile garages and basements have been converted to workshops and laboratories in this same pursuit. Numerous Rube Goldbergian contraptions have been cobbled together to convert that last bit of starch and extract that last bit of maltose, to decrease lag times, to heat the wort up fast and cool it down faster.

The commonsensical approach seems to be to follow the typical sequential steps required to brew a beer, so let's start at the beginning.

Sanitize, Sanitize, Sanitize

There is no single effort in brewing good beer that is more important than proper cleaning and sanitizing of your brewing equipment. Anything that comes in contact with your beer must be free of contaminants, both seen and unseen. The "seen" contaminants (dust, dirt, grease, organic matter) are removed by cleaning the equipment; the "unseen" or bacterial contaminants must be killed off during sanitizing procedures. These are two separate activities; cleaning usually requires the application of a little cleansing agent and a lot of elbow grease. Sanitizing is usually accomplished with a simple soak in water and the anti-bacterial agent of your choice.

Hints and Tips:

• A lot of the pre-brewing cleaning effort can be minimized or negated by good hot water rinses and sanitizing soaks immediately following the use of each piece of equipment. After the equipment is dry, cover items in large plastic garbage bags and seal them completely. This will keep most, if not all, visible contaminants away from your equipment — but this will not free you from following sanitizing procedures before brewing your next batch.

• With regards to sanitizing, the two most important data points are dilution rates and contact times. Dilution rates change depending on which sanitizer is being used and contact times vary greatly. There are a number of effective sanitizers on the market; always read directions for proper use. If saving time is your goal, I'd go with a "no-rinse" sanitizer like One-Step.

• Having a short length (4 to 5 feet) of old garden hose hooked up to my utility sink faucet is a real plus. You might even want to attach a threaded female end to the hose and add a lawn and garden type spray gun to control water flow and pressure.

• If you don't already own a jet-spray bottle washer or carboy washer, I highly recommend getting one. These gizmos are automatically activated when a bottle presses down onto the unit, sending a high-powered stream of water blasting against the glass. If you want to maximize your rinsing efforts and minimize the time it takes you to do this, get one now!

Just Buy It

Before you can brew a beer, you need to get the ingredients needed to brew the beer. While this may sound obvious, you'd be surprised how many brewers have had to make second trips to the store to grab that lousy two-dollar item they forgot to pick up.

Another common mistake made among new brewers is the unthinking use of old and outdated product. We all know that liquid yeast has a limited shelf life, but so do hops, grains and even malt extracts. These are all organic materials and they are all subject to eventual decomposition. If you don't brew often, only buy what you need at the time. If it's more economical to buy in bulk, be sure whatever it is you buy is properly stored *(see "Shelf Life" on page 26)*.

Hints and Tips:

• Before trudging off to your local homebrew supply shop or browsing your favorite homebrew supply Web site, consider taking inventory of what you have and writing down those things you need. Don't just focus on the primary consumable ingredients — the sanitizer, acidifier, clarifier, nutrient, priming sugar or bottle caps may not be listed in the recipe, but they may be just as important to the finished product. Create an all-inclusive checklist and make copies of it for routine use.

• Give your beer a fighting chance at greatness. If your extract is beyond its freshness date, dump it! If your grain looks, smells or tastes moldy, toss

PHOTO BY CHARLES A. PARKER/IMAGES PLUS

beer MADE EASY

simplify your brew day and make beer the no-hassle way with these slick tricks, tips and simple techniques.

by MARTY NACHEL

shop talk: tips from retailers

Use a small fountain pump to re-circulate ice water through a standard copper-coil wort chiller. In the summer months, when tap water temperature is near 80° F, this will reduce brew time by more than one hour!

Mark Mallory,
Lubbock Homebrew Supply
Lubbock, Texas

Use a "jet" bottle and carboy washer to start a siphon. After sanitizing your tube and racking cane, hold the tube on the jet and press down, using your hand to form a seal. The pressure from the jet will force water into the tubing. This will rinse the tube and cane quickly. Then clamp the tube to trap water inside. Re-sanitize the end of the tubing that was on the jet. The water trapped inside can then be used to start your siphon. Just place the cane in the beer, lower the flexible tube and open the clamp!

Wil Kolb
The Beer Man
Mount Pleasant, South Carolina

Motorize your malt mill! Most mills can be motorized easily by using a standard household drill and the proper attachment, which either comes with the mill or can be ordered through almost any homebrew store. The drill attaches to the mill like any drill bit. Five pounds of grain goes through my JSP mill in under a minute by using the drill. It would take significantly longer, and a lot more effort, to turn the mill by hand. And all-grain brewers shouldn't even think about trying to crush 12 pounds of grain or more with a rolling pin!

Bill Wible
Brew By You
Philadelphia, Pennsylvania

I save packaging time by bottling only half my batch, then putting the remainder into two 5-liter mini-kegs. To do this, first I add 1/3 cup of priming sugar (dextrose) to a bottling bucket with all of the beer. Then I fill the mini-kegs. Next I add an additional 1/4 cup priming sugar to the bucket and fill 24 12-ounce bottles.

Bob Henderson, The WeekEnd Brewer
Home Beer and Wine Supply
Chester, Virginia

Stand cans of extract in hot water for a few minutes before adding to the brewpot. This thins the extract and makes it much easier to pour, which saves time and exasperation.

Bill Wible
Brew By You
Philadelphia, Pennsylvania

Attach a new fishing bobber to weighted dry hop bags in a keg. The bobber sits on top of the beer and allows you to easily remove the dry hops from the keg when enough aroma has been imparted to the beer. Be sure to sanitize the bobber before using it!

Mark Alston
The Beer Nut
Salt Lake City, Utah

Don't bottle! Try using mini-kegs with a portable 12-gram gas unit. You need the newer mini-kegs with the pull-out spout on the bottom. Four of these hold five gallons of beer. You can move the tap easily from one keg to another without losing any gas. One tablespoon of priming sugar is enough to prime each keg.

Anne Whyte
Vermont Homebrew
Burlington, Vermont

I put 8 pounds of purified ice straight into my plastic fermenter, pour the wort on top, top it up with preboiled water and stir. This cools the wort to 80° F almost immediately.

Suzanne Wallace-Swint
Brewstuff
Bryan, Texas

Here's a fast and easy way to clean your bottles: Cut the loop off the end of a regular bottle brush, then insert the brush into a cordless drill. Bam! Motorized bottle cleaning!

Bret Kuhnhenn
Kuhnhenn Brewing Co.
Warren, Michigan

Want my tip on how to make lots of predictably good beer with minimum effort? Get a tube of some reasonably versatile liquid yeast (Wyeast 1056, 1028, 1098 or the comparable White Labs numbers) and two packages of a brand-name dried yeast.

Make a batch of beer with the liquid yeast and start it in a plastic bucket. Four to five days after the start of fermentation, rack off the beer into a carboy. Taste the beer for any sign of yeast-related problems. Assuming there aren't any, start another batch of beer the same day, repitching the yeast from the primary. Four to five days later, transfer batch two to the secondary, check the beer for any signs of contamination, and start batch three.

Of course, if you're brewing every four to five days, you can't brew solely on the weekends. So some of your batches may have to be "easy beers" (prehopped kits), brewed to keep the yeast running hot. Fear not! These beers will turn out great, and keep your yeast in tip-top shape for when you want to brew that all-grain barleywine.

The secret here is that the typical brewer tries to make the yeast fit his or her schedule instead of vice versa. Pitching yeast when it's at its peak of activity eliminates lag time and minimizes chances for infection. Add this to the huge amount of yeast available when repitching and you will have trouble making a bad batch of beer.

What about the dried yeast? Use it to substitute for the liquid yeast sediments in case you detect signs of contamination. Pitching two packets will give you a faster start and fewer lagtime-related infection problems.

Paul Dyster
Niagara Tradition Home Beer & Wine Supplies
Buffalo, New York

it! If your hops are brown, wilted or smell like cheese, get rid of 'em! When it comes to ingredients, brewing good beer is little different than preparing good meals — freshness counts. A bad batch of beer, brewed from old ingredients, is the biggest possible waste of your brewing time.

For extract brewers

Beer kits — which include a can of prehopped extract and a packet of dried yeast — offer a great way to master basic brewing techniques. But once you're comfortable with your skills, experiment with some new ingredients. Start with the palest unhopped malt extract available. Whatever color and grain flavor is required by the beer style can be derived from specialty grains such as crystal malt, chocolate malt and roasted barley.

Hints and Tips:

• Consider using dry malt extract (DME) instead of liquid malt extract (LME). Unlike LME, DME can usually be purchased by the pound and in any quantity and it has a longer shelf life.

• Your beer's hop character — bitterness, flavor and aroma — can be tightly controlled by the use of appropriate hop varieties and quantities added in stages to the brew. Did you know that there are three different ways to increase or decrease hop bitterness in your beer? Try using a greater or lesser quantity of the specified hop variety called for in a recipe, switch to a different hop variety with a higher or lower alpha acid content, or simply adjust the timing of the hop additions to the wort.

• If you are not particularly knowledgeable on the subject of beer styles or need some help in recipe formulation, consider buying one of the recipe formulator software programs regularly advertised in homebrewing publications *(see BYO, March-April 2002)*. These program offer a quick way to expand your skills and get comfortable with recipe formulation.

Just Brew It

So now it's brew day ... your equipment is clean and sanitized, your ingredients are at hand. What's the best course of action? Regardless of whether you are an extract or an all-grain brewer, you need to get some water boiling on the double. Extract-only brewers need little more than a good rolling boil in their brewpot, while extract and specialty grain brewers need a pre-boil steeping temperature of about 150° F for their specialty grain. All-grain brewers should be working towards strike temperature.

Hints for extract brewers:

• Always use the largest-volume brewpot available, preferably one made of stainless steel or (chip-free) enamel-coated metal. The goal here is to boil as much of your wort as possible. Full 60-minute boils are recommended to cause precipitation of the proteins and resins in the wort (called "hot break") as well as to more fully dissolve the hop alpha acids (called "isomerization") that bitter your beer.

• Save time by steeping all of your specialty grains in a separate, smaller pot while the brewpot is brought to a full-out boil. And rather than steeping your specialty grain in a grain bag, consider steeping the grain loosely in a pot. This allows you to stir the grain, which increases water-grain contact that both hastens and maximizes the steeping and extraction process. Loose grain steeping requires the use of a large colander or mesh strainer in order to strain the specialty grain "juice" off into the brewpot.

• Extract and specialty grain brewers not quite ready to try all-grain brewing might want to consider partial-mash brewing. This means deriving a portion of your wort's fermentable content from grain while still using malt extract as your beer's base. This requires you to perform all the mashing procedures done by all-grain brewers, but in a much smaller, more manageable volume. Partial-mash brewing is typically done in grain quantities of two or three pounds.

1. Start with a couple of pounds of two-row English pale malt.

2. Do a simple, basic single-step infusion mash.

30-MINUTE BREWS

By Steve Bader

Fifteen no-boil beers you can make in half an hour. Homebrewing doesn't get any easier (or faster) than this!

When you're making a batch of no-boil beer, your brew "day" will be done in 30 minutes. Fermentation takes 10 to 14 days, and you can bottle the batch in just 90 minutes. At room temperature, your beer will carbonate in another 7 days. Then it's ready to drink!

Each of these recipes makes five gallons of beer and includes the following ingredients: one "beer kit" can of liquid malt extract (the kits are pre-hopped, which is why my recipes don't call for hops); some additional malt extract, rice syrup solids or corn sugar (to boost the flavor and alcohol); one vial or "smack pack" of liquid yeast; and Primetabs to carbonate the beer in bottles.

How to make a no-boil beer

Sanitation is the most important process in brewing great beer. Everything that comes in contact with your beer must be clean and sanitary. A liquid iodophor sanitizer called BTF works well to sanitize your equipment and does not require rinsing. Simply make a solution of 1 tablespoon iodophor mixed in 5 gallons of water. Make your sanitizing solution before you start, and use it during the entire process. Hoses, carboys, funnels, spoons and airlocks all need to be sanitized; a five-minute soak in BTF will do.

Remember: Clean and sanitary are two different things. Clean means that there is no visible residue on your equipment. Sanitary means that all bacteria, mold and wild yeast are killed or neutralized. Clean your equipment after every use. Sanitize your equipment right before you use it. If you sanitize properly, you will make great beer.

1. Remove the yeast from the refrigerator and set it out at room temperature. The yeast should warm up for at least 2 hours before you add it to your beer.

2. Rinse the inside of your plastic fermenter, then sanitize the fermenter by filling it with 1.5 tablespoons liquid BTF and cold water. Fill it to the very top; the bucket should hold about seven gallons. Let it soak for 5 minutes, then dump the sanitizing solution into a sink to soak the rest of your equipment (including bucket lid).

3. While the fermenter is soaking, place the unopened can of malt extract syrup in hot water for about 5 minutes. This will soften the malt syrup and make it much easier to pour.

4. Bring about 1/2 gallon of water to a boil in a 1-gallon (or larger) pot. Pour the hot water into the sanitized fermenter. Now add the contents of the malt syrup kit and the dry sugar (or unhopped syrup) to the hot water. Stir until all of the sugar is dissolved, then top off with cold water to about 5-1/2 gallons total volume. Mix well with a sterilized spoon.

5. Check the temperature strip on the fermenter to determine the beer temperature. When the beer is 78° F or cooler, it's time to add the yeast. Shake the vial to suspend the yeast sediment in the liquid. Then add the yeast to the beer, securely place the lid on the bucket, and put the airlock in the lid. Fill the airlock with some of the sanitizing solution. Fermentation should start in about 10 to 20 hours. Ferment your beer at room temperature, about 68° F. Avoid temperatures above 72° and below 64° F.

To check for fermentation activity, look for air bubbles that push through the water in the airlock. You also can peek inside by removing the airlock and rubber cork. There should be a small layer of foam after 24 to 36 hours.

6. Sit back and relax. Fermentation should last about 10 to 14 days. But it is possible — even quite likely — for the fermentation to be shorter or longer. (Warmer temperatures cause a faster fermentation, and cooler temperatures cause a slower fermentation.) The easiest way to tell if fermentation is done is to time how fast the bubbles come out of the airlock. When at least 60 seconds elapse between each bubble (assuming the temperature of the beer has not dropped below 64°), it is time to bottle. You may wait up to 3 more weeks. This gives the beer time to mature.

7. Clean and sanitize your bottles, bottle caps, Auto-Siphon, hose and bottle filler with the iodophor and about 5 gallons of water. A 5-minute soak is adequate. Let them drip dry. (I use an Auto-Siphon from Fermtech to bottle my beer. If you don't have one of these gizmos, you can use a racking cane and hose.)

8. Gently put the full fermenter of beer on a table. Insert the Auto-Siphon assembly into the beer. Slip the bottle filler on the end of the siphon hose.

You want to separate the beer from the sediment on the bottom of the fermenter, so try not to mix up the beer when you siphon. The "sediment tip" on

shop talk

Quick disconnects make a brewer's life much simpler. Water is used for so many things in brewing! I mount the male side of the disconnect on the faucet, with a female side on all the things that require water. In my home brewery, I have quick disconnects on a jet washer, a water filter, and my wort chiller.

Chris Schiffer
Northern Brewer, Ltd.
St. Paul, Minnesota

To handle low temperatures or wild swings in temperatures during fermentation, which can ruin an entire batch (the ultimate waste of a homebrewer's time!), here's what I recommend:

a) get a large all-purpose plastic bucket that will hold your 6.5 gallon carboy and additional water.

b) visit your local aquarium store and pick up a small aquarium thermostatic water heater.

c) while brewing, heat 2 gallons of water in the bucket to your desired fermentation temperature (I prefer 62 to 65° F) by using the heater and a floating thermometer.

d) finish brewing, chill the wort, add your yeast, then place the fermenter into the bucket. The thermostat will keep the temperature right where you want it.

Phil Montalbano
Fermentation Frenzy
Los Altos, California

Using a Pyrex Erlenmeyer flask for yeast starters makes sanitation easy and reduces the risk of contamination since there is no need to transfer from a boiling vessel into a fermentation vessel. Dissolve 3/4 cup dried malt extract in 1 quart of water, mix well. Pour mixture into a 2-liter Pyrex Erlenmeyer flask and boil for 10 minutes. Careful: Once the mixture starts boiling, turn down the temperature to reduce risk of boilover! After boiling, place the stopper with a glass airlock on the flask and put it in cool water. The steam from the wort sanitizes both the stopper and the airlock. Add yeast when the flask cools to 80° F. Don't forget to add water to the airlock.

Anita Johnson
Great Fermentations of Indiana
Indianapolis, Indiana

Save time and avoid mistakes by getting organized. Check all ingredients and lay them out, from the grains and hops to water salts, Irish moss or spices. Make sure the grain is crushed and the hops are measured. Be sure the yeast pack has been activated. Lay out all your equipment and sanitize it. The kitchen should be clutter-free, with squeaky-clean countertops. When all that's done, then you're ready to brew.

Tess and Mark Szamatulski
Maltose Express
Monroe, Connecticut

3. Always keep track of the three most important mash variables: time, temperature and pH. Also, see tips for all-grain brewers below.

Hints for all-grain brewers:

• Assuming you already have the brewpot and/or mash tun necessary for mashing and boiling large quantities of grain and wort, consider increasing the BTU capacity of your heat source. This not only assures you of reaching strike temperature quickly, but it also provides you with a good, consistent rolling boil during the brewing phase.

One of the most important objectives of mashing is achieving high efficiency levels. This simply means deriving the greatest amount of soluble sugars possible from your grain. Most homebrewers hit mash efficiencies of about 65-70%; efficiency levels of 80% and better are often envied. There are a number of things you can do to boost your mash efficiency.

• Mill grain properly. A properly milled grain is one whose husk is sufficiently cracked open to expose the inner starch, but is not reduced to sawdust by over-milling.

• Be attentive to mash variables. The three most important mash variables that will affect your efficiency are time, temperature and pH level of your mash (which should measure between 5.2 and 5.4). Precise mash temperature is important because enzymes needed to make the grain's endosperm (where the maltose sugars are stored) soluble, perform differently at various temperatures. Proper timing is needed to break down and extract the maltose sugars during mashing, especially as it pertains to temperature.

• Proper sparging. Now that you've created sugary wort from the grain, you need to drain it away from the grain bed. In doing so, you want to leave behind as much of the particulate haze as possible and you want to capture as much of the wort as possible from the grain bed. Sometimes these procedures can be done in the same vessel the grain was mashed in and sometimes they require separate vessels — it all depends on your system.

Since the grain bed itself is an effective filter, brewers can re-circulate the wort back through the grain bed as they drain it off. After several quarts have been re-circulated, the wort will begin to "run clear." When the wort is no longer hazy or milky looking, you can begin to sparge, or draw off the wort. Some things that are important to remember here:

• Keep the sparge water and the grain bed at the proper temperature (sugar-laden liquid flows better at warmer temperatures).

• Don't over-circulate the wort, as it can pick up an unpleasant "husky" astringency from the grain.

Occasionally, brewers experience the frustration of a stuck sparge. This means the grain bed compresses and compacts on itself and will not allow the sparge water to pass through it. This problem can be avoided or minimized by employing a number of time-tested methods.

1. Always sparge at a steady rate; add fresh sparge water at the same rate that the wort is being drained.

2. Never let the water "channel" down the sides of your sparge vessel.

3. Always keep a shallow pool of sparge water at the top of the grain bed as well as an "underlet" or pool of water below or at the bottom of the grain bed.

4. When brewing any style whose recipe calls for a large quantity of huskless grains such as wheat or rye, consider adding yeast hulls to the grist. These flavorless hulls work in the same manner as grain husks, keeping the grain bed more porous, and therefore, more permeable by the water.

Cool It

When the boiling phase is done, it's time to start cooling down the wort quickly. You want to get your wort fermenting as soon as possible, but you shouldn't pitch the yeast until the temperature of the wort is below 80° F; 70° F is even better.

• Sink baths. Carefully move your covered brewpot to a sink large enough to accommodate your pot. Stop up the sink drain and begin filling the sink with cold water — adding ice cubes to the water isn't a bad idea. Make sure none of the water is allowed to seep into the brewpot. When the water around the brewpot gets warm, drain the sink and repeat the process as many times as is necessary.

• Wort chillers. Wort chillers can easily cut the wort cooling process in half. Wort chillers come in two types: simple immersion chillers, and the more complex counterflow chillers. Immersion chillers, made of coiled copper tube, are designed to be placed directly into the hot wort. Cold water flowing from a water source through the coil draws heat out of the wort (the resulting hot water flowing out the open end can either be collected for later use or directed down a drain).

Immersion chillers should always be thoroughly rinsed before being placed into the brewpot. By placing the chiller in the hot wort in the last 5 minutes or so of the boil, it is automatically sanitized.

Counterflow chillers, made in a variety of designs, force cold water past the hot wort, both liquids flowing in opposite directions. A counterflow chiller is used external to the brewpot, which requires that the beer be either siphoned or pumped through it.

Clarifying the Wort

If you are an all-grain brewer, you already started the clarifying process when you re-circulated your wort back through the grain bed just prior to sparging. The next three opportunities to clarify your wort are while it's still in the brewpot, and the last one is while the beer is conditioning in the carboy.

• Add an ounce of Irish moss (also called carageenan) in the last 15 minutes of the boil. Once this flaky dried seaweed is re-hydrated it becomes a coagulant, which causes proteins and other organic solids to clump together. These clumps will readily fall out of suspension with the help of gravity.

• Whirlpool the wort. When the boil is done and the wort has been cooled, vigorously stir the wort in a circular pattern. The resulting whirlpool will cause any particulate matter in the

30-MINUTE BREWS

the siphon allows you to set the gadget gently on the sediment, yet suck only a small amount of sediment into your beer. Be careful when you siphon; you want to avoid splashing the beer, which could oxidize the batch.

Start the siphon by pressing the bottle filler against the bottom of the first bottle. This will open the plastic valve. Lift up on the rigid racking cane on the inside of the Auto-Siphon about 8 inches and then pump it back down. The beer should begin flowing into the bottle.

Fill the bottles to the top with the bottle filler. When you remove the filler from the bottle, the flow of beer stops and the beer level drops to about 1-1/2 inches below the top. This is the proper level. Place the bottle filler in the bottom of the next bottle and fill them all up!

9. Clean your hands and rinse them in the iodophor solution. Then place 4 Primetabs in each 12-ounce beer bottle (or 7 in a 22-ounce bottle). Place the caps on the bottles and crimp them with the capper. Primetabs are sugar tablets; they cause fermentation to re-start in the bottle and carbonate your beer. (If you don't want to use Primetabs, you can add 3/4 cup corn sugar to the entire five-gallon batch, then bottle as described above.)

10. Let the bottles age at room temperature (65° to 80° F) for 1 week to carbonate. Then chill and drink! There will be yeast sediment in the bottle, so pour the beer into a glass in one fluid motion so you don't mix the sediment into the beer.

Light American Lager
4% alcohol (Bud, Miller, Coors)

1 4-lb. can Muntons American Style Light or Premier Cream Ale
1 lb. rice syrup solids
1 lb. corn sugar
Yeast: White Labs WLP029 (Kölsch) or Wyeast 2565 (Kölsch)
Primetabs

Dutch Pilsner
4.5% alcohol (Heineken, Grolsch)

1 3.75-lb. can Laaglander Dutch Light or Ironmaster European Premium Pilsner
1 lb. rice syrup solids
1 lb. light dry malt extract
Yeast: White Labs WLP029 (Kölsch) or Wyeast 2565 (Kölsch)
Primetabs

Pale Ale
4.5% alcohol (Bass Pale Ale)

1 4-lb. can Coopers Real Ale or John Bull Traditional English Ale
1 3.3-lb. can Coopers Light liquid malt extract
Yeast: White Labs WLP005 (British) or Wyeast 1098 (British)
Primetabs

India Pale Ale
5.5% alcohol (Bridgeport IPA)

1 3.75-lb. can Coopers India Pale Ale or Muntons India Pale Ale
3 lbs. light dry malt extract
Yeast: White Labs WLP001 (California) or Wyeast 1056 (American)
Primetabs

Australian Draught Lager
5.5% alcohol (Fosters)

1 4-lb. can Coopers Draught or John Bull Australian
1 lb. rice syrup solids
2 lbs. corn sugar
Yeast: White Labs WLP029 (Kölsch) or Wyeast 2565 (Kölsch)
Primetabs

European Pilsner
4% alcohol (Becks, Saint Pauli Girl)

1 3.75-lb. can Coopers Pilsner or Muntons Premium Pilsner
1 3.3-lb. can Coopers Light
Yeast: White Labs WLP029 (Kölsch) or Wyeast 2565 (Kölsch)
Primetabs

Extra Special Bitter (ESB)
4.5% alcohol (Redhook, Fullers)

1 4-lb. can Coopers Bitter or Muntons Old English Ale
1 3.3-lb. can Coopers Light
Yeast: White Labs WLP002 (English) or Wyeast 1968 (Special London)
Primetabs (use 3 per 12-ounce bottle for "cask-conditioned" beer)

British Bitter (Ordinary)
3.5% alcohol (Adnams Bitter, Boddingtons Bitter)

1 4-lb. can Coopers Bitter or Muntons Premium Bitter
1 lb. light dry malt extract
Yeast: White Labs WLP002 (English) or Wyeast 1968 (Special London)
Primetabs (use 3 per 12-ounce bottle for "cask-conditioned" beer)

Amber Ale
4.5% alcohol (Fat Tire Amber Ale, Alaskan Amber)

1 4-lb. can Coopers Real Ale or Ironmaster Imperial Pale Ale
1 3.3-lb. can Coopers Amber
Yeast: White Labs WLP005 (British) or Wyeast 1098 (British)
Primetabs

shop talk

Empty a glass carboy quickly — and eliminate the risk of implosion from the vacuum that's created by liquid flowing out. Here's how to do it: Insert a racking tube cane into your inverted carboy to equalize the pressure in the carboy. The equalized pressure keeps the carboy from imploding and allows the liquid to empty smoothly, rather than glug out of the carboy.

Anita Johnson
Great Fermentations of Indiana
Indianapolis, Indiana

Keep a bottle of Star-San sanitizer around the brewery to sanitize mouths of carboys before siphoning or an emergency airlock and stopper when they become filled with krausen during a vigorous fermentation. A bottle of liquid hand sanitizer in the brewery is a quick way to sanitize your hands.

Jason Harris
Keystone Homebrew Supply
Montgomeryville, Pennsylvania

Steep your grains while you are bringing your water up to a boil for an extract batch. Remove the grains when the water reaches 170° F. It generally takes more than 20 minutes for the water to reach 170° F, which is ample time to get the color and flavor out of the specialty grains.

Olin Schultz
Beer, Beer and More Beer
Concord, California

Mark a dowel rod for the desired volume of liquid wanted in the brew pot at the end of the boil. With about 15 minutes left in the boil, measure the water level with the dowel rod and top up the kettle to account for any evaporation. This eliminates low volumes, running to the store for bottled water or boiling water later to top up the carboy to 5 gallons.

Anita Johnson
Great Fermentations of Indiana
Indianapolis, Indiana

All-grain brewers can save lots of time by overlapping parts of the process. Heat sparge water during the mash so that sparging can begin immediately upon completion of the mash. Begin heating the boil kettle when there are at least 2 quarts of run-off in the kettle to enable a full boil at the end of the sparge. Extract brewers can save time by boiling the extract and enough water to make up 1.5 gallons for 15 minutes to sanitize. Put the wort into a plastic primary and add preboiled, chilled water to a final volume of 5 gallons. This will drop the temperature almost immediately to 75° to 80° F, and you're ready to pitch the yeast!

Paul Zocco
Zok's Homebrewing & Winemaking Supplies
Willimantic, Connecticut

brewpot to collect in the relative calm in the center of the pot. By gently siphoning the cooled wort from the brewpot into a fermentation vessel, you can leave most of the hot break and hop solids behind.

• Strain the wort. Remember the mesh strainer that I mentioned earlier? Here's where it serves a dual purpose. Rather than siphon the wort from brewpot to fermenter, I prefer to pour the cooled wort through the strainer directly into the fermenter. By doing so, I accomplish two things — I am able to strain most of the hot break and hop solids out of the wort, while at the same time I am aerating the wort in preparation for fermentation.

• Add clarifier to wort in the carboy. Isinglass (in powdered and liquid form), gelatin, polyclar and bentonite can all be mixed with water and added directly to the carboy (liquid isinglass need not be hydrated). These finings are added after fermentation.

Pitching Yeast

After sanitizing, proper pitching of the yeast is perhaps the second most important thing you can do to make good beer. Regardless of how well you sanitize your equipment and how good your recipe is, if your beer doesn't ferment quickly and cleanly, it may all be for naught.

Hints and Tips

• Quantity (volume). Of primary importance is the amount of yeast pitched. Suffice it to say, more is always better. Under-pitching of yeast can lead to a host of problems, starting with long lag times. If you currently use dry yeast, consider using those brands that are packaged in 11 gram packets as opposed to those in 7 or 8 gram packages — or use two of them. If you are using liquid yeast strains, pay close attention to expiration dates. According to the manufacturers, most ale yeast is considered good for 4 months after the package date; lager yeast for only 3 months. I always recommend building up the cell count by making a yeast starter *(see BYO, March-April 2002).*

• Don't be afraid to use yeast nutrients and energizers, especially for last-minute yeast starter worts and high gravity beers — those above 1.060. These are chock full of vitamins and minerals that are like dietary supplements for yeast, designed to accelerate cell growth.

• Temperature. Next in order of importance is the temperature of the yeast and the wort. Dried yeast should be "proofed" or re-hydrated in warm water before pitching it into the warm wort. Make sure your liquid yeast also has been warmed to room temperature or warmer. You can easily avoid a fermentation delayed by temperature shock by closely matching the temperature of the yeast slurry and the wort.

• Aerate the wort. Absorbed oxygen in the cooled wort is a key to quick and healthy fermentations. As I mentioned above, a relatively painless way is to pour the cooled wort through a strainer or similar device. Another sure-fire way to aerate your wort — but not without some expense — is to buy a "beer stone" hooked up to a small oxygen cylinder or to a pump. Agitation is also important. Once your wort has been aerated and the yeast has been pitched it's time to introduce the two to one another. A good vigorous shake or swirl of the closed fermenter is a good idea to get things started (avoid stirring the wort).

Hopefully you've noticed that I've repeatedly mentioned that the wort should be cool before it is aerated. This is because when air (oxygen) comes in contact with hot wort, the beer will more quickly oxidize and staling will be the eventual result. This is referred to as HSA, or hot-side aeration. Oxidized beer smells and tastes papery or cardboardy in the early stages and can become winey or sherry-like as the beer ages. If oxidation is prevalent in your beers or if you are sensitive to it, avoid HSA at all costs. Properly cool your beer before aerating or agitating it — besides, you should already be cooling it so you can pitch the yeast as soon as you can.

• If you have a high-gravity beer such as a barleywine in mind, and you want to get the fermentation off to an explosive start and a quick completion, consider the shotgun approach. Shotgun brewing involves making two batches of beer, back-to-back. Timing is essential. When the primary fermentation of the first beer is done, brew a second batch ASAP (preferably a higher-gravity beer). Rack the first beer over to a secondary fermentation vessel and pour the fresh-brewed wort right on top of the yeast bed in the primary fermenter. Three things to be mindful of:

1. Both beers must be of similar styles as they'll be sharing the same yeast strain.

2. Make sure the first brew was successful and the remaining yeast is still clean before committing a second brew to it; smelling and tasting the beer is usually all the proof that is needed.

3. Having the equipment necessary to ferment two beers simultaneously is a prerequisite to shotgun brewing.

Primary fermentation

Standard debates in this area usually have to do with the preference for either plastic vs. glass fermenters and airlocks vs. blow-off tubes. Personally, I consider this debate a tempest in a brewpot. The key to success (and to this debate) is in keeping all plastics free from scratching and pitting caused by rough treatment and repeated usage; simply buy new ones when the old ones get beat up. The second part of this key to success is to limit the amount of time the beer is left to sit in the plastic vessel. As soon as fermentation is complete, transfer the beer to glass for long-term aging. I find that plastic primary fermenters are much simpler to use and clean than glass carboys, and airlocks are safer and much easier to use than blow-off tubes.

Whether you ferment in plastic or glass, one important issue regarding primary fermentation is that of fermentation temperature. Unless you are brewing an estery and alcoholic Belgian Trappist or strong ale, primary fermentation temperature should never be allowed to rise above 70° F. Very warm fermentations are known to create a whole bunch of unwanted — and even unpleasant — aromas and flavors in beer. There is even an increased risk of bacterial contamination at higher temperatures. Esters, phenolics and diacetyl are legendary, but the demon known as fusel alcohol is infamous. Fusel alcohol is a class of "higher" alcohol produced at high fermentation temperatures. Its presence can be smelled, tasted and felt in the throat and it is often blamed for aggravated headaches and hangovers.

Keep in mind that fermentation itself is responsible for producing heat and can increase the beer's temperature between 3 and 5 degrees depending on the type of fermentation vessel and its location.

Siphoning

One procedure that is necessary to homebrewing, yet seems to vex new brewers, is the siphoning procedure. The most natural method of getting liquid to flow through a tube is to suck it through, but this is unhealthy for your beer, and there are better ways.

• The best way I have found to get a siphon started is to let Mother Nature do most of the work. With your transfer tubing looped in a circle and both open ends pointed upward, fill the tube with water. Connect one end to the racking cane; by simply dropping the open end into the vessel into which the beer is to be transferred, gravity pulls the water out of the tubing followed obediently by the beer. The small volume of water added to your beer will have no effect on the finished product.

Two-Stage Fermentation

Another simple procedure that is very important to the outcome of your beer is two-stage fermentation, also known as secondary fermentation. Since the vast majority of fermentation took place in the primary vessel, secondary fermentation is somewhat of a misnomer. What takes place in this secondary vessel is more of a maturation process; the beer simply ages, mellows and clarifies. Because this process typically takes a minimum of two weeks, it should always be done in a glass or stainless steel vessel. For most ales,

30-MINUTE BREWS

Kölsch
4.0% alcohol (Kuppers, Paffgen)
1 4-lb. can Coopers Real Ale or Ironmaster Imperial Pale Ale
2 lbs. light dry malt extract
Yeast: White Labs WLP029 (Kölsch) or Wyeast 2565 (Kölsch)
Primetabs

Porter
4.5% alcohol (Deschutes Black Butte Porter)
1 4-lb. can Coopers Classic Dark Ale or Telford Porter
1 3.3-lb. can Coopers Amber
Yeast: White Labs WLP005 (British) or Wyeast 1098 (British)
Primetabs

Winter Warmer
6.0% alcohol (Portland Brewing Bobby Dazzler, RedHook WinterHook)
1 4-lb. can Coopers Classic Dark or John Bull Porter
4 lbs. light dry malt extract
Yeast: White Labs WLP001 (California Ale) or Wyeast 1056 (American Ale)
Primetabs

American Style Hefeweizen
4.0% alcohol (Widmer, Pyramid)
1 3.75-lb. can Coopers Wheat (kit) or Premier Brewers Wheat (kit)
1 3.3-lb. can Coopers Wheat (unhopped liquid malt extract)
Yeast: White Labs WLP320 (American Hefeweizen) or Wyeast 1010 (American Wheat)
Primetabs

Robust Stout
4.5% alcohol (McMenamin's Hammerhead, Beamish Stout)
1 4-lb. can Coopers Stout or John Bull Stout
1 3.3-lb. can Coopers Dark (unhopped liquid malt extract)
Yeast: White Labs WLP004 (Irish) or Wyeast 1084 (Irish)
Primetabs

Nut Brown Ale
4.5% alcohol (Samuel Smith)
1 3.75-lb. can Coopers Nut Brown Ale or Muntons Nut Brown Ale
2 lbs. light dry malt extract
Yeast: White Labs WLP023 (Burton) or Wyeast 1028 (London Ale)
Primetabs

Recipes provided by Bader Beer & Wine Supply in Vancouver, Washington. Call (360) 750-1551 or (800) 596-3610 or shop online at www.baderbrewing.com.

shop talk

If you really want to save time, go to the 7-11 and pick up a six-pack! No? OK, how about sanitizing your bottles in the oven? Place clean bottles with about 1/2 ounce of water in each one stacked on their sides in your cold oven. Set the oven for 185° F. Once the bottles reach 185° F, hold at that temperature for 15 minutes. Turn the oven off and do not open the door until the bottles are cool. If you cool the bottles too fast they will crack. When the bottles are about 95 to 100° F, they will drive out some CO2 from the beer and the resulting foam will push out the residual oxygen in the bottle. This saves about 45 minutes over using iodophor and a bottle tree.

Colin Kaminski
Beer, Beer and More Beer
Concord, California

A spray bottle filled with clean water keeps wort from boiling over. When the wort threatens to boil over, just spritz the foam with your spray bottle and, voila! No boilover. This saves tons of clean-up. I also like to bottle my batches on the open dishwasher door. The door contains any spills or mess, and once you're done bottling, you can just shut the door and run the washer. No mopping!

Todd Frye
The Home Brewery
Ozark, Missouri

Reduce the length of the boil when you are in a hurry. Some of the best beer I have ever made was on the top of Mt. Whitney in California, when I and 3 others set the world record for beer brewed at the highest altitude. During that brew we utilized a 30-minute boil to reduce overall brew time. Adjust your bittering hops accordingly and realize your overall evaporation during boil will be halved as well.

Olin Schultz
Beer Beer and More Beer
Concord, California

Attach a stick-on "fermometer" to your keg to check the temperature of the keg when force carbonating. The temperature of the beer is used to determine the pounds per square inch (psi) necessary to carbonate the beer to a given volume of CO2 for a particular beer style.

Anne Whyte
Vermont Homebrew
Burlington, Vermont

Keep one of your carboys filled with sanitizer all the time. This will enable you to brew and rack with a minimum of preparation. Siphon out the sanitizer and you're good to go! I always keep a hydrometer inside a Fermtech wine thief in a carboy filled with sanitizer. That way I can check gravities and sample beer whenever I want to, without having to lift the carboy or siphon.

Anne Whyte
Vermont Homebrew
Burlington, Vermont

secondary fermentation temperature need not be any different from primary fermentation.

Where cooler, lager-type fermentation is called for, however, nothing beats a compressed gas refrigeration system. Where none exists, however, the brewer has to be inventive.

Hints and Tips

• Make a lagering vessel. One of the simplest and cheapest lagering setups starts with a medium-sized (30-gallon) rubber garbage can with a lid. Place your carboy inside the (clean) can and fill the can with water equal to the beer level in the carboy. After freezing eight 1-pound gel freeze packs, put half of them in the water. Every eight hours, replace the thawed gel packs with frozen ones from your freezer. If kept in a basement or crawl space and wrapped with a heavy insulating blanket (held in place with bungie cords) with the lid kept on, this lagering vessel should be able to maintain a water temperature in the high 40s with some minor fluctuation. Place a floating thermometer in the water or attach a non-floating thermometer to the neck of the carboy that dangles below the water line for constant and instantaneous temperature readings.

• Make a beer-friendly fridge. If you intend to employ a refrigerator in your home brewery, you might need to find a way to warm it up, as typical refrigerators — even on their warmest settings — may still be too cold for primary fermentations. Consider getting an external thermostat that allows you to set your fridge to temperatures higher than those pre-set in your fridge.

• Handling your carboy. Wort-filled carboys can weigh as much as 50 lbs. and they are eminently breakable. There are some handy carboy handles on the market, but old plastic milk crates also serve the purpose nicely.

Bottling and Packaging

Ultimately, when your beer is done fermenting and aging, you'll need to decide on how to store it. The vast majority of homebrewers bottle their beer, but there are still a number of options to consider.

If you choose to join the crowd and bottle your beer, the first decision you confront is the choice of bottles. You can choose self-sealing or you can choose to cap them yourself. If you choose to buy those that require capping, you can choose from among 7 ounce, 12 ounce, 16 ounce, 22 ounce and quart-sized bottles (depending on your supplier). Obviously, the larger the bottle, the fewer you'll need to buy, clean, fill and cap per batch. Whichever you choose, remember that you'll need enough to contain 640 ounces of beer (for a 5-gallon batch).

If you choose the self-sealing type, alternately known as swing-top bottles or Grolsch bottles (after the Dutch brand that popularized them), consider two things: the rubber gaskets will require replacement with regular use, and homebrew competitions in the U.S. don't accept self-sealing bottles.

Hints and Tips

• Bulk Priming. Before bottling your beer, don't forget to add a measured amount of priming sugar, typically 3/4 cup dextrose or 1-1/4 cup dry malt extract per 5-gallon batch. Rather than measure out and add the sugar directly to the bottles, bulk prime your beer. This simple procedure can be done by boiling your priming sugar in a cup or two of water (the exact amount is inconsequential) and adding the cooled mixture to the beer. This ensures more consistent carbonation throughout the entire batch of beer.

• Yet a couple more options exist when it comes to priming your beer.

First, you can use Primetabs, a unique product designed specifically for priming beer. These aspirin-sized tablets are made of pure dextrose and they can be added directly to the beer bottles. Since a single bottle typically requires two or more tablets, you can purposely vary the carbonation in your beer by adding more, or fewer, tablets. (I use four in a 12-ounce bottle.)

Second, you can prime your beer and flavor it by adding a bottle of fruit flavored liqueur to it instead of priming sugar. One 750-ml bottle of liqueur contains just about enough sugar to prime a 5-gallon batch of beer (you might want to add another couple ounces of dextrose just to be sure).

• Kegging. A kegging system typically consists of a 5-gallon stainless steel soda-pop keg, a 5- to 10-pound CO2 tank, a regulator, keg connectors, hosing and a faucet/dispenser.

By kegging your beer, you eliminate the need to prime your brew with sugar — though that is still an option. If you continue to prime your beer in the keg, you might want to cut the last inch or so of the "out" dip tube so you won't suck up the layer of yeast created during the carbonation phase. Most brewers choose to carbonate their beer by forcing CO_2 into the beer under high pressure. When doing this, make sure your beer is as cold as possible; absorbed carbon dioxide is retained better at cold temperatures.

• Carbonator Cap. Concerned about not being able to take small quantities of your beer out of your home brewery? Look into buying a Carbonator Cap, which allows you to bottle your beer in plastic soda containers over the short term. Don't worry about carbonation — the Carbonator Cap is threaded and designed like a ball-lock tank plug on a soda keg, so you can pressurize the plastic bottle in the same manner you would a keg.

Owning a CO2 kegging system also opens the door to other homebrewing options such as force carbonating, filtering, and counter-pressure bottling. Force carbonating frees you from having to prime your beer before transferring it into the keg; you literally force CO2 into the beer by turning up the CO2 pressure in the keg and agitate the beer over two or three days time. Filtering and counter-pressure bottle-filling really go hand-in-hand. If you filter your beer you are removing most, if not all of the yeast. Since yeast is necessary to bottle condition (carbonate) homebrew, you need to force carbonate your beer in the keg and bottle it under counter pressure. Get it?

Record Keeping

Of primary importance to all homebrewers is to make good beer. Of secondary interest to all homebrewers should be to make good beer consistently, batch after batch. This is where good record keeping comes in.

Having good notes and records of all your brews is worth its weight in amber. Not just your basic recipe, but all of the details surrounding the procedures and handling of your beer: quantities, types, dates, times and temperatures. It's invaluable information that you've worked hard for, and it can be reviewed at your leisure and for your drinking pleasure in the future. Remember — this is all about "Rapidius, Facilius, Frugalius" — making better beer, faster, easier and cheaper. ■

Marty Nachel is the author of "Homebrewing for Dummies" and "Beer for Dummies" (IDG). This is his second article for Brew Your Own.

skip the SPARGE!

By John Palmer

ILLUSTRATION BY DON MARTIN

Use more grain and simply drain: The "no-sparge" method makes brewing easier and produces a rich, smooth, pH-stable wort.

HAVE YOU EVER wanted to make an all-grain beer that practically brewed itself? A batch that didn't require you to monitor everything — the mash pH, the sparge flow rate, the gravity of the runnings and more? Have you been searching for that perfect batch — a batch in which the malt flavors are clean, without any drying or dullness to the palate? There is a technique that can deliver these wishes, and it is simply this: "Don't sparge."

What? Don't sparge?

The "no-sparge" technique uses 20-25 percent more grain than a standard recipe. This produces a larger mash that can simply be drained to achieve your full boil volume. This method produces a richer, smoother-tasting wort with the same gravity as a standard recipe, but with a mashing and lautering process that makes the wort more robust and pH-stable.

No-sparge brewing differs from conventional all-grain brewing by incorporating the full boil volume of water into the mash, instead of adding it afterwards during the lauter as a separate sparging (rinsing) step. Typically, sparge water is added continuously as the wort is drained from the grain bed to rinse the remaining sugars from the grain. Sparging continues until the full boil volume is achieved or the gravity of the runnings gets down to 1.008. If the grain bed is oversparged and the gravity drops below that point, it is likely that harsh tannins and polyphenols will be extracted from the grain husks.

At the end of the continuous sparging process, the mash pH typically rises to around 6 as the sugars are extracted and the buffering effect of the malt and wort is replaced by water. This rise in mash pH tends to extract greater proportions of tannins, polyphenols and silicates into the wort that have a dulling effect on the taste. Batch sparging (in which first, second and even third runnings are combined to produce the wort) can exacerbate this effect because all of the wort is drained away, including the majority of the buffering capability, before adding the next sparge volume. No-sparge brewing provides for a stable lautering pH that is not significantly different than the mash pH, due to the large buffering capacity of the malt.

The amount of water used for continuous sparging (3 to 5 gallons) is typically 1.5 times as much for the mash. When you brew with the no-sparge method, this 3 to 5 gallons is added to the mash tun at the end of the mash, before recirculation, and allows the mash tun to be simply drained to achieve full boil volume. By using more grain and adding all the water during the mash, you can relax and not worry about mash pH, astringency and undershooting your gravity.

So why doesn't everyone use the no-sparge method? Because continuous sparging usually works just fine — and pound for pound, it extracts the highest yield from the grain. No-sparge uses more grain and doubles the size of the mash tun.

Here is a comparison of the standard recipe and the no-sparge recipe for a Sierra Nevada Porter clone that I call Port O' Palmer:

Grain Bill	Standard	No-Sparge
pale ale malt	7.5 lbs.	9 lbs.
crystal (60° L)	0.5 lbs.	0.6 lbs.
chocolate malt	0.5 lbs.	0.6 lbs.
black patent	0.25 lbs.	0.3 lbs.
Total weight	**8.75 lbs.**	**10.5 lbs.**
Total mash vol.	**3.75 gal.**	**8.6 gal.**

Each recipe produces 6.5 gallons of wort with a specific gravity of 1.041. The obvious difference is the size of the mash: 8.6 gallons for no-sparge versus 3.75 gallons for the continuous sparge.

No-Sparge Recipe Calculations

These calculations combine the scaling-up of the grain bill with a three-step infusion-mash that makes the whole process more manageable.

Inputs:

- OG: Standard recipe original gravity (just the points, i.e. 48 for 1.048).
- Gr: Standard recipe grain bill (total pounds).
- Vr: Standard recipe batch size (e.g. 5.5 gallons).
- Vb: Standard recipe boil volume (e.g. 6.5 gallons).

Calculation Coefficients:

- k: Water-retention coefficient (0.125 gallon per pound)
- Rr: Standard recipe conversion rest mash ratio (e.g. 2 quarts/lb.)

Outputs:

- S: Scale-up factor for grain bill.
- Gn: No-sparge grain bill (total pounds).
- BG: No-sparge boil gravity (points).
- Rn: No-sparge final mash ratio (quarts/lb.).
- Wn: No-sparge total water volume (quarts).
- Wmo: Mash-out water volume (quarts).
- Vt: No-sparge total mash volume (quarts).

Now I'll walk you through a sample calculation for Port O' Palmer.

1. Decide how many gallons of wort you need to boil to achieve your target recipe volume. For this recipe, we'll boil 6.5 gallons of wort.
Vb = 6.5 gallons **(6.5)**

2. Calculate the scale-up factor.
S = Vb/(Vb – kGr) **(1.2)**

3. Calculate the no-sparge grain bill.
Gn = S x Gr **(10.5)**

4. Calculate the no-sparge boil gravity.
BG = OG x Vr/Vb **(41)** **(i.e. 1.041)**

5. Calculate the no-sparge mash ratio (qts/lb).
Rn = 4(Vb + kGn)/Gn **(2.98)**

6. Calculate the total no-sparge water volume (quarts).
Wn = Gn x Rn or 4(Vb + kGn) **(31.3)**

7. Calculate the volume of water you will use for mashout (quarts).
Wmo = Gn(Rn-Rr) or Wn – infusions **(10.4)**

8. Calculate the total no-sparge mash volume (quarts). The volume of 1 pound of dry grain, mashed at 1 quart per pound, has a volume of 42 fluid ounces (1.3125 quarts). Higher ratios only add the additional water volume.
Vt = Gn(1.3125 + (Rn – 1) **(34.5)**

No-Sparge Mash Example

1. We have determined that the scale-up factor for the Port O' Palmer recipe is 1.2. The new grain bill is:

Grain Bill	Standard	No-Sparge
pale ale malt	7.5 lbs.	9 lbs.
crystal (60° L)	0.5 lbs.	0.6 lbs.
chocolate malt	0.5 lbs.	0.6 lbs.
black patent malt	0.25 lbs.	0.3 lbs.
Total weight	**8.75 lbs.**	**10.5 lbs.**
Total mash vol.	**3.75 gal.**	**8.6 gal.**

INFUSION EQUATIONS

These calculations allow you to estimate the amount of heat provided by a volume of hot water so you can predict how much that heat will change the temperature of the mash. This method makes a few simplifications, one of which is the assumption that no heat will be lost to the surroundings, but we can minimize this error by pre-heating the tun with boiling water.

Most of the thermodynamic constants used in the following equations have been rounded to single digits to make the math easier. The difference in the results is at most a cup of hot water and less than 1°F. Experience has shown the equation to be fairly reliable and consistent batch-to-batch, as long as you pre-heat your mash tun.

When mixing hot water with dry grain for the initial infusion, the equation is algebraically simplified so that the amount of grain does not matter, only your initial grain temperature, the target mash temperature, and the ratio (r) of water to grain in quarts per pound.

INITIAL INFUSION EQUATION
Strike Water Temperature Tw = (.2/r)(T2 - T1) + T2

MASH INFUSION EQUATION
Wa = (T2 - T1)(.2G + Wm)/(Tw - T2)
where:

r = The ratio of water to grain in quarts per pound.

Wa = The amount of boiling water added (in quarts).

Wm = The total amount of water in the mash (in quarts).

T1 = The initial temperature (°F) of the mash.

T2 = The target temperature (°F) of the mash.

Tw = The actual temperature (°F) of the infusion water.

G = The amount of grain in the mash (in pounds).

The infusion water does not have to be boiling, a common choice is to use the sparge water at 170° F. Then Tw becomes 170 ° F and more water (Wa) will be needed to make up the additional quantity of heat.

2. From the infusion equations in the sidebar, we can calculate the infusions for dough-in and conversion, based on the new grain bill of 10.5 lbs.

DOUGH-IN INFUSION

Target temperature:	104° F
Dough-in infusion ratio:	1 quart/lb.
Infusion water temp.	111° F
Infusion volume:	10.5 quarts

CONVERSION INFUSION

Water volume of mash is:	10.5 quarts
Target temperature:	154° F
Infusion water temp.:	210° F
Infusion volume:	10.4 quarts
Total water volume	20.9 quarts

3. At this point we have a rather ordinary mash of 10.5 lbs. in 20.9 quarts of water, i.e., a mash ratio of about 2 qts/lb. The total volume is about 6 gallons. Now we will calculate how much water we need to add to make up the total no-sparge water volume (Wn) and use it for a mashout infusion.

$$Wn = 4(Vb + kGn) = 31.25 \text{ quarts}$$
$$Wmo = Wn - \text{infusions} = 31.25 - 20.9 = 10.35$$

4. You might think, "Just add 10.35 quarts and call it good," but we don't want to push the mash-out temperature over 170° F because of the risk of tannin extraction. We want to calculate the infusion temperature that will give us a final mash temperature of 170° F (max). From the equations in the sidebar, we can re-arrange the equation:

$$Tw = (T2 - T1)(.2G + Wm)/Wa + T2$$
$$Tw = (170 - 154)(.2 \times 10.5 + 20.9)/10.35 + 170 = 205.5° \text{ F}$$

In this case, using our usual infusion water of 210° F would possibly increase the potential for tannin extraction from the grain husks. However, when you calculate the final temperature using 210° F, the result is a mash-out temperature of only 171.4° F, which is not a big difference.

Yes, there are a few calculations involved and it's a lot bigger mash, but it does simplify the lautering process to add all the water to the mash and drain it to start your boil. And if you want to simplify the calculation aspect, then loading the equation into a spreadsheet or using a brewing software program like ProMash or StrangeBrew will make it a snap! ■

John Palmer is the author of "How to Brew" (Defenestrative Publishing, 2001). This is his first BYO article.

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Big Batches

A guide to making more beer on brewing day

by Chris Colby

PHOTO BY CHRIS COLBY

With this equipment, you could brew a 10-gallon batch of beer. Extract brewers would not need the mash vessel or second burner.

Most homebrewers start out by brewing five-gallon batches, and this is an affordable and manageable size to brew. At some point in their brewing lives, however, many homebrewers at least consider scaling up. Some may want to brew more beer. Others may want to brew the same amount of beer each year in less time. Still others may simply want to brew a large batch or two for a special event.

Brewing larger batches of homebrew has its advantages and disadvantages. The primary advantage is productivity — you can brew 10, 15 or more gallons of beer in roughly the same amount of time that it takes to brew five gallons. The primary disadvantage is the cost of buying the required new equipment. At a minumum, you'll probably have to spend a few hundred dollars to upgrade your system if you buy everything new. And, there's added time required on brew day to clean equipment and to heat the larger volumes of water required.

The fundamentals of brewing do not change, regardless of whether you are brewing five gallons of beer with your wise buddy or 50,000 barrels of Budweiser. However, the equipment for brewing does change with scale and your techniques must adapt to it.

The biggest difference in brewing larger than five-gallon batches is that your wort is no longer portable.

The key to brewing your first big batch is planning. You will be dealing with new equipment and new techniques in addition to managing more water and ingredients. You should develop a brewing plan that aims to both avoid potential problems and also to deal with likely problems that may arise on brewing day.

Equipment

To scale up from five-gallon batches to 10-gallon or larger batches, you will need several key pieces of equipment. For beginners, you'll need a brewpot capable of holding the wort. The brewpot should be able to hold at least 20% percent more volume than the volume of wort you plan to boil. The "extra" volume allows for the foaming that occurs when the wort begins to boil. To go along with the brewpot, you'll need a heat source capable of heating the wort and a chiller capable of quickly cooling it. If you are an all-grain brewer, you'll also need a mash and lauter vessel to hold all your grain. You can ferment in multiple buckets or carboys or invest in a larger fermenter.

There are many sources for brewing equipment, and they have been amply discussed elsewhere. (For example, the September 2000 issue of *BYO* has an article explaining how to convert a keg to a kettle and the Summer 2001 issue has an article that describes how to build a large mash tun.) If you simply wish to brew a few big batches for a special event, you have a few other options. If you know an avid homebrewer with a large set-up, you could probably arrange to use his or her system in exchange for some beer. An advantage of brewing on an experienced brewer's system is that he knows his brewing set-up and can assist you in getting the most from it. The knowledge you get from this may be more valuable than the cases of beer you end up with. Alternately, if there is a brew-on-premises (BOP) shop in your area, you can brew there. You should, however, check the facility out and see if they have the equipment to accommodate your brewing plans.

If you can't beg, borrow or steal the appropriate equipment, don't try to brew a big batch of homebrew — you're just setting yourself up for disappointment. I once spent a very long night in my grad-student apartment trying to cool 10 gallons of wort in my bathtub. The ice I'd set aside for the job melted within 10 minutes and it was hours later before the wort was even close to being pitchable. So, make sure you have the right tools before you start the job.

Water Preparation

Heating the amount of water used to brew five gallons of beer can be done reasonably quickly on most kitchen stovetops, which typically produce less than 15,000 BTUs of thermal energy. For 10-gallon or larger batches, you will need a better heat source. Most brewers who make 10 or more gallons of beer use propane burners to heat their water and boil their wort. Most propane burners are rated at 35,000 to more than a hundred thousand BTUs. Even so, heating the brewing water can take awhile, especially for very large all-grain batches. I recommend that you begin heating your brewing liquor (your treated brewing water) first, and do other preparatory tasks while the water heats.

Extract brewers will need to heat enough water to dissolve and boil the malt extract. If you can manage it, your best bet is to perform a full-wort boil.

In that case, you will need to heat a volume of water equal to your batch size plus about 10%, which allows for evaporative losses during the boil. If you boil a concentrated wort, avoid making the wort concentrate too thick. Don't, for example, try to boil a 10-gallon recipe's amount of malt extract in your usual 5-gallon-sized amount of liquid. At a minimum, you should expand the amount of wort you boil linearly with batch size. For example, if you usually boil three gallons of water and malt extract and add two gallons of water to your fermenter to make five gallons of wort, you should boil at least six gallons of water and malt extract and add four gallons of water to make a 10-gallon batch. The closer you get to boiling your full wort, the less wort darkening will occur. You'll also minimize the chance of scorching your wort. (Boiling a full wort has other benefits. See Steve Parkes' "Homebrew Science" article on page 51 for more on wort boiling.)

All-grain brewers will need a volume of water almost double their batch size. You will need the water that goes into the beer and the water lost to evaporation during the boil, plus the amount of water left in the mash tun when sparging is complete. As I indicated above, this amounts to almost double your batch size. The exact amount will depend on brewing specifics such as how vigorous your boil is and the shape of your mash tun. Having a second burner and large pot reserved for a hot-water tank will help your all-grain brew-day immensely.

Mashing

An all-grain brewer may need to make a few changes to his procedures for mashing larger amounts of grain. However, the procedure really doesn't change that much from how smaller mashes are performed. As with five-gallon batches, you need to match the mash tun with your brewing procedures. Specifically, if you use a picnic cooler mash tun, you cannot directly heat your mash as you can with a stainless steel vessel. Also, you'll need more room in your mash tun if you plan on performing step-infusion mashes in which you add hot water to elevate the temperature of the mash.

You should mash in with the same liquid-to-grain ratio as you are used to in five-gallon brewing, usually around 1.25 quarts of water per pound of grain. The amount of time you spend mashing should likewise remain unchanged. The amount of time it takes to collect your wort shouldn't change much either. This means you'll be collecting a larger volume of wort per unit time, but you'll be draining the same percentage of your mash as with five-gallon batches. (Think about it: Commercial breweries don't collect wort at the trickle that characterizes five-gallon run-offs. There'd be no beer on the store shelves if so.)

Stirring the mash will require a mash paddle. While you could get away with using a large serving spoon to stir a five-gallon mash, you'll need something more substantial to stir the amount of grains required for a 10-gallon batch. Without a mash paddle, you'll almost certainly end up with dry "malt-balls" in your mash.

For your first mash in, hitting your target temperature might be difficult because you're using new equipment and more ingredients than you're used to. To make mashing in more controlled, pre-heat the mash tun by filling it with hot water prior to mashing in. This will ensure that you don't quickly lose heat to a cold tun when you begin adding the hot water.

Also, keep a few gallons of boiling water and a few gallons of room-temperature water on hand in case you over or undershoot your target temperature. While you are mashing in, measure the mash temperature when the mash is still thick and make your adjustments as you approach your desired water to grain ratio.

Boil

Although your kettle may be larger, managing the boil doesn't change much when you switch to making larger batches. You want to maintain a rolling boil for the duration of the boil, just as you should for five-gallon batches. This is can be managed by choosing the right equipment, adjusting the lid and adjusting your burner's output. Avoiding scorching is also a consideration. If your brewing kettle has a thin bottom, or your burner focuses heat at one point, stirring can help avoid this. You'll also want to avoid a boilover. With larger volumes of wort, boiling is not only a pain to clean up, it can be a scalding hazard.

Cooling the Wort

Most extract brewers heat less than five gallons of wort and cool it in a sink. Most homebrewers who boil a full five-gallon wort or brew larger batches of beer use one of two different methods for cooling their wort. Some cool by using an immersion chiller; others use a counterflow chiller. This is the part of brewing that changes the most when switching to larger batches. Instead of moving your wort to your source of cold water you need to move the cooling equipment to your wort.

Even if you could move your wort, it would be time-consuming to cool it by immersing the kettle in cold water. As the volume of a liquid increases, its surface-to-volume ratio decreases. In other words, with bigger worts a smaller percentage of the wort is touching the outside of the kettle. Since the outside of the kettle is the surface where the heat exchange occurs, it takes a proportionally longer time to cool a large wort by cooling the outside surface of the kettle.

An immersion chiller is a metal coil, usually copper, that is submerged in the wort. Cold water runs through the chiller, picks up heat from the wort and exits the chiller. To sanitize the chiller, clean it and place it in your wort for the final 15 minutes of the boil. The heat of the wort will kill any stray bacteria or fungi. The wort can be periodically whirlpooled by moving the chiller in a circular manner. Once you stop swirling the chiller, the rotating wort will flow past the coils, speeding the cooling of the wort.

A counterflow chiller is essentially a tube within a tube. With this type of chiller, wort is cooled as it is siphoned from the kettle to the fermenter. As the hot wort flows one way through the chiller, cold water flows the other way. Heat exchange occurs as the liquids flow past each other. Cold wort empties into the fermenter and hot water flows out the other tube.

The effectiveness of either type of chiller can be increased with the use of a pre-chiller. A pre-chiller is an immersion chiller kept in an ice bath. Water from the pre-chiller cools water headed for the primary chiller. The greater the temperature differential between the wort and the water running through the chiller, the faster the wort is chilled.

Fermentation

Although larger fermenters are available, most "big-batch" homebrewers simply split their wort into multiple carboys. Thus, you can ferment your beer exactly as you did before. No matter how many carboys you ferment in, all you need is one empty carboy to rack all your beer to secondary. When it comes time to rack the beer, rack one carboy to the empty carboy. Clean the just-emptied carboy and rack the next carboy and so on. Just-emptied carboys can be quickly washed and lightly rinsed with sterilizing solution. If the beer that just came out of the carboy smells and tastes alright, then the carboy can be quickly processed.

Brewing for Special Occasions

If you are brewing your large batch for a special occasion and want as much beer as possible, you may also want to consider high-gravity brewing. In high-gravity brewing, you ferment a concentrated wort and dilute the beer to working strength at packaging. (See the February 2000 *BYO* and the January-February 2002 *BYO* for more information.)

Before hauling a load of homebrew to a wedding or other special event, check to see if you'll be able to serve it. The liquor licenses or business contracts at some venues may only allow alcohol from designated distributors to be served. Some caterers or event coordinators may object to serving homebrew, especially if they profit from selling their own alcohol. And, of course, be sure that the guests of honor know and approve of your plan. Your buddy may love your homebrew, but his soon-to-be mother-in-law may frown at the sight of your Igloo cooler next to the ice sculpture. ■

Chris Colby is the managing editor of Brew Your Own.

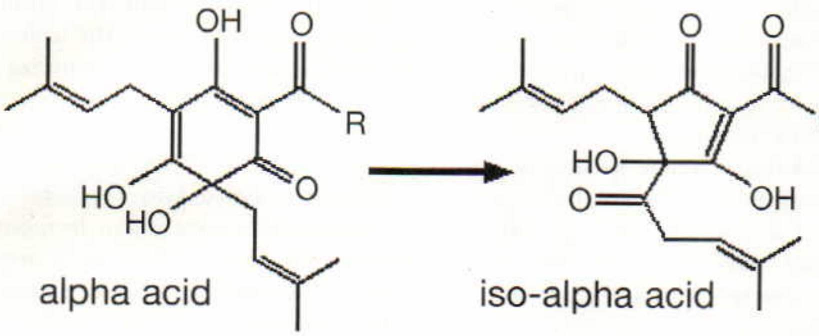
Boil Basics

How wort is transformed in the kettle

Homebrew Science

by Steve Parkes

Isomerization of alpha acids



In the boil, alpha acids from hops are converted to iso-alpha acids. Alpha acids are insoluble in wort and do not taste bitter. In contrast, iso-alpha acids are both soluble and bitter. In most brewing situations, only 20 to 30 percent of the alpha acids present in the hops are isomerized.

Many new all-grain brewers are prepared for the added difficulty of mashing. They already have read about the effects of different temperatures, mash thicknesses and rest combinations. However, because the techniques for wort boiling are very straightforward, they may not have learned about the important benefits that boiling the wort correctly brings to their beer. When asked for advice on what it takes to make great beer, a famous German brewer listed four things: Buy the best ingredients you can possibly afford, clean everything all the time, boil the kettle well and pray.

There are several reasons why a good wort boil is important.

Wort sterilization

Boiling your wort provides enough heat to render the wort free from any bacterial contamination. The principle wort bacteria are *Lactobacillus* and they are easily killed by heat. The low pH and the antibacterial action of certain hop constituents will ensure that the pathogenic and spore-forming organisms that would otherwise survive are precluded.

Enzyme inactivation

Most of the enzyme action ceases early during wort collection, either due to raising the mash temperature for mash-off or by sparging at a higher temperature in an infusion mash. Boiling ceases the remaining enzyme activity and fixes the carbohydrate composition of the wort, and hence the dextrin content of the final beer. Dextrins are complex carbohydrates. In the absence of enzyme activity to break them down into simpler sugars, brewers yeast cannot ferment them.

Boiling's effect on proteins

Under the favorable conditions of wort boiling, proteins and other polypeptides present in the wort will combine with polyphenols or tannins. The rate and extent to which this occurs is influenced by several factors. Since the meeting of the components depends on chance encounters, the rate is increased by the mixing action of the wort, and also by their relative concentrations. Protein-tannin complexes collide with other protein-tannin complexes and stick together until they achieve a certain mass and precipitate out of solution.

Boiling also can destroy a protein's three-dimensional structure. Proteins are large molecules made from smaller molecules called amino acids. In a protein, amino acids are linked end to end to form a "string." This string is coiled, folded and looped into a three-dimensional structure. In addition, some proteins are actually complexes formed from several different protein strands. The three-dimensional shape of a protein determines the protein's function. Thus, when boiling destroys the three-dimensional shape of protein, it also destroys its function. (This is, in fact, why wort boiling stops enzyme functions. Enzymes are proteins.)

Protein and tannins are the primary constituents of the hot break in the kettle. The hot break is the brown scum that forms on top of the wort as boil approaches and is also known as hot trub. Its formation is aided by the addition of kettle finings, usually extracted from seaweed. Irish moss can be added to the kettle 15 minutes before the end of the boil; the moss is negatively charged and can attract positively charged proteins in the wort. Although boiling for extended periods can increase the amount of trub formed, boiling for too long creates "shear forces" that break up the larger flocs back into smaller ones, making their ultimate removal more difficult. Lower pH causes flocs to be larger and more stable, and the presence of calcium ions aids protein aggregation by binding proteins together.

Hot break must be removed so that the hot wort can be clear. Most commercial brewers whirlpool their wort and leave the hot break behind when the hot wort is moved to the heat exchanger. Other proteins are precipitated by cooling and this material is called cold break.

Cold break is very similar in makeup to hot break except that the flocs are much smaller. Opinion is divided on the need to remove this prior to fermentation. Some brewers feel that removal provides cleaner flavor, but cold break contains some unsaturated fatty acids required for yeast nutrition.

Irish moss is a seaweed-derived polymer of the sugar galactose. Individual galactose molecules are linked to other galactose molecules through alpha 1-3 or alpha 1-4 linkages. In Irish moss, some hydroxyl (OH) groups are substituted with sulphate groups, giving it an overall negative charge. Irish moss acts like a net that falls through the wort and traps any positively charged proteins by binding to them. It is usually added to boiling wort around 15 minutes from the end of the boil.

There is an optimum rate of use for Irish moss, and tests should be done using different rates of addition. Most homebrewers add between 3/4 and 1-1/2 teaspoons per five gallons of wort. Too much Irish moss will form very clear wort, but results in a fluffy sediment that leaves behind a lot of wort in the trub. Excessive levels of Irish moss in the boil can reduce the levels of proteins responsible for head formation.

Solubilize and isomerize hops

Although there are a great many reactions occurring during the kettle boil, the principle one of interest is the isomerization — and subsequent solubilization — of alpha acids. Isomerized alpha acids are the molecules responsible for the bitter flavor in beer. The chief component of alpha acids is the compound humulone.

The isomerization of humulone to isohumulone is facilitated by the presence of magnesium ions. The extraction and isomerization are very inefficient, however, and as many as 70% of the alpha acids remain unconverted, and hence insoluble.

Other reactions have secondary effects on bitterness. For example, the oxidation of the beta acids — including the oxidation of lupulone to hulupone — produces a molecule that is much more bitter and is probably responsible for more lingering unpleasant bitterness in beer.

Factors affecting hop utilization

There are many factors that affect hop utilization. Boil intensity is one such factor. The longer and more intense the boil is, the more alpha-acids isomerization occurs. The pH of the wort also has an effect. The higher the wort pH, the greater the isomerization and solubility of humolone.

It is generally accepted that hop utilization is better in low-gravity worts than in high-gravity wort. This is why homebrewers are told to decrease the amount of hops in a recipe if they switch from boiling a concentrated wort to conducting a full-wort boil.

The amount of hot break present can also influence hop utilization. Hops are associated with proteins that precipitate during boiling. For this reason, some brewers wait until the hot break begins before adding their first charge of hops.

The form of hop used is yet another factor. Hop extracts produce the most bitterness, follow by pellet hops and whole-leaf hops.

High hopping rates reduce hop utilization. Adding more hops always increases hop bitterness, but — beyond a certain point — you get decreasing returns with greater hop additions.

Oxidation of lupulone

Beta acids are insoluble, but they can oxidize during storage to a variety of compounds that are soluble and bitter in boiling wort. While it is accepted that the bitterness of oxidized beta acid is different from isomerized beta acid, opinions are divided as to its quality. Some researchers insist that the oxidized beta acids are more mellow than isomerized beta acids, while others say that oxidized beta acids are more harsh. Either way, oxidized beta acids go some way to replacing the bittering potential of alpha acids that are lost during storage.

Volatalize aromas

Dimethyl sulphide (DMS) is an intensely aromatic compound present in most beers. When it's present in amounts large enough for it to be tasted and smelled, it can be an important flavor characteristic or defect. At low levels it smells of corn or sweet corn. When it is more intense it can resemble over-stewed vegetables or even garlic. In some European lagers, it is an important part of the flavor profile; a large regional brewer in the United States (Rolling Rock) also features it.

DMS is formed from s-methylmethionine (SMM), which in turn is produced from amino acids during malting. SMM is converted to DMS by heat and then the DMS is volatilized and whisked away with the steam during wort boiling. Some homebrewers who leave a lid on the kettle find that this compound is re-introduced when the steam condenses on the lid and drips back in. Unless the precursor is all removed, then more DMS can be formed during wort clarification and this DMS will survive to the final beer. This is a problem in commercial breweries using whirlpools. For this reason, homebrewers should attempt to cool their wort as quickly as possible after the boil is complete.

Hop aroma

Hops also contain an essential oil component, which is responsible for the characteristic hop aromas. Each oil imparts its own smell, and hop aroma is made up from the combinations of many smells. The oils are soluble in hot wort and are very volatile. So, they are soon boiled away in the steam from the kettle. This is why many brewers add a charge of hops as late in the boil as possible to try to trap the aroma before it is evaporated away. Dry hopping is another technique designed to avoid losing volatile hop compounds.

Color development

Color pick-up in the kettle is a combination of several factors. The caramelization of wort sugars darkens the wort as it boils. Loss of an H_2O molecule from the complex sugar molecule forms a double bond inside the sugar molecule, which changes the way the sugar molecule absorbs light, thereby affecting the color. Drive off all water and you're left with carbon.

Color development also comes from melanoidin production from polymerization of reductones. (These Maillard reactions are described in more detail in the November 2001 "Homebrew Science" article on crystal malts.) These reactions also contribute some flavor compounds. The rate that these reactions occur is slow due to the unfavorable pH and temperature conditions in boiling wort.

Finally, the wort can be darkened due to charring or burning from excessive heat at a heat transfer surface. Homebrewers can experience this if their brewpot has a thin bottom.

Concentration of the wort

In a large brewery, up to 10% of the kettle contents can be lost due to evaporation during a boil of normal duration. This increases the original gravity of the wort accordingly. This is important when brewing some high-gravity beers, such as barleywines, made only from grains. In order to achieve their high original gravities, the wort is boiled for an extended period — often up to three hours.

Good place for the addition of syrups and sugars

Some recipes call for an increase in wort gravity above that which can be obtained by the mashing system. Alternatively, when nitrogen-rich malts are used, it may be necessary to add an adjunct that contributes no nitrogen. In that case, corn syrups or brewing sugar can be added in the kettle. Home brewers can also add flavorings and other adjuncts, such as fruit.

pH

Wort pH will fall from 5.6–5.8 at the start of boiling to around 5.2–5.4 at the end. This is primarily due to the precipitation of calcium phosphate. Calcium ions in brewing water reacts with phosphates from the malt to form calcium phospate and hydrogen ions, which lower wort pH.

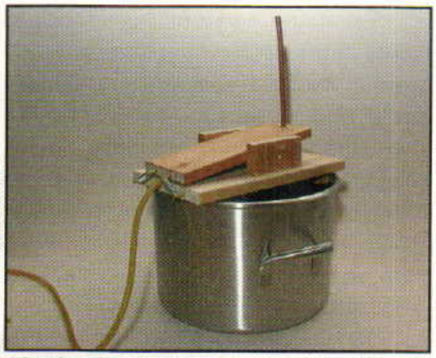
This demonstrates the importance of excess calcium ions in the wort after mashing. For this reason, it is sometimes a good idea to add gypsum to the kettle. If your mash pH is fine, but the pH does not drop to at least 5.4 by the end of the boil, add 1/4–1/2 teaspoon of gypsum per five gallons. ■

Steve Parkes, owner and lead instructor at the American Brewer's Guild, writes "Homebrew Science" each issue.

Spritz it!

Spray your way to sanitized bottles

by Thom Cannell



PHOTOS BY THOM CANNELL

This bottle sprayer, powered by pressure from a keg or small pump, can speed up the process of sanitizing beer bottles.

The idea for this project came from our very own Mr. Wizard. Whether wizard or mortal, we must all sanitize our bottles if we're going to put beer in them. How we accomplish this task is the genesis of this project.

In my homebrew club, the number of different bottle-sanitizing procedures equals the number of homebrewers. Some bake their bottles in a 500° F oven for half an hour. Others use their dishwasher in a variety of ways. Some of the dishwasher advocates use sanitizer in place of soap. Others use the dry cycle for moist heat. A few do both. And, of course, some of my fellow brewers submerge their bottles in buckets of sanitizing solution — at a no-rinse concentration — and then drain and bottle. Soaking in sanitizer is a great method, but it's time consuming and requires five to 10 gallons of sanitizing solution.

What if you could simply spray the interior of your bottles with your favorite no-rinse sanitizer, drain and bottle? Spraying the inside of a bottle shouldn't be too hard; just grab a spray bottle full of Star San, hold each beer bottle horizontal and spritz. Still, there must be a better way. How about a spray wand, much like the commercial bottle rinsers that hook up to your sink nozzle? Add a source of pressure to spray the sanitizing solution and we've got ourselves a bottle sanitizer. It's the details that make this project a wee bit more difficult.

The first question is, where will the pressurized sanitizing solution come from? Those who keg might answer, "from a couple of gallons of sanitizing solution in a keg at two to four psi of pressure." The rest of us can take inspiration from the now-ubiquitous home and office-sized mood fountains. These fountains use inexpensive submersible pumps to recirculate water over rocks and pebbles.

Conceptually, we're almost complete. We have a bucket or keg of sanitizing solution, pressure (from a keg or a small pump) and a homemade spray wand. If you choose the recirculating pump option, note the critical shutoff height. The shutoff height is the height above which the pump can't push liquid any higher. For us that means that the distance between the tip of your wand and the bottom of your bucket can't be greater than the shutoff height. Pumps rated with a greater shutoff height are better. And oops . . . where's the on-off switch?

To create a fluid shut-off valve, or hydraulic "on-off" switch, my pal Mike suggested something like a teeter-totter. With equal weight at each end, the plank of a teeter-totter is perfectly balanced. With more weight on one end — perhaps from a big kid — that end slams to the ground and stays there. Now imagine that there's a hose running under the teeter-totter. When the big kid sits down, the teeter-totter plank hits the ground and shuts off the flow of water through the hose. We can use that same concept to control the flow of sanitizing solution through our bottle-sanitizing device.

We'll use latex, not ordinary clear Tygon® tubing, because latex can be easily pinched shut. And, instead of renting the neighbor's kid to provide clamping force, we'll use springs. Pushing down on the other end of our teeter-totter will "raise the big kid" and release our sanitizing solution. If we build our teeter-totter on a wooden platform over a bucket, we can reuse or recirculate our sanitizing solution.

Construction

This is an easy project and it requires only hand tools: a saw, a hacksaw, a drill motor and drills, and a regular screwdriver (and maybe a Phillips screwdriver, too).

Begin by cutting two solid pine or poplar boards. (Plywood or other man-made wood will come unglued when wet.) One board should be sized to reach across a spare brew pot or plastic bucket with plenty of run-off space on either side; the other makes the teeter-totter. Because buckets and scrap wood will vary, your sizes may not match mine. I cut a 7 x 13 x 3/4" base and a 7-1/4 x 11 x 3/4" teeter-totter. (If you're not a woodworker, "one-inch" boards are actually 3/4 of an inch thick because of the planing or

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- Wood and pins
  1 foot 4" x 1" clear pine
  2 feet 8" x 1" clear pine
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- 2-3/8" hardwood pegs
  $2 (bag of 10)
- Wood screws
  (4) #8 x 1-1/2" brass round-head
  (4) #6 x 1-1/2" pan-head
  $1.00 (bag of 4)
- 24" of 3/8" outer-diameter soft copper tube
  $13.00/20'
- 2-8' of latex rubber tube
  $1.45/foot
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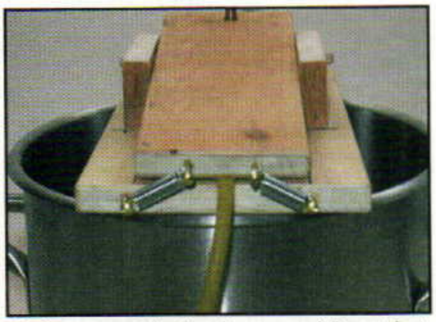
  Submersible **$20-$30**
  RIMS pump **$120**
- Keg system **$135**

For pump examples try:
http://pumpworld.net/minipumps.htm

The shutoff mechanism for our bottle sanitizer pivots at a point that is off-center. The board pivots on dowels.



Springs provide the downward force that clamps the tube. Pressing on the other side of the board allows liquid to flow.

smoothing performed on the surface. Length and width are accurate, but a "two by four" is actually 1-3/4 x 3-3/4".)

To create our teeter-totter, we'll need two support brackets and two pivot pins. The pins are 5/16" hardwood pegs available at most home-improvement stores and lumberyards. Cut two support brackets to approximately 2 x 4". Clamp the brackets together, then mark a centerline and drill a 21/64" hole through both, approximately 1" from the top. Drill these holes as close to perpendicular as possible, as they form a bearing.

Measure and mark the teeter-totter at approximately 2/3 of its length. Carry the marks down and make a mark at the midpoint. Drill a 21/64" hole that will leave the pivot pins exposed 3/4–1". Each hole should be approximately 1" deep.

Fit the pins into the teeter-totter, then through the support brackets. Center the teeter-totter right to left with the longer end meeting one end of the support board. Then measure the position of the support brackets. Mark their position (footprint) and drill two holes through the support board. Clamp the support brackets back in place and drill up through the holes into the brackets.

Two notes: A pair of cleats screwed to the bottom of the support board will prevent it sliding about. Also, you must pre-drill holes in the brackets or the end grain will split. Assuming you're using #6 brass wood screws, 1/16" or 5/64" drills are the proper size for softwood. Be sure to use brass or other rust-proof screws. (I used galvanized deck screws.)

Two common "Handyman" springs available from home-improvement stores provide clamping or shut-off force. (I originally thought of using the thick rubber bands found on produce.) Drill two 3/32" holes into the cross-pot support board, each about 1" from the end centerline. Screw #8 x 1-1/2" brass round-head wood screws into the end and slip one end of the springs over them. Slip the rubber tubing between the support board and the teeter-totter. Put enough tension on the springs to firmly collapse the rubber tube. Extend each spring and mark a screw position on the teeter-totter that keeps tension on the spring. Drill holes into the end of the teeter-totter. The correct predrill size for a #8 wood screw is approximately 3/32" or 5/64".

Disassemble the teeter-totter — the wooden pegs should slip out. Cut a piece of 3/8" copper tube (soft copper preferred) 18–24" long. Using a spring bender or other tubing bender, make a tight 90° bend in the tube approximately 10" from one end.

On the remainder end, solder a support flange 1–2" from the end. Make the flange of scrap copper tube that's beaten flat. Thick is better; you'll need room to slip the rubber tube over this end. Drill two 1/8" holes into the support flange.

Drill a 1/2" or larger hole through the short end of the teeter-totter and slip the copper tube through, allowing 7–10" to protrude. This length will depend on your bottles. Use a longer length if you use only 22 oz. "bomber" bottles; make the tube shorter if you use recycled Guinness or Anchor bottles. Ideally, you'll want the wand to extend to within an inch of the bottom of the bottle. Mark the length correct for you, then remove the tube and cut off all but an extra 1/4". That will become the spray tip.

To make a spray tip, make an "L" shaped cut about 1/2" from the end. Bend the remaining copper over and hammer the end closed. Don't be too concerned about leaks — we need them. Once the end is closed, drill four to eight holes radially around the tube and at least one through the end. Use the smallest drill bit you can, 1/8" or smaller. Remember that small bits require less pressure. When you are done drilling, lightly sand the surface to remove the wire edges.

Reassemble the spray wand and attach the rubber tube to the spray wand. A low-pressure clamp to hold this together might be a good idea. Secure the flange to the teeter-totter with stainless steel or brass wood screws. You'll likely have to bend the copper tube a bit to allow the latex tube to fit on. Replace the teeter-totter and pivot pins and you're almost done.

Buy enough latex rubber tubing — between two and eight feet — to reach to one of three pressure sources: a small recirculating pump in a bucket, a RIMS pump, or a keg. Keggers will have to experiment with CO_2 pressures, but 2–5 psi should work.

The final consideration is sanitizing solution. Iodine solutions and Five Star Star San come to mind. Both are readily available and have clear instructions for making no-rinse concentrations. With well-cleaned bottles, a five- to 10-second blast from our homemade sanitizing machine followed by a 20–60 second drain time should provide the required contact time for properly sanitized bottles. ■

The holes in our wand tip were made with a small drill bit. Sand the copper around the holes when finished.

Our device can attach with a CPC quick-connect, a ball-lock keg connector or a connection for a RIMS pump.

Thom Cannell also writes and takes photographs for auto magazines.

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In Memoriam

Fond Farewell

Dr. George J. Fix III (1939-2002)

By Louis Bonham
Houston, Texas

Dr. George Fix won hundreds of awards nationwide for his beers and gave countless lectures on homebrewing.

On March 10, we lost one of the true giants of the brewing community when Dr. George Fix died of cancer.

A list of all of George's accomplishments would be lengthy indeed. Born in Dallas, Texas, he earned a BS from Texas A&M University, an MS from Rice University and a PhD from Harvard University. He was the chairman of the mathematics department at Carnegie-Mellon University for more than 20 years, and also chaired the mathematics departments at the University of Texas at Arlington and Clemson University. He also taught at Harvard University, the University of Michigan, the University of Maryland and the University of Bonn (in Germany). He published two books and over 100 scholarly articles in the field of mathematics, and received numerous professional honors.

In the field of amateur brewing, there was little George did not do. He served on the Board of Advisors of the American Homebrewers Association (AHA), the editorial board of *Brewing Techniques* magazine, and the steering committee of the Masters Championship of Amateur Brewing. He won, literally, hundreds of awards nationwide for his beers, which from personal experience I can say were typically nothing less than spectacular.

George was a member of the Beer Judge Certification Program, and the American Association of Brewing Chemists, and the Master Brewers Association of America. He was a consultant to numerous microbreweries and brewpubs. He served as an expert witness in brewing-related litigation, including a patent infringement lawsuit between two of the largest breweries in the world. He published numerous articles and three books on beer and brewing, including his seminal works, "Principles of Brewing Science" and (with his beloved wife Laurie) "An Analysis of Brewing Techniques." (Both books were published by Brewers Publications in Boulder, Colorado.) For his record of achievement, George was the recipient of the AHA Recognition Award in 1991.

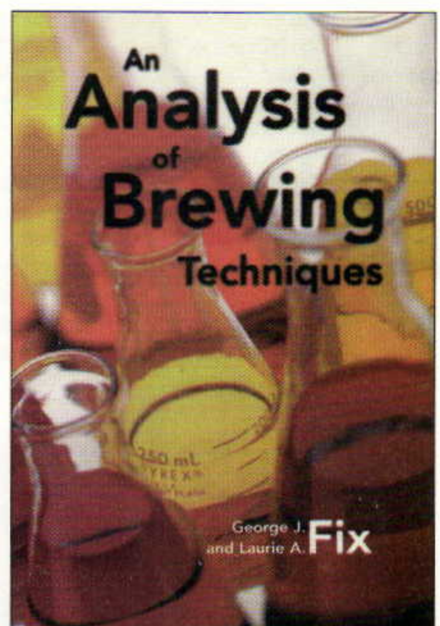
Perhaps befitting his profession, George will probably best be remembered in the homebrewing community for his role as an educator. George gave countless presentations at local and national gatherings of amateur and professional brewers. Most of us remember his presentations for the torrents of valuable information he enthusiastically conveyed in his rapid-fire, almost manic style, always accompanied by copious handouts. These handouts were often particularly valuable because, as one brewer once observed, listening to George was sometimes like trying to get a sip of water from a gushing fire hydrant.

Indeed, George served as a critical bridge between the worlds of professional and amateur brewing. With the publication of "Principles of Brewing Science," and in his many presentations, George inspired legions of homebrewers to begin to try to appreciate, understand and apply the scientific bases of what is actually going on in brewing and fermentation processes. In his writings and presentations, and in his posts to the "Home Brew Digest" on the Internet, George introduced the homebrewing community to techniques such as no-sparge brewing, first-wort hopping, ice brewing, using selective media such as HLP, and the potential hazards of hot-side aeration. Although these topics were known (and in some cases all but forgotten) among professional brewers, George's insatiable quest for better beer led him to investigate and experiment with these techniques in small-scale brewing, and then share his results with us.

In his farewell to Dr. Fix, Karl Lutzen of the "Home Brew Digest" perhaps said it best: "I no longer put faith in the adage, 'In heaven there is no beer,' because you are there now getting it ready for the rest of us."

Rest in peace, George. You will definitely be missed. ■

Louis K. Bonham is a homebrewer and an attorney from Houston, Texas.



Dr. Fix's brewing books brought a wealth of valuable information and experimental data to homebrewers.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