

Brew

YOUR OWN TM

August 1995, Vol.1, No.2
Niche Publications Inc.

THE HOW-TO HOMEBREW BEER MAGAZINE

**Catch the Perfect
Hop Flavor**

**Cool Tips for
Summer Brewing**

**Build the
Ultimate
Mash Tun**

**Simple Steps
to Great Lager**



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Microbrewers should have nothing to hide from their customers.

That's why I believe all microbrewers should put a clear, easy-to-read freshness date in a prominent place on their labels. The Institute for Brewing Studies, a non-profit organization, also supports the edu-



There's an easy-to-read freshness date on every Samuel Adams.

cation of the brewing community on consumer legible freshness dating.

I hope consumers support the following microbreweries. You can help push for industry-wide freshness dating by calling your favorite microbrewery and urging them to include clear, uncoded freshness dating on each bottle. You'll be doing microbrew drinkers everywhere a favor.

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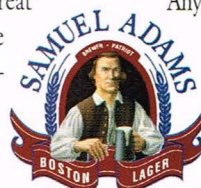
If we have forgotten any breweries that employ consumer friendly freshness labels, please send samples of the labels (so we can include them in any future lists) to: The Boston Beer Company, 30 Germania Street, Boston, MA 02130.

Our industry exists because we take such pride in the quality of our beer. We use better ingredients, and take great care to brew our beers. Don't we owe it to our customers to be honest about the freshness of our beers?

I believe all microbreweries should join the Boston Beer

Company and the other microbreweries listed here in insisting on freshness dating.

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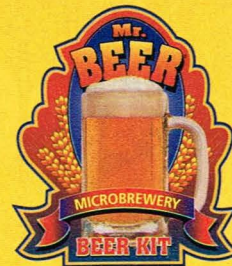
James Koch

Brewer/President
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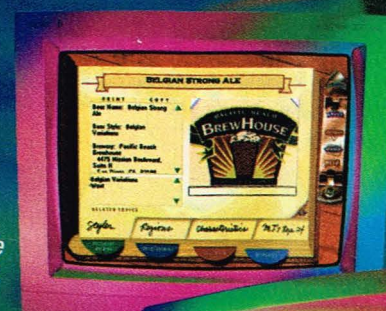
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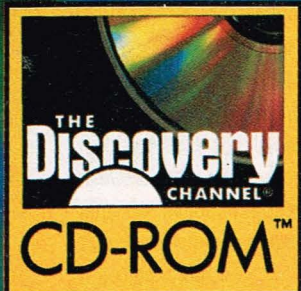
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CIRCLE 76 ON READER SERVICE CARD



Contents

AUGUST 1995

FEATURES

- 27 Make a Great Lager** *David A. Weisberg*
All it takes is patience and the right technique. A step-by-step guide to the art of lagering.
- 30 Keep Cool for Summer Brewing** *Sal Emma*
Five easy ways to cool your fermenting brew and other chilly advice to beat the summer heat.
- 36 Get the Full Effect from Your Hops** *Martin Lodahl*
Choose and use hops to improve your beer. Advice for the novice and experienced brewer alike.
- 46 Build Your Own Mash/Lauter Tun** *Randy Mosher*
Three great designs and step-by-step instructions.
- 53 Brewing For Flavor** *Ashton Lewis and Tom Flores*
Hops provide bitterness, taste, and aroma. But do you know how they do it? Part one of a series on beer ingredients and their effect on your brew.
- 61 Beer Overboard!** *L. Michael Sabo*
Don't let too much, or too little, carbonation spoil your beer.



DEPARTMENTS

- 4 Editor's Note**
Negotiating the next brew.
- 6 Pot Shots**
A homebrew club shoots for a world record.
- 10 Mail**
Congratulations, complaints, and good ideas for future articles.
- 72 Last Call**
The true-life story of a hard-core equipment addict.

COLUMNS

- 13 Help Me, Mr. Wizard**
Oxygen in fermentation, chilling wort, and other answers from our resident sorcerer.
- 17 Tips from the Pros**
How do you formulate a recipe? Advice from three professional brewers.
- 21 Style of the Month**
Märzen: Brew now for Oktoberfest. Extract and all-grain recipes included.
- 67 Microbreweries You've Never Heard Of**
Brian Hunt makes his mark at tiny Moonlight Brewing.

The Negotiating Session

The last time we brewed, my wife, Heidi, wanted to make a weizen. It's her favorite type of beer.

She didn't come right out and say so. It's just that every time we went out, she'd order weizen. Then she'd talk about how great it was. Her strategy was to get me to suggest brewing one. But I wasn't taking the bait.

My friend David and I had been plotting. We'd go to our favorite brewpub, order a pint, and discuss strategy in low tones. We wanted to brew a porter.

There was one basic hurdle. We had to be firm during the next brew negotiating session. Unfortunately, that was never our strong point.

Heidi will drink porter, but only occasionally. Ditto David's wife, Mary. Since the four of us brew together, consensus is essential.

We've been friends and brewing partners for years, so there's a certain process to work these things out.

The men suggest: "This time, let's make a nice chocolate stout."

The women counter: "We've never made a pilsner."

Men, giving ground: "You liked that Anchor Porter we had the other day."

Women, not easily swayed: "Don't you like Pilsner Urquell?"

Men, scrambling: "Sure, but..."

We usually end up somewhere in the neighborhood of pale or amber ale.

The choice is important because we like to brew the same recipe at least three times in a row. Once we pick one, we're committed to it.

As brew day inched closer, David and I laid low. We abandoned our usual tactic of bringing home 22 oz. bottles of porter and cajoling our wives to drink with us. They were on to that ploy.

Heidi continued to plug weizen at every opportunity. When Mary mentioned that weizen sounded good, the deal was practically sealed. We never even managed to launch an offensive.

Then David's neighbor, also a

homebrewer, announced that he was moving overseas and wouldn't be able to take his equipment with him. He gave it all to us: kettle, bucket, siphon, capper (our third)—and a carboy.

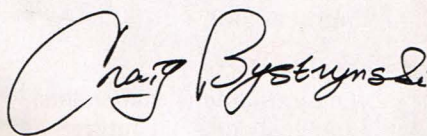
Of course, we could have bought a second carboy long ago. But we had always brewed as a foursome, and nobody wanted to mess with a good thing. Now, however, David and I saw our chance. On brew day, we readily agreed to make a weizen.

We also managed to free up the next two weekends for beer tasting and "analysis," and then brewing our long-awaited porter. On the first weekend we toured area brewpubs. We did the same thing the following Saturday.

Eventually, we both tired of trying only porter. We started ordering other types of beer.

By the time Sunday, brew day, rolled around—I can't really explain how this happened—we decided to brew a Scotch ale. When we bottled it a few weeks later, we all sampled it and our wives loved it. David and I liked it, too. But we're still scratching our heads about the porter thing. We're not locked into three batches of Scotch ale. But now it's our wives' turn to use the extra carboy.

Before they do, maybe we can try a little negotiating.



We Want You

You don't need midnight strategy sessions to get your ideas across to us. We want to know what you think! Tell us what you'd like to see in *Brew Your Own*—or what you hope to never see again. Drop us a line at 216 F St., Davis, CA 95616; fax (916) 758-7477. Help us make this a magazine you use and enjoy. No negotiations necessary. The direct approach is sure to work.

Brew

YOUR OWN™

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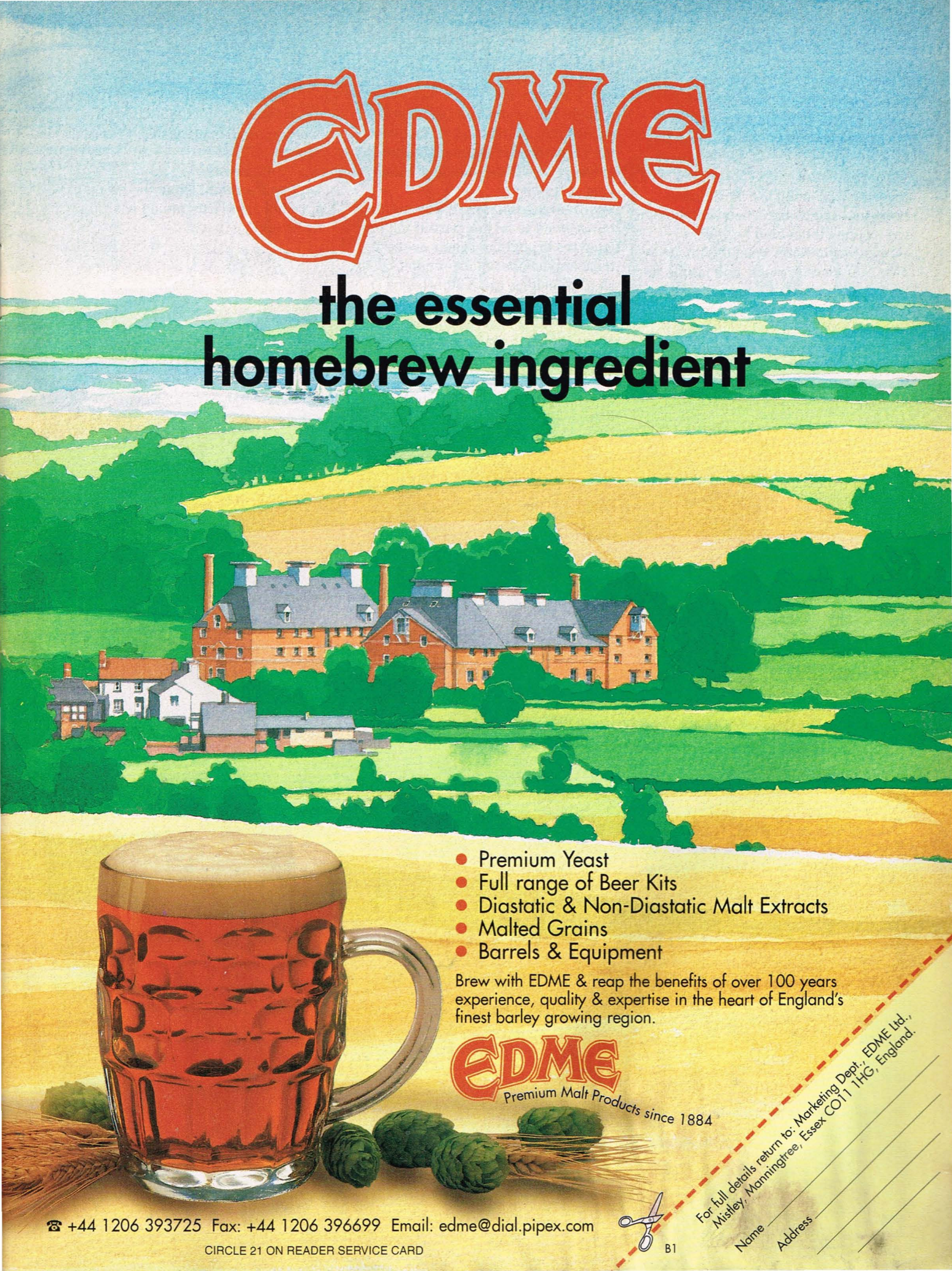
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Alers Take World Record

To honor National Homebrew Day on May 6, members of the Impaling Alers homebrew club gathered to set a record for brewing the most homebrew in a single day. The event, held in the parking lot behind Larry's Homebrew in Kent, Washington, drew over 100 Alers, friends, and family, as well as a share of curious passersby.

Various styles from lagers and pale ales to brown ales and stouts to an Oktoberfest brew were bubbling away as the club tried to earn the world record, set at 450 gallons by the Great Northern Brewers in Anchorage, Alaska.

Early on in the day Impaling Alers' President Don Johnson said that his club was shooting for 580 gallons and

thought the actual number might exceed 600. At the end of the event, the carboys were counted and the grand total was a whopping 781.5 gallons.

Breaking the record was exciting but seemed to be just part of the fun. Brewers brought out their own systems and compared inventions, shared recipes, and told brewing tales.

According to Johnson, the group wants to make this brew-off an annual event, with or without the record attempt. Store owner Larry Riftenberick would like to see even more people

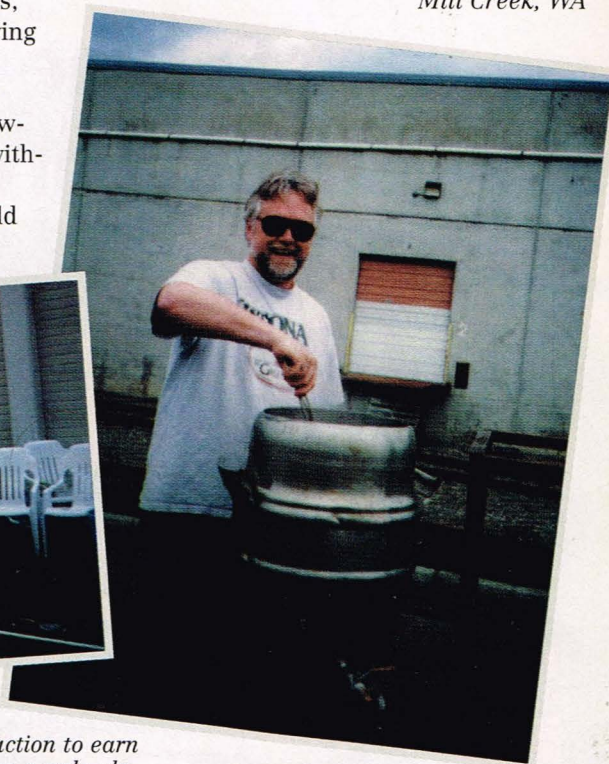
get involved by inviting other local clubs as well as the well-represented Alers.

While another try at the record isn't on the menu, when the group gets together there's no telling what they'll brew up!

*Don Goins
Mill Creek, WA*



The Impaling Alers had every kind of system design in action to earn the world record. Club member Jim Belch (right) whips up a pale ale.



Spotted on the Internet

The rec.crafts.brewing Internet newsgroup is a great place to get tips on homebrewing. Typical messages run the gamut from the recent "Dang, Dang, Dang!" to the ever popular "Help! Stuck fermentation!"

But the chat isn't limited to specific gravity and the vagaries of flocculation. Yes, there are brewer poets in our midst, and their unheralded work turned up recently under the topic "Homebrew Haiku." Here are our favorites:

pitched yeast in hot wort
overvigorous bubbles
messy foam on floor

—Derrick Williams

malt crushed too finely
inevitable stuck sparge
stir, recirculate

—Bruce Buck

thermometer broke
quicksilver falls into the mash
no witbier for Derek

—Derek Vandivere

More Homebrew Humor

I regret to inform you today,
That the yeast in your beer passed
away

It seems such a sin
That they did themselves in
But let's drink to their health, anyway.

*Dick Reese
Anaheim, CA*

CONFESS!

Share your darkest brewing secrets with your fellow homebrewers. Show off your homebrew set-up, and brag about it, too. Send your photo/story to Pot Shots, c/o Brew Your Own, 216 F Street, Suite 160, Davis, CA 95616. E-mail: BYOmag@mother.com. Be sure to include your address and phone number.

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CIRCLE 16 ON READER SERVICE CARD

David O'Neil Green Acres, Florida

This design resulted from plans to include all the steps to brew grain beer and to minimize problems. We wanted as few places for contamination as possible, nothing in the (off-limits) kitchen, minimum footprint, in-garage hose-end operation, all-grain or extract brewing, precise temperature control, all stainless, no dipping from a boiling kettle, etc. In short, the next consumer must-have gadget: a beer-making appliance.

One way I've found to eliminate problems is to eliminate parts such as pumps, wort valves, recirculators, threaded fittings, and electric heating elements in the brew. Simplicity has its own elegance. This design began to take shape after many discussions and a lot of reading.

We began with the purchase of a used stainless keg, fish fryer, propane tank, camping cooler, water filter, hose fittings, in-line hose valve, and electronic thermometers. Later we bought another stainless keg.

We assembled all the parts, got all the dimensions, and drew a scale diagram. We discovered the planned no-lifting gravity system would have had to be eight feet tall! We could do it, but it would be a tight fit. Furthermore, there would be a tank with a lot of hot water at the very top. We backtracked and decided that the carboys would be the lowest parts. It would be necessary to lift the carboys up two feet for racking into the kegs after fermentation. No problem.

All the steel for the frame cost \$20. There are four types of steel used and the jobber cut them into the smaller lengths I needed. I used bimetal hacksaw blades in a high-tension frame for any other cuts. I TIG welded the frame together. If you're following along, the three-foot base will bow up when you weld it to the six-foot upright, so weld it first, then weld the two-foot-long feet on last.

We cut an eight-inch hole in the top of the 14-inch keg for the upper tank using a jig saw, attached a spout, and secured it to the frame with a stainless wing nut through the keg

handle-rim. For testing during brew, we drilled a hole for surgical tubing through which we inserted an electronic thermometer. It's a tight fit and won't leak.

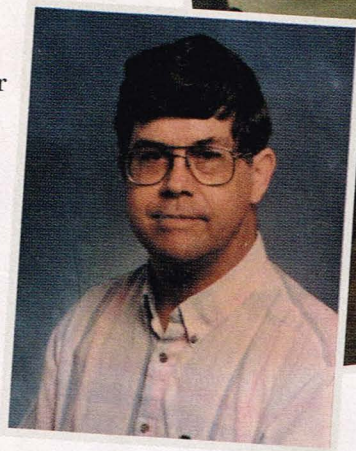
The stainless dip tube from the 14-inch keg was made into the false bottom for the sparge-mash-lauter tun (cooler) by hack-sawing slits and getting all the burrs out. In the tun it is covered with a loose piece of copper screening.

We used the 15-inch diameter keg for the kettle by cutting the top off, attaching a spout and mounting bolt. Actually, no hole is necessary for a thermometer in the boiling kettle but we drilled one anyway. It looks neat!

The frame includes a base and main upright, along with cross arms and support arms for the cooler and burners. We made a plywood shelf with brass corner braces for the cooler to keep it from sliding around. The water filter bracket is riveted to the upright, and we put another electronic thermometer in the grains in the cooler.

To keep the whole thing stable, we placed wedges under the feet to make it level and secured them in place with duct tape. We even created a plywood base to fit over the cooler to hold our malt mill. Everything is right where we need it.

We christened it "The Beerbecue—the Hose-end Homebrewery for the All-Grain True Believer" (a.k.a. Igor's Laboratory).



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- * Barleywine

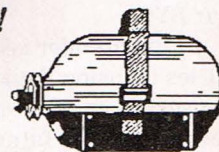
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BYO Mania

Dear Brew Your Own:

Great Brewmag! Good job. You should be proud. I lift a pint of my fabulous brown ale to you. We here at the Brewcenter wish you all the luck in the world, although we out in brewland are actually the true beneficiaries. Congratulations and keep 'em comin'.

*Michael Bunker
Southwest Brewcenter
Lubbock, TX.*

Thanks to everyone who faxed, e-mailed, and sent us warm wishes and congratulations. The response has been overwhelming—far too many notes to publish. Please write again with more comments, criticism, and suggestions.

Planning for the Future

Dear BYO:

I'm an extract brewer and using adjunct grains is about as close as I plan to get to mashing things (although my four-year-old son thinks it sounds nifty), so for future issues, could I ask that you include extract versions of some of your recipes? I'm particularly thinking of the "Capone" recipe. I realize that that would not be appropriate for the "decoction" article, though.

*Bob Withers
Peyton, CO*

Dear BYO:

In the premier issue I found the articles on using liquid yeast and kegging very insightful—perfect for my brewing level. In future issues of BYO please devote more of your magazine to the "intermediate brewer." Let me define intermediate brewer: Me! I suspect that there are a great many "Me's" in your readership.

I have been brewing for approximately three years and have brewed roughly 25 to 30 five-gallon batches of beer. I have progressed from two-canslamming kit brewing into a combination of small amounts of grains, fruits, and malt extracts (both dried and syrup). I enjoy experimenting with use of raw materials in my brew. I am not prepared to start all grain brewing nor do I think I ever will. After all this is

my hobby, and I don't want it to become a chore.

Please keep us intermediate brewers in mind as you publish your magazine.

*Don Gould
Holland, MI*

Dear BYO:

I must admit, even though I have been brewing beer for about a year successfully, there is always room for improvement. Your article regarding decoction mashing was most informative. It was very easy to follow and understand. It will without a doubt become a permanent part of my brewing library.

Some of the things I would like to see as a subscriber are:

- Features of different types of beer each month.
- A quick review of the following month's issue.
- More methods and tricks of the trade.
- Ways to design and build your own home brew equipment.
- An opportunity for fellow brewers to share tried and true recipes.
- More of your writers' recipes.
- Ways to make brews like we buy in the store.

*Kevin Fallon
Kendall Park, N.J.*

Dear BYO:

I just finished reading your premier issue, and I must say that I was very pleased. My only complaint about the articles is that they either were extremely basic or they were completely over my head. I know trying to write to all levels of homebrewers is difficult, but I hope you will be able to smooth out the highs and lows.

When thinking about the magazine, a few ideas for future articles came to mind:

- How to evaluate your homebrew with a score sheet.
- Step-by-step breakdown of the lager process.
- How to grow your own hops.
- A review of available filters for beers plus the advantages/disadvantages of all the various clearing agents.
- A gadget column.

- Food recipes that include beer.

Keep up the good work, and I look forward to my next issue.

*Bob Beckmann
St. Louis, MO*

Room for Improvement

Dear BYO:

I seldom read any magazine literally cover to cover including the ads... but that is exactly what I did with your first issue of BYO.

Congratulations on a flying start; keep it up and you will have a steady reader.

I have a point to mention, however. In Kathy Kincade's article on Al Capone's brew, mention is made of using soy grits. To the best of my recollection (backed by the reference librarian of our local library), soy products were not used for edible purposes in

HOW TO REACH Brew YOUR OWN.

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1924. Soy oil was still "innovative" at the 1933 World's Fair in Chicago. Soy meal was only used as fertilizer until about 1940.

But it's a good idea to add soy grits to a mash. For good yeast growth a supply of polyunsaturated fatty acids is needed. I'm an iconoclastic home brewer (for over 20 years). I would recommend trying flaxseed meal instead of soy. Use not more than half as much as the 1/2 pound in you recipe; maybe four ounces in a five-gallon batch.

I am old enough to remember Canadian Ace beer and visited the brewery many years ago...never met Al Capone, but his name was mentioned every time we passed the Metropole Hotel on 22nd and Michigan.

John E. Thompson
Monee, IL

Dear BYO

I just read your premier issue and wanted to let you know I enjoyed it. The articles provided useful information without requiring a degree in chemistry. How about a regular column that reviews new beers? Software? Books? Gadgets?

I liked the article about kits, but I would have found it more useful if the reviews contained more content about the resulting beers. I don't care about the yeast or the directions that come on the can. (I know, I know, first timers might). I want to know if it can be used reliably to produce a full-flavored beer. This is the type of information that I would find helpful.

Good luck. I look forward to your next issue.

Matt Gregory
Kalamazoo, MI

Dear BYO

In response to the article "A Shopper's Guide to Beer Kits" in the premier issue, I'd like to clear up a misconception that a small but vocal group of people in the homebrewing business have about the use of corn syrup in my Superbrau ingredient kits.

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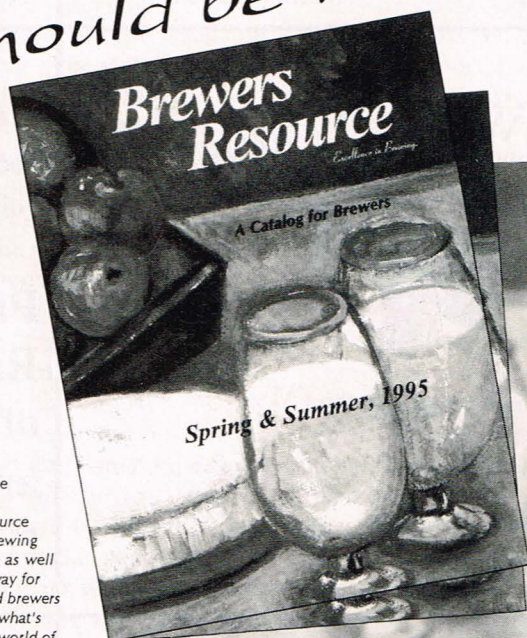
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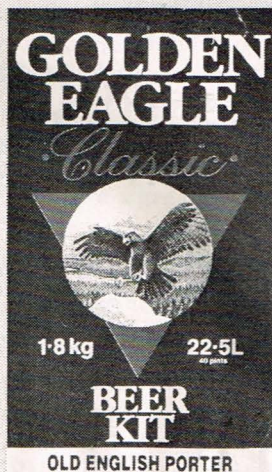
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One Alligator, Two Alligator...



Mr. Wizard

What is your advice on using pure oxygen in a five-gallon primary fermentation? I use a racking cane to inject gas into the carboy. I'm counting to five alligators at a flow rate of 15 liters/minute. I'm guessing and hoping not to overdo it and get off flavors. Should I count to more or less alligators?

*Tim Klopfer
Girdwood, Alaska*

Hmmm. While most beer is consumed by mammals, there is definitely a place in brewing for reptiles. The short answer is that you're off to a good start and that a few more alligators wouldn't hurt.

The long answer has to do with (1) How much oxygen is enough? and (2) How do you get oxygen into the wort?

Technically speaking, yeast require around six to eight milligrams of O₂ per liter of wort to produce healthy off-spring in the early stages of a brewery fermentation. This is about all the oxygen you can get into wort if using air. If

you use pure oxygen, you can reach five times this level.

If the yeast don't get enough oxygen, you will have poor yeast growth during fermentation and the yeast off-spring will be sickly. This may cause sluggish fermentation rates and the finished beer may be very fruity.

If you add too much oxygen, you may get excessive yeast growth and very vigorous fermentations. So the solution is to hit it just right!

Let's address the second issue and come back to this "just right" idea. As far as getting the oxygen into the wort, we're up against buoyancy. Since oxygen bubbles float to the surface of wort and release their booty to the atmosphere, only part of a bubble's cargo makes it into the wort. Smaller bubbles allow more oxygen to diffuse into solution than large bubbles. That means that the large bubbles created by your racking cane release most of their oxygen into the atmosphere.

Getting the needed oxygen into wort is easily accomplished by pushing gas through a porous device. Aquarium stones are ideal for this, but tiny holes poked in a racking cane with a sealed end also work well. The smaller bubbles have a larger surface-to-volume ratio and are better able to diffuse their oxygen into the wort. Also they rise slower than large bubbles and have more time to give up their load.

Armed with small bubbles, let's get back to the "just right" thing. This figure depends on yeast strain (some require more oxygen than others), pitching rate (underpitching requires more yeast growth), and wort gravity. The yeast issues are straightforward. Basically, get a feel for your yeast's oxygen needs, meet the oxygen needs, and then pitch enough yeast.

The wort gravity issue is one of the many catch-22's in brewing. Generally, higher-gravity worts require more oxygen than lower-gravity worts for a normal fermentation, but high-gravity

worts allow less oxygen into solution. That's because oxygen solubility is inversely proportional to wort gravity. Insufficient wort oxygen is a recipe for fruity beer. So high gravity beers are usually more fruity than lower gravity brews.

Professional brewers resolve this dilemma by getting as much oxygen into solution as possible, because not having enough oxygen causes many more problems than having too much. Too much oxygen will create a copious yeast crop during fermentation, blowing some of the yeast crop out of the fermenter. If that happens, the oxygen level is simply reduced.

Most brewers use air instead of oxygen (air cannot add too much oxygen). They inject the air in line while the cooled wort is headed towards the fermenter.

I would suggest that you continue using your oxygen since you have it and that you get your bubble size down. After that, experiment to determine how many alligators produce the best beer. Just remember, extra alligators are better than too few. Hopefully this advice helps. If it does, send some bottles of that 18-alligator amber to Mr. Wizard in care of BYO!

Mr. Wizard

My question for the day: Is there a subtlety in chilling wort? I let mine sit until it gets down to pitching temperature, which can take awhile. I don't know how I can affect the brew by accelerating the cooling process.

*Seppo Lehto
Wolfeboro, NH*

I like these to-the-point questions with direct answers. The answer is, getting your wort cooled quickly is

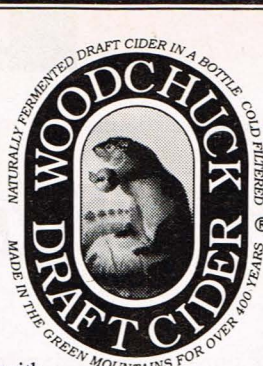
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what is best. The primary reason is flavor preservation and the secondary reason is to produce a good cold break.

The flavor preservation argument goes something like this: Hot wort can and will get bacteria in it, even though the wort is sterile before splashing into the carboy. When the wort reaches about 140° F, some of these bacteria will start growing. Since bacteria grow rapidly, bacterial populations can become extremely high before you ever pitch your yeast. All of the time they are growing, they're stinkin' up your brew.

If you are able to cool the wort quickly, the chance of wort spoilage is decreased because of yeast. Yeast are handy because they quickly reduce the wort pH, produce alcohol, and inhibit the growth of many bacteria. Those bacteria that still can grow are in competition with yeast for food. Since there are far more yeast than bacteria cruising around in the wort looking for food, the yeast tend to gobble it up before the bacteria have much of a chance. Of course, this is only true if your pitching yeast is clean. If you pitch contaminated yeast, all bets are off—but then again, so is your beer!

Assuming you have cooled the wort relatively quickly, you may notice an increased amount of cold break. This is the protein that comes out of solution when wort is cooled. Cold break explains why clear, hot wort turns cloudy when chilled. In any case, fast cooling produces more cold break than slow cooling.

Some brewers, especially those from Germany, firmly believe that cold break left in the wort contributes to harsh flavors. These brewers want to maximize its formation during cooling and remove it. So if you want to buy into that idea, there are now two valid reasons to cool your wort rapidly.

The best way to cool it is with a specialized cooling system. The two most common types are the counter-current heat exchanger and the submersion chiller.

In the first type, wort passes through a copper tube or some other good conductor of heat, while cool water is passing over the outside of the tube. The water flows counter to the wort flow, hence the name.

Submersion chillers are also made of copper or an equivalent conductor. In these devices, however, the cool water

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runs inside of the tube and the whole device is submerged in the hot wort. They both work well and will cool five gallons of wort within 20 minutes.

I like the counter current chillers because the wort is cooled more rapidly; it enters hot and exits about 20 seconds later cool. The total cooling time for the batch is the same, but since the time for any given wort drop to cool is quick, you get better cold break formation.

The bottom line is that hanging around waiting for your wort to cool should make you nervous because of the increased risk of spoilage. The other perk may be a crisper, cleaner barley pop!

Mr. Wizard

I am new to homebrewing, so new in fact that I am still gathering my materials. All of the sources I have consulted recommend the use of glass bottles. Yet when I opened your magazine the first thing I see is an advertisement for an equipment kit that includes plastic screw-top bottles. How do plastic bottles compare to glass bottles, and how good in general are plastic bottles for this purpose?

Mark Poukkula
Monroe, WA

I hate bottles. I mean taking the soggy cigarette butts out of those bar bottles, getting the labels off, cleaning them, filling them, and then cleaning them again for re-use is a royal pain in the can! The only good thing about the whole process is the drinking stage. Plastic soda bottles obviously cut down on a lot of this effort. You can save them from home use, and it only takes 10 two-liter bottles to bottle off a five-gallon batch.

So what's the downside? Plastic soda bottles allow light to strike your prized beer and eventually allow for the slow transfer of gasses across the bottle wall. This means that over time the beer will flatten due to carbon dioxide escape and that the beer will

gradually oxidize due to oxygen ingress. If you don't mind skunky, oxidized homebrew, plastic bottles will do the trick!

On the upside, however, the gas transfer business is slow, and light can be kept out by putting the bottles in the dark. Recent research from England shows that beer will hold its carbonation for up to three months in

plastic (PET) bottles. These bottles also ward off beer oxidation for the same time period. This means that if you don't drink the beer within three months, its quality will start to show noticeable signs of deterioration. That's no problem; just drink your beer while its fresh.

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the packaging aesthetics so prized by the alcohol sales industry. This is the main reason that real corks are still used in wine bottles even though much spoiled wine is the direct result of cork failure. It's also the same reason that expensive beer is packaged in glass and cheaper beer in cans, even though cans are a superior package.

Some brewers are beginning to use plastic bottles. Better polymers are being developed to help extend the shelf life beyond three months. Check out the malt liquor in the 96-ounce plastic bottle—I think that's the size. Anyhow, it's a monster!

One true negative to big plastic bottles is resealing. If you open a two-liter bottle, then you've committed to a six pack! In response to this, a small company out of Florida has developed a cap to put on a two-liter bottle that connects to a soda fitting.

This means that you can artificially carbonate your beer in a small bottle (if you want to), remove the beer from the bottle without opening the cap, or repressurize the bottle after pouring a beer. Whatever you use it for, it's a clever device.

So if you want to use plastic bottles, rest assured. Just be sure to consume the beer within a reasonable time period and to keep it in the dark during storage. If you want to brew a beer to lay down, then bring out the glass. ■

Mr. Wizard's Address

Do you have a question for Mr. Wizard? Write to Mr. Wizard, c/o Brew Your Own, 216 F St., Suite 160, Davis CA 95616. You can also reach us by fax at (916) 758-7477 or e-mail at BYOmag@mother.com.

It's a bird! It's a plane! No, it's Mr. Wizard. Mr. Wizard, BYO's resident expert is a leading authority in homebrewing whose identity, like the identity of all super heroes, must be kept confidential.

Create Your Own Recipe

by Gailen Jacobs

Creating your own recipe can be one of the most fun and rewarding parts of homebrewing. It takes creativity, a bit of daring, and a basic understanding of the brewing process.

Three pros share their techniques and offer advice. While each of the three has a different method—one relies on formulas, another uses trial and error, and the third recommends steadfast trials and notetaking—all of them repeat a few themes: Find and use some reference manuals. Study different examples of your chosen style (that means you get to drink a lot of beer). Choose a beer that you really enjoy drinking.

Brewer: Doug MacNair

Brewery: Redhook Ale Brewery, Seattle

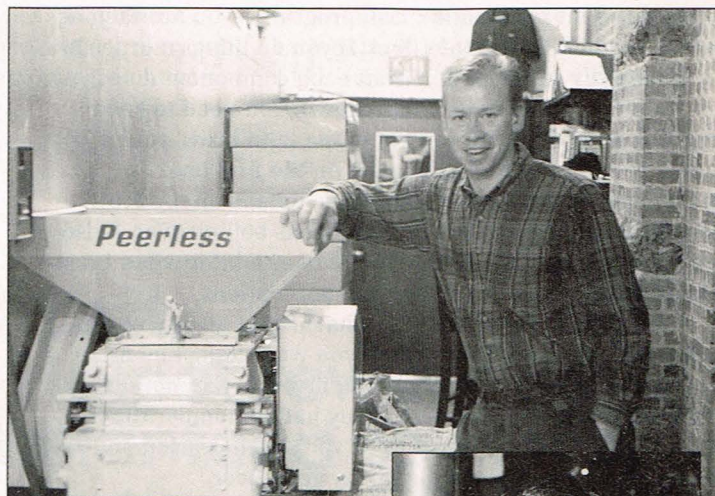
Years of professional experience: Seven

Education: Practical training in three different breweries in Northern Germany; Courses with the American Brewer's Guild and others; six years homebrewing.

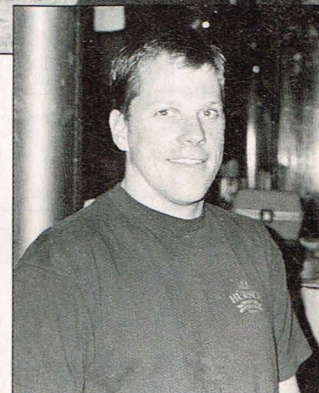
We do a new product every two months, so we're constantly in the process of formulating new recipes. We first figure out what style we want to do, which is no small feat in itself. There are a lot of different beers out there.

Once we've picked a style, the very first thing I do is gather as much information on the style as I can. There are all sorts of books available about the products and brewing history. Research materials that give set points for given styles give me a real solid technical feel for that beer's spectrum. Take an India pale ale for instance. If you go back to the turn of the century, there were IPAs that had gravities of 18° or 19° Plato (1.070 to 1.075 specific gravity). These were huge beers. A modern-day English IPA is a pretty mild-mannered product. You have to figure out what you want to do in that spectrum.

After I get an idea of where I want my beer to fall, I base a lot of my decisions on intuition. I don't try to model my recipes after any other beer; there's no fun in copying what somebody else did. Trying to track down the amounts to reproduce a beer is also incredibly difficult. I have two breweries on opposite sides of Seattle. It took a huge amount of diligence on my part to get the product to be



David Hartmann (above) recommends formulating a recipe to match a particular model. David Sipes suggests starting with kits as a good way to develop a better understanding of beer ingredients and what they do.



exactly the same between the two plants. The recipes are not the same to have the same end product.

While not trying to copy a beer, you do need to look at what's out there to know that you are faithfully staying within the parameters of the style.

When I actually begin to put the recipe on paper, I always start out with the gravity, and I consider what kind of body the beer should have. Is it going to be a light product or is it going to be a big, meaty beer? I leave the hops for last for that reason. If you decide on a very light-bodied product with low gravity, you're not going to want to hop it too high or you'll end up with a really unbalanced beer.

For example the IPA is a really hoppy beer, but hops are just part of the beer's characteristics. If you make a low-gravity modern IPA and a turn-of-the-century IPA, you end up with very different hopping rates. A beer that has an original gravity of 16° or 17° Plato is going to be able to withstand a lot higher bittering level. You just have to get out there and play with it. There is no magic formula.

When you begin formulating recipes, try something simple. Do an amber ale, not a stout. It's basically a very straightforward recipe. Pick one element to experiment

with. For example play around with the same amount of different malt crystals. Try some Crystal 40; try some Crystal 60. If you're really wanting to learn about the ingredients, this is what you have to do.

Unfortunately, experimentation is very time consuming. If you change many variables at once—change your hopping, different malts, and mash program—you aren't going to know which had what effect. If you do things a little slower, you really get a feel for what each component does.

Don't forget to write things down. You need to keep records or by the time you get to the 20th brew, you're not going to remember what you did on the first one. I'm scrupulous about writing out all the details on my brew-sheets, including any problems such as boiling over. I also go back to that same brew sheet a month later when I taste the beer to I write down my taste perceptions.

You can get very precise, if that's what gives you pleasure. But this is a hobby. And if you want to just be more relaxed, that's great. Professional brewers had nothing at their disposal 300 years ago. They had no temperatures, they had very little in the way of volume measurement. And they were probably making pretty good beer.

To improve your recipes play around logically and take notes. But the bottom line—and the beauty of homebrewing—is that you can make an outstanding beer and you don't have to have all that exactitude.

Brewer: David Sipes

Brewery: Sudwerk Privatbrauerei Hübsch, Davis, California

Years of professional experience: 5 1/2

Education: BS in fermentation science at University of California, Davis. Homebrewer for six years.

I don't really apply any science when formulating recipes; it's a lot of personal taste and knowledge of styles. There are certain flavors I like. Being able to identify things about beer that I like and don't like is basically knowing what kind of characters different malts and hops lend. I approximate various percentages for the ingredients based on the taste I want and the characters of the ingredients.

There are certain formulas around to help—"if you want this color then you need to use this percentage of that malt"—but I do it more or less by trial and error. For the most part I've been pretty successful.

When first formulating a recipe, I give beers I like in the style a critical evaluation. When tasting a beer, I can get a rough approximation of the alcohol content and accordingly what the starting gravity would be. Recognized styles are supposed to be within a certain range with starting gravity, alcohol content, residual sugars, and things of that nature as well as hop bitterness. That takes away some of the guess work and starts you off.

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I've always recommended that less-experienced homebrewers stick to kits to get an idea of what the basic ingredients do. Developing one's palate is of tremendous importance. If you buy a kit that mimics Dos Equis, you can decide what you like and what you don't about the taste. The more you deal with the kits and the fundamentals, the better you can predict what a certain ingredient is going to do. The more experienced you are with those, the easier it will be to get into less-mainstream ingredients and play around with hops and things like that.

There's an abundance of kits to choose from, but the main thing is getting to know the characteristics of different ingredients such as caramel, Munich, and chocolate malt, and Cascade and Chinook hops. Once you have a good understanding of that stuff, then it's really easy to play around.

Above all, watch the sterilization. I'd say that 95 percent of the homebrews I've tried have some fermentation flaw or microbial problem. My advice from a formulation standpoint is to work for a balanced beer.

Oftentimes people—both homebrewers and professionals—seem to try to mimic a style like a Sierra Nevada Pale Ale, which is known for being a really hoppy beer, and they neglect the malts. Sierra Nevada is very hoppy, but it has a very firm malt backbone as well. It's a balanced beer. Often homebrewers seem to miss that. It's the case with the chocolate malt as well. All the beer's characteristics are supposed to come together and provide a balance. Play around. It's trial and error, but it works for me.

Brewer: David Hartmann

Brewery: Empire Brewing Co., Syracuse, New York

Years of professional experience:

2 1/2

Education: Master Brewers Program, University of California, Davis.

The first step I take when making up a new recipe is figuring out which style I'm shooting for. There are fairly

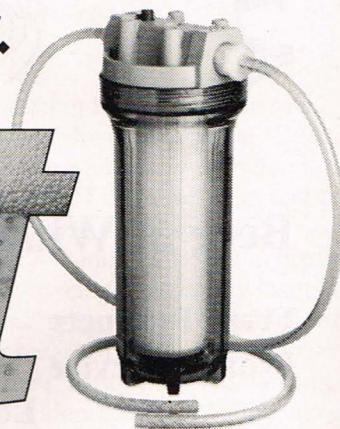
strictly defined guidelines as to what you're supposed to hit to make the different styles. I use guidelines from books from the Institute for Brewing Studies.

While there are many guidelines for style, I look at the specifics for color, original gravity, final gravity, and bitterness to give me the groundwork for my brew.

After I get a feel for the style based on the guidelines, I run out to the store and pick up as many different examples of the style as I can. I taste them and read them based on my taste preferences. I might find one a little too bitter, and I'll try to make a guess at how bitter it is. When I figure out what I like and don't like in the samples, I will formulate the recipe.

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I usually have a concept of what I want based on my brewing experience before beginning the process. In some cases I'm almost trying to copy what I consider the perfect example of a style. Guinness is the classic stout. When I made stout I tried to make something very similar to Guinness.

I think it's a good exercise for homebrewers formulating recipes to

try to match a particular model. At least it is for me. I find a beer that I think is very good and try to get close to it. Maybe I'll vary it—make it a little more bitter, a little less bitter, a little darker. I like to shoot for that and see how close I can get.

Once you choose the style of beer that you want and pick a possible model, defining the color is a good

next step, because it is an easy variable to figure out with the equations.

There are some easy tricks to simplify all the ingredient decisions. In terms of the malt, I try to pick pretty traditional ingredients. My idea is that I pick the color that I'm shooting for, and then I use the ingredients that would traditionally be used. For example in a pale ale, caramel is typically where you derive most of the color. I'll use caramel solely for the color and then a very pale malt to fill it out. For something like a stout I use roasted barley, because the color that you're shooting for is basically black.

Obviously, there are several kinds of malt that have different colors. Each gives a different flavor as well. Two different malts might give you the same color, but they would taste very different. That's something you can play around with.

Calculations found in the brewing reference materials help you set up the amounts of ingredients. First, I figure out how much grain I want. Say I'm making a recipe for an amber ale starting at 13° Plato (1.052 specific gravity) using a 70 percent extraction rate. Calculations can tell me how much caramel 60 Lovibond malt I need to get a certain color. (Lovibond is a scale from 10 to 120 degrees used to measure the color of malt. The higher the number, the darker the color.)

I hope that amount gives me the right flavor as well. If not, the next time I will change it. The calculations usually work out very well. The guidelines and calculations help give you a balanced brew.

I hate to say this, but it seems to me that a lot of homebrewers tend to overdo the darker brews. A too dark, too heavy stout is pretty common. My advice is to hold back on the darker malts the first time you brew a particular beer, then add more the next times until you get it at a good level. I make beers professionally so I have to be more concerned with it, but it's a good rule of thumb: Try not to overdo it on anything. ■

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Märzen: Brew Now for Oktoberfest

by Jeff Frane

All right, pop history quiz.

Who were Gabriel Sedlmayr and Anton Dreher, and what was their contribution to brewing science. You have five minutes.

No, sorry, that's Dreher, not Durer, and anyway I'm pretty sure Durer never drew any beer labels. But at least you're in the right country.

Time's up. If you said that Sedlmayr and Dreher were responsible for the first commercial production of lager beers, you were correct. Sedlmayr in Munich and Dreher in Vienna essentially created the lager industry, beginning with their introduction of lager yeast and cold fermentation in 1841. Their beers (and the lager beers of Pilsen, which began using the yeast the following year) met with immediate success throughout Central Europe.

The two brewers not only had their own genius working for their success, but history favored them as well. In 1841 the Austrian Empire still ruled much of central and southeastern



Märzens are standard seasonal fare in German beer Gardens.

Europe, including the extremely valuable regions (from a brewer's perspective) of Bohemia and Moravia, home to some of the world's finest hops and malting barley. To the north Prussia

was starting to stretch its borders and beginning the unification of Germany. There were no geographic barriers to the spread of the new beers and the new brewing technologies.

While Sedlmayr's Spaten brewery was producing dark, malty lagers (the simplest to brew with Munich's water), Dreher started producing a copper-colored beer, malty yet crisp, that rapidly became identified as "Vienna lager." In the next decades he also applied the "Märzen" approach: laying the beer down during spring (March) in ice caves and leaving it there to mellow, blend, and clear until the cool days of autumn. Eventually, in the 1860s, Dreher and Sedlmayr introduced some of the first systems of artificial refrigeration, probably the single most dramatic technological achievement in brewing history.

The Märzen beers emerged from their caves just in time for Oktoberfest, a huge party originally held in 1810 to celebrate the Bavarian crown prince's nuptials. The Vienna-styled beers Sedlmayr introduced in Munich (using

Oktoberfest (All-grain)

Ingredients:

- 7.5 lbs. Pilsner Malt (German or Belgian)
- .84 lbs. Belgian CaraVienne Malt
- .42 lbs. Belgian Special B Malt
- .5 oz. Tettnanger hops (at 45 min.)
- .8 oz. Styrian Goldings hops (at 60 min.)
- .8 oz. Saaz hops (at 75 min.)

Step-By-Step:

Mash grains in 3.25 gallons of water at 125° F for 30 minutes. After 30 minutes, raise temperature to 154° F. Hold for 45 minutes. Quickly raise temperature to 159°

F, hold for 10 minutes. Sparge with an equal amount of water. Boil for 90 minutes, adding the hops as indicated (if pelletized hops are used, they may be added all together at the 45-minute mark).

Ferment out with a good lager yeast (W-34/70 or Wyeast 2206) at the appropriate temperature (42°-48° F), for 8-12 days. Over a 24-72-hour period, cool to 34°-38° F and hold for 4-6 weeks. Follow standard lager beer techniques for kegging or bottling.

Recipe courtesy of George Fix

the Vienna malts Dreher had developed) have been known by that appellation ever since. In fact, Märzen/Oktoberfest beers are among the few surviving versions of the style today.

Although Vienna lagers enjoyed a tremendous popularity throughout Europe during the latter part of the 19th century, they rapidly disappeared in the 20th in the face of competition from the new, paler styles such as pil-

sners and Dortmunders. It's also likely that history, once again, played its part as the Austro-Hungarian empire crumbled and Vienna's influence waned considerably.

As George and Laurie Fix point out in their thorough study of Vienna lagers, *Märzen/Oktoberfest/Vienna*, the style made a valiant attempt at survival in Mexico and Texas of all places, under the supervision of a Mexican

brewer, Santiago Graf. Graf went so far as to import both his malts and hops from Europe, having found nothing suitable in the New World for the production of quality lagers. Elsewhere in the US, the use of poor-quality domestic hops and six-row barley (which makes poor Vienna malt) ensured that the style never gained a foothold in the North.

Prohibition in Texas and political turmoil in Mexico led to the destruction of Graf's efforts, but remnants of the style have survived in Mexico, in bottles of Noche Bueno and Negra Modelo. Throughout the rest of the world, the Vienna lager has fared poorly, except in Bavaria where

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Oktoberfest (Extract/Grain Recipe)

Additional Ingredients:

- 4 lbs. light malt syrup
- 3 lbs. light dry malt extract

Step-By-Step:

Substitute 4 pounds light malt syrup and 3 pounds light dry malt extract for the Pilsner malt in the all-grain recipe (page 21). If you will not be boiling the entire wort (6 gallons), but instead boiling half the wort and diluting with cold water, you need to increase the quantity of hops to make up for the reduction in extraction efficiency from the heavier wort. Doubling the hopping rate (especially the addition at 45 minutes) is a good place to start; if this turns out to be too bitter, or too hoppy, reduce your additions the next time.

Steep the CaraVienne and Special B malts in 1 gallon water at 150° F for 90 min. Rinse with hot water, gathering 2.5 to 3 gallons of water. Add the malt extract and boil for 90 minutes, adding the hops.

Follow the fermentation procedures outlined in the all-grain recipe.

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Märzens are still produced, along with Oktoberfests and Festbiers.

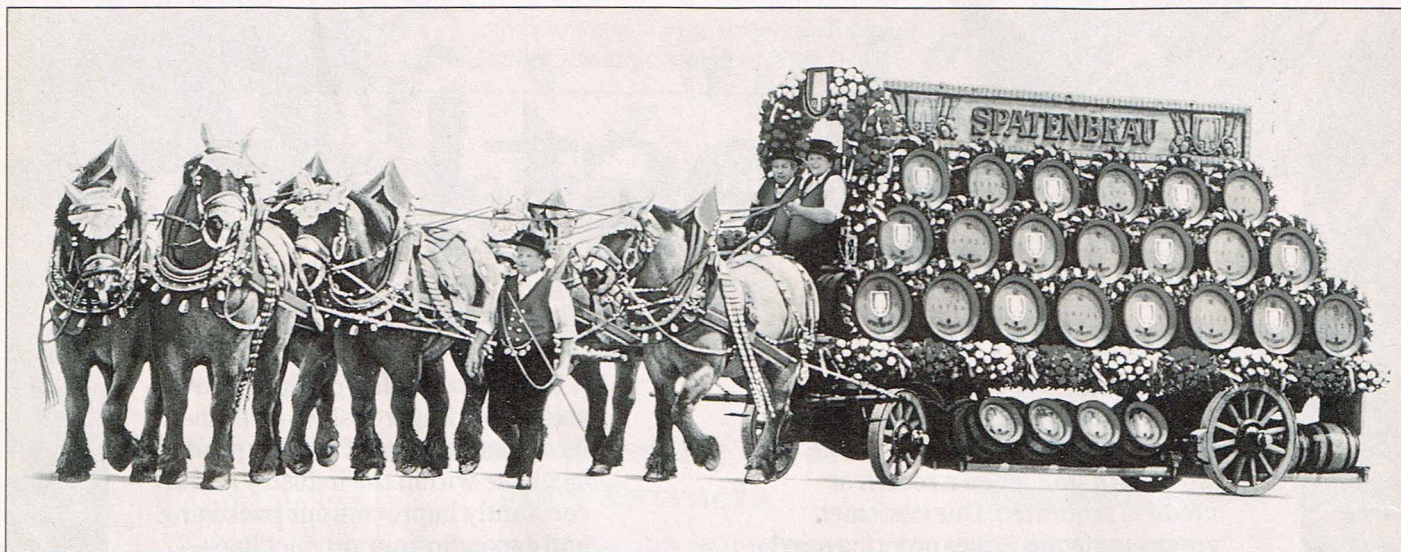
So what is a Vienna lager? Consider this tantalizing lead from Michael Jackson's *Beer Companion*. "For mouthwatering succulence, there is no type of beer to compare with the Vienna style: the amber-red, bronze,

or copper-colored lager with the soft maltiness of aroma and palate." It certainly sounds wonderful, but finding commercial versions to taste is tough.

In Munich the "Märzenbiers" or "Märzen/Oktoberfest" beers tend to be closest to a "pure" version of the original style. Others, known simply as

"festbier" or "Oktoberfest," may be paler and less malty.

Some of the versions appearing from American microbrewers, while tasty, tend to overplay the hops. They are generally closer, however, than the many "amber lagers" appearing all over the US these days. These beers,



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which may be worthy enough in their own right, lack the elegant balance and fine ingredients that mark the true Vienna lager. They likewise tend to be, well, boring, which a good Vienna is definitely *not*. While it is important to have a balance of hops and malt, balancing zero with zero (or very little with not very much) can only result in a bland beer.

The alcohol content of the purer form is slightly above what we consider an "average" beer, with a starting gravity ranging from 1.050 to 1.055 (12.5° to 13.5° Plato), with some of the Oktoberfests ranging up a bit higher. Their finish is paradoxical: malty yet crisp and dry. The bitterness contributed by the hops is tightly controlled, merely enough to allay the sweetness of the malts and never overpowering.

Needless to say, these are always all-malt beers; no corn or sugar need apply.

Although distinct variations appear among these beers, there are some clear standards. Neither heavily malty, like the dunkels and bocks of Munich, nor heavily hopped, like pale, sharp pilsners, Vienna lagers are artfully balanced, with subtle contributions of fine malts and noble aroma hops.

They can generally be defined as copper in color, although some Oktoberfests are paler and some of the Mexican versions are considerably darker. As Vienna lagers are among the world's finest, they are likewise among the more difficult to brew. The Fix book stresses the vital importance of quality ingredients and bemoans the lack of a truly high-quality Vienna malt.

Dreher's original beer was produced from a single, amber malt, but today's brewers must gain color and flavor from the use of fine Munich, caramel, and lager malts. Brewers should pay particular attention to hops, using only the finest: Czech Saaz, German Hallertau, Styrian Goldings, or some of the new American replacement varieties such as Mt. Hood or Liberty.

It is absolutely essential to use true lager yeast at the proper temperatures, so the beer must either be

brewed in winter or refrigeration is necessary. The original Märzens were cold-stored from March to September, but a lagering period of six weeks will certainly suffice.

Here is a style in which homebrewers can readily exceed the quality of commercial versions; many of the commercial beers are disappointing, and even the finest ones tend to be in poor condition by the time they reach us.

Vienna lagers require a lot of careful attention, but the rewards are tremendous. Some of the best homebrewed beers I've ever had were Vienna lagers produced at home by people such as George Fix and Wisconsin's Steve Klafka, and as Michael Jackson noted, a fine Vienna lager is a truly amazing beer.

These are not necessarily for the new brewer, but with time and patience, they will be worth the effort. ■

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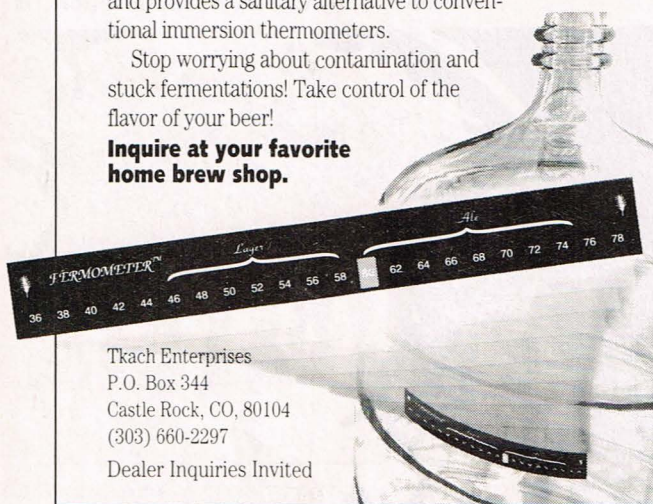
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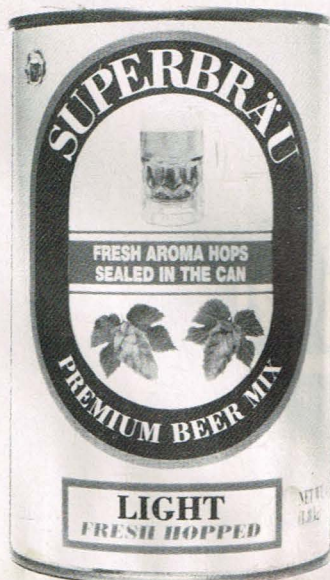
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Simple Steps to Great Lager

by David A. Weisberg

Why do most people recommend that new homebrewers start by brewing ales? Is it because lager-style beers take longer, need more attention, and need excellent temperature control? Yes. All of the above. But with the right brewing techniques, quality ingredients, equipment, and patience, you can easily perfect lagering. Here's how...

Lager is a German word that means anything from a bed to a storehouse; "to lay down" is the gist. Lager beer is laid down in the sense that it must be stored for a long, cold maturation period. Commercial breweries generally store lager in tanks that are kept near 32° F. As a result, lagers must use a yeast that works in cold temperatures.

Lagering, in many ways, is similar to cask conditioning, except that lagering is done at a lower temperature and takes longer. During lagering beer flavor matures, clarity is achieved, and the beer gains its carbonation. The process creates a clean, crisp beer without the typical esters (fruity aromas) usually found with ales.

Traditionally, lagering was done in caves, where the beer could be stored during the hot summer months. The first lagers were brewed in the 1400s in Bavaria. The first pilsner, a popular style of lager, was made in Pilsen, Czechoslovakia in 1842. The first modern lagers were brewed in 1880 at the Carlsberg brewery in Copenhagen, Denmark after a scientist named Emil Hansen isolated the first pure lager yeast culture. Hansen's work helped spawn the modern brewery and gave rise to the giant breweries of the world.

The Lagering Process

There are two basic forms of lagering. One is the traditional, commonly called "lagering," and the sec-



Giant lagering tanks at Anheuser-Busch keep beer near freezing during lagering.

ond is the kraeusen process.

The lagering process is what occurs after brewing, beginning with pitching the yeast. To get to that point, however, you must start with a lager-style wort. Pilsner, American lager, and Märzen/Okttoberfest are among the most popular types.

If you're doing a full mash, you can choose decoction, temperature program (upward step), or infusion. At one time decoction mashing was considered the standard technique for lagers, but most commercial breweries today use adjunct grains and a double mash technique.

Hop choice is probably more important than mash technique for producing quality lagers, since hop selection has a more profound effect on the beer's flavor. European lager breweries use traditional noble hops such as Saaz, Hallertau, and Tettnang. If you vary much from these, your beer is likely to get some unusual, and perhaps unwanted, characteristics. Adding a large amount of Cascade, for

example, would produce an aroma not normally associated with lager.

The fermentation profile of a lager is cold and only gets colder. Fermentation is usually carried out between 48° and 52° F and lasts about seven days. This cold fermentation helps produce the clean and crisp flavors for which lagers are known.

When the apparent gravity (the gravity measured by a hydrometer in the presence of alcohol) reaches about 1.016 (4° Plato), the fermenting beer is transferred to a closed vessel capable of handling pressure. This is where lagering begins and fermentation ends.

A Cornelius keg (soda canister) is commonly used for lagering. The still-fermenting beer is held at 48° F for two to three days. During this time, pressure builds in the lagering tank. It's important to release some of the pressure to get rid of the sulfury aromas created during fermentation. However, by the end of the second or third day you need about 13 pounds per square inch (psi) in the lagering

tank. This pressure is enough for complete carbonation.

Once you have reached this point, it's time to cool the beer to 32° to 35° F and keep it there for at least 21 days.

During cold storage the beer's flavor continues to improve since the yeast, even though groggy due to the low temperature, take up some of the "green" flavors in the young lager. The beer becomes quite clear due to sedimentation. Also, the cold temperature stabilizes the beer and protects it from later developing chill haze, a cloudiness that can occur in cold beer.

At the end of lagering, the beer is mature, carbonated, and clear. Now's the time to rack it out of the lagering tank into a keg or bottle.

Krausening

Homebrewers generally think of krausening (pronounced *kroy' zen*) as the procedure of adding gyle (unfermented wort) at the bottling stage as priming sugar. Commercial brewers call krausening the process of adding already-fermenting wort at high

krausening (the peak of primary fermentation) into an almost-finished batch to further the process.

Krausened beers begin like other lagers, except the primary fermentation is taken to completion. Once completely fermented, the flat beer is

transferred to the krausening vessel (Cornelius keg, e.g.) and is mixed with some beer that is in the "high krausening" stage of fermentation. This is when the fermenting beer has produced a nice cauliflower crop of foam and is fermenting strongly—usually

Take a Weekend Vacation

One of the challenges of using the lager process is transferring the beer from your primary to lagering tank with enough fermentables to completely carbonate the beer.

If producing the same beer over and over, you will know the terminal gravity and will know when you need to transfer.

Some brewers ferment and lager in the same vessel. Knowing when to transfer is not an issue for them. If you do this, however, some method of yeast removal is needed. Lagering in the presence of too much yeast will give the finished beer a yeast bite.

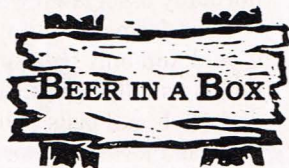
Another challenge to this transfer business is being around at the right time. According to Karl Eden, former brewmaster at the Sudwerk Privatbrauerei Hübsch in Davis, California, "the krausening process was invented by lazy brewers who wanted to go home on Friday and return to work on Monday without having to worry about their beers over the weekend."

Whether this is an old lager-brewer's tale or not, the krausening process lets you complete the primary fermentation before moving on, thus allowing a quiet weekend away from the (home) brewery!

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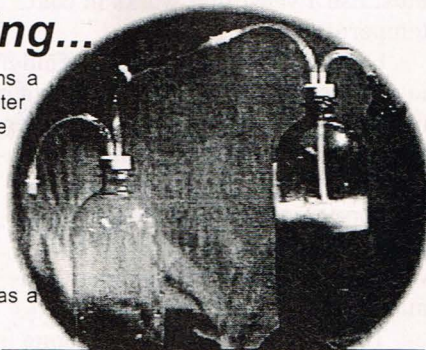
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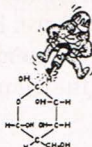
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day two or three of fermentation.

Once the attenuated (fully fermented) beer is mixed with the kraeusen beer, about 90 percent of the total volume is the fully attenuated beer and 10 percent is the kraeusen beer.

Hold the beer for two to three days at 48° F, then cool to 32° F and hold for several weeks as in the traditional lager process. One of the advantages to krausening is that the flavor changes occur much more rapidly, since the yeast from the kraeusen beer is very active. Another advantage is that you can work on your own time schedule and not on your fermenter's!

When using a soda keg as a secondary fermenter, you can carbonate the beer by adding an amount of actively fermenting wort (about one to two quarts will work) into the soda keg, then closing the lid. If the keg has a gas-line bleeder valve, adjust it for the correct pressure (usually 13 psi or less). Otherwise, you will need to release the pressure pin daily.

If you don't have a pressure valve, press the center pin (or ball) to release

pressure. The trick is to *not* release all the pressure, because you are actually trying to carbonate the beer.

When the aging is complete, you will need to transfer the beer under pressure into the serving keg. Place the serving tank's lid on and purge out any O₂ with CO₂. Repeat two or three times to make sure most of the O₂ has been replaced by CO₂. Connect the liquid outflow connector on the secondary keg to the liquid outflow connector on the serving tank. Connect the CO₂ tank to the gas intake connector on the secondary keg. Then slowly release the pressure on the serving keg's gas intake to move the beer.

Clarification

To brew a clean, crisp lager, it's important to be concerned with (but not overly retentive about) clarification. Here are four ways to make your lager clearer.

1. Irish Moss. Adding 1/4 to 1/2 teaspoon of Irish Moss (dried marine algae) 15 to 20 minutes from the end of the boil will help bring protein mat-

ter out of solution during the hot break, making your final beer clearer.

2. The Big Chill. Using a wort chiller after a full-wort boil allows for maximum cooling (called cold break), when unwanted proteins and tannins solidify out of the solution. After racking into the primary fermenter, you are leaving behind much of the proteins that can cause chill haze.

3. Deep Freeze. After the secondary fermentation is complete, slowly lower the temperature of the fermenter in order to conduct a traditional lagering. The closer you get the beer to freezing (32° F) without actually freezing it, the better. But do not lower the temperature too fast (i.e. more than 5° F per day), or you could knock the yeast out of suspension.

By lagering at 35° to 40° F (which is more realistic for most homebrewers with a spare refrigerator and a temperature-control thermostat) you will reduce the amount of yeast left and the amount of chill haze-causing

Continued on p. 70

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Cool S

By **S**al **E**mma



It's 200 degrees outside. In the shade. Humidity is a million percent. Inside, it's 250 degrees. All the windows are open, but there's no breeze and nightfall brings no relief. When you finally fall asleep, after flipping the pillow to the cool side for the hundredth time, the cicadas wake you up.

The Weather Channel says tomorrow will be another record breaker, and now you are stuck to your naugahyde Barcolounger.

Too hot to brew, right?

Wrong!

If you can peel yourself from the cheap chair and don't mind standing over a pot of boiling brew, you *can* brew in the summer. All it takes is some good old-fashioned Yankee Homebrew Ingenuity and a little planning.



UMMER BREWING

You have probably heard about the problems associated with too-warm beer fermentation: yeast run wild, infection leading to butter, and other nasties. Too-warm fermenting conditions can produce weird flavors in your beer, such as ethyl acetate (nail polish remover), fusel alcohols, and even rotten egg aromas. This is not a technical article, so we can skip the figures and equations. Suffice to say that if your ferment temperature is too high, your beer flavor may suffer.



Warm fermentation can also spur production of fusel alcohols and other compounds that can cause a blockbuster katzenjammer the morning after.

But armed with that knowledge, you can choose a brew that won't mind the heat of the kitchen.

Choose the Right Brew

For summer brewing it's best to shelve plans to make a light Czech pilsner or American lawnmower beer. The basic rule is by the time it's hot enough for you to crave icy-cold light lager, it's too late to make it.

It's better to choose a gutsy ale, stout, or porter. These brews are more forgiving of esters and excess fruitiness spurred by the warm ferment.

You should also choose a yeast strain that can handle the heat.

Assuming you have mastered the art of liquid yeast cultures, choose a forgiving strain of ale yeast.

(See BYO's premier edition if you need a brush-up on handling liquid yeast cultures).

Wyeast's 1028 London Ale or 1968 Special London Ale are good choices. They will perform at higher temperatures and will leave a butterscotch note, completely appropriate in English ale. The same goes for BrewTek CL-160 British Draft Ale, Yeast Culture Kit A17, and Yeast Lab

A03 London Ale. Wyeast 1056 American Chico and 1338 European Ale will also do well at higher temperatures.

If you crave the riot of diabolically complex flavors in Belgian beer, now is the time to experiment with an abbey, trappist, or white (wit) style. The heat will maximize production of fruit notes for which those styles are famous. Try any of BrewTek's Belgian ale series, Wyeast 1214, Yeast Culture Kit A16, or Yeast Lab A08. For wit, try Wyeast 3944 or Yeast Culture Kit M01.

If you are using dry yeast, Cooper's has gotten some good press for performing well at higher temps.

Chill Out, Carboy

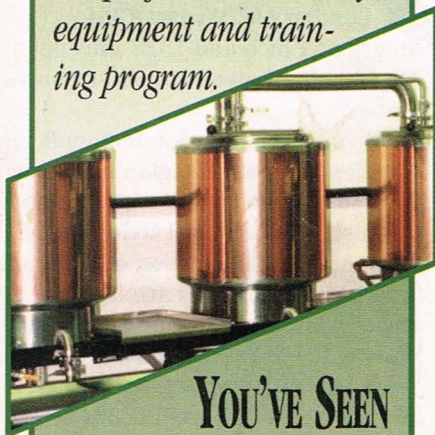
So how do you keep that fermenting barrel cool when the rest of the house is about to burst into flames from the summer heat? As you can imagine, there are as many techniques as there are homebrewers.

About the lowest low-tech option (and the least expensive) is the old towel-around-the-carboy trick.

Everybody knows that as a liquid evaporates, its temperature drops. Why? Philadelphia refrigeration engineer Ike Ehrlich explained it this way: "Liquid evaporates in the presence of heat. But as it evaporates, it takes energy—in the form of heat—away from the surroundings. So the area

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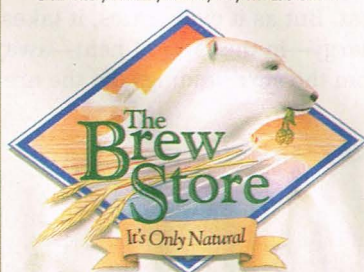


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very close to the evaporation will be cooler than the surrounding area."

It's why we get cold when we are wet. And why we sweat when it's hot. As the sweat evaporates, it uses this trick of nature to cool the surface of the body. You can use nature's tricks to keep your beer cool, too.

You will need a basin, bathtub, or even your brewpot, if it's big enough for your carboy to fit inside. Put a few inches of water in the basin, wrap the carboy in a big beach towel, place it in the basin, wet the towel, and let nature take its course. It helps to tie or rubber-band the towel in place around the neck of the carboy to keep it from slipping off.

The towel wicks the water up from the basin and it evaporates, lowering the temperature of your fermenting brew, depending on the relative humidity at the time.

That's probably this system's biggest limitation: If you live in a really muggy place, evaporation comes close to a standstill during the humid "dog days" of summer.

You can help it along, though. As homebrewer Rick Theiner of Memphis discovered, an electric fan will accentuate the effect of evaporation. "I put a box fan next to the whole setup with a timer switch. The fan runs for about four hours a day. The evaporation rate is increased, and the towel stays damp since the fan does not run all the time," Theiner says.

The towel system is low maintenance. You need only to keep an eye on the water level during the fermentation.

The Icebox Method

Do you remember iceboxes? Or maybe you heard about them from your parents. Lots of folks still call the refrigerator an icebox. And the icebox was central to the life of Ralph and Alice Kramden (Norton was always foraging there).

In the old days everybody's kitchen had a tightly insulated box with convenient compartments and doors. Every so often you bought a block of ice from the ice man and put it in the top compartment. This kept the food inside relatively cool.

Homebrewer and equipment designer Dan Listermann of Norwood, Ohio, employs a variation on the icebox theme. "We have a broken refrigerator, the kind the tenants defrosted with a sharp knife. This is my icebox. I freeze milk jugs filled three-quarters full of water in my good fridge and each day place a few inside the old fridge with the fermenter.

"I can depress the temperature up to 15° C (59° F). Perfect for ale in the summer, lager in the winter," Listermann says.

He rotates the milk jugs, refreezing them as needed. He says the inside of the box gets rather damp, so he wipes it down with bleach solution every few days to prevent mildew.

If you don't have a dead fridge, you could use a very large picnic cooler, standing on one end, or a wooden or cardboard box lined with Styrofoam as your icebox.

Stealing Cold Air

If you have air conditioning, either window units or central, another way to beat the heat is to route the cold air outflow to your fermenter before the air fills the room.

Jones Rutledge of Memphis uses this method: "I park the carboy as close as possible to the air conditioner. I made some cardboard deflectors to ensure the carboy gets plenty of cold air. This prevents having to run the AC full force, freezing everyone out."

A High-Tech Chicken Coop

Fridge-techie Ehrlich says if you can get your hands on a small window air conditioner, you can build an air-conditioned "chicken-coop."

"Stud it out, use plywood or paneling for the walls, and insulate every inch of the interior. Weather strip the door. Cut a hole and frame it out for the air conditioner, put on a pitched roof with some tar paper, and you're in business," he says.

Ehrlich uses a window AC unit to successfully cool to between 65 and 70° F. Lower than that and the unit's coils will start to freeze. So don't go this route if you have authentic lager in mind. But this idea is perfect for ale.

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Going All the Way

If you really want to take control and thumb your nose at the summer heat, you will need a working refrigerator.

"What's the problem?" asks Ed McNierney of Groton, Massachusetts. "My brew fridge stays 44° F, even in the middle of July!"

McNierney admits he would rather brew light lager in the summer instead of stocking up on it in the spring. "I just can't seem to let good beer sit around for months, waiting for the right drinking season. I recommend getting the spare fridge, assuming you have someplace to put it.

"Mine came from a yard sale. A nearly new 21-cubic-foot box, with freezer, for \$100. I ferment in the fridge section, store my hops and other goodies in the freezer section," he says. In addition to yard sales, cheap fridges can be found at large apartment buildings because they often update their appliances.

Going the fridge route offers obvi-

ous advantages. You can brew whatever style you like whenever you like, without having to be concerned about

"I don't use any fancy auxiliary thermostat. I bought a \$5 fridge thermometer from the kitchen store and fiddled with the temperature dials until I got it right. It's good enough for me!"

overheated fermenters and fruit-salad aftertaste.

To really, really take control, you

will need to invest in an external thermostat for your brew fridge. The thermostats installed in most refrigerators and freezers operate in a narrow range, around 35° to 45° F. Okay for lager but too cold for ale.

The best option here is the "plug 'n' play" thermostat. You plug it into the electrical socket, then plug your fridge or freezer's power cord into it. A temperature probe goes inside the box, and you simply set your desired temperature. Ready to rock 'n' roll in 60 seconds. These run between \$40 and \$60 and are available at many well-equipped homebrew supply stores.

But as McNierney discovered, you might not need any help from an external device. "I don't use any fancy auxiliary thermostat. I bought a \$5 fridge thermometer from the kitchen store and fiddled with the temperature dials until I got it right. It's good enough for me!" he explains.

So what are you waiting for? Scrape yourself from that Barcolounger and get brewing.



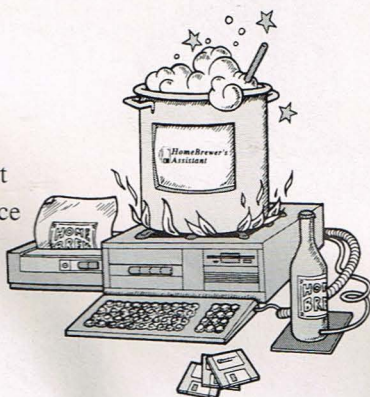
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"Can it really be any good?" a young woman whispered. "Heavens no," Thomas exclaimed. "He's never brewed a drop in his life."



They Laughed When I Told Them I Was Serving My Own Home Brewed Beer, But When They Tasted My Pale Ale!—

Thomas brought a gift of his latest micro-brew discovery that he wanted everyone to try. I decided that this would be a dramatic moment for me to make my debut. To the amazement of all of my friends, I strode confidently over to my Alephenalia Micro Brewery-Home Brew Kit and began to pull out the professional looking bottles that I had placed there.

"Chuck is up to his old tricks," somebody chuckled. The crowd laughed. They were all certain that I couldn't brew any more than I could make potatoes au gratin.

"Can he really brew?" I heard Thomas' partner whisper. "Heavens, no!" Thomas exclaimed. "He's never brewed a drop in his life. But just you watch him. This is going to be good."

I decided to make the most of the situation. Holding up the wing capper, I explained that I had bottled it just for this occasion. With mock dignity, I drew out a bottle and cradled it in my arms like a great wine. "Is this another of those disappearing ink trips," called a voice from the rear. The crowd rocked with laughter.

Then I began to pour.

Instantly a tense silence fell on the guests. The laughter died on their lips as if by magic. I poured a glass for everyone, even those who exclaimed "I don't like beer." I heard a gasp of amazement. My friends sat breathless, spell-bound.

I sampled it myself and for a brief moment I forgot the people around me. I forgot the hour, the place, my fellow imbibers. The little world I lived in

seemed to fade—seemed to grow dim—unreal. Only the ale was real. Only the ale and the visions it brought me. Visions as beautiful and as changing as an autumn sunset, with its amber hues, just like my homebrew.

A real Triumph!

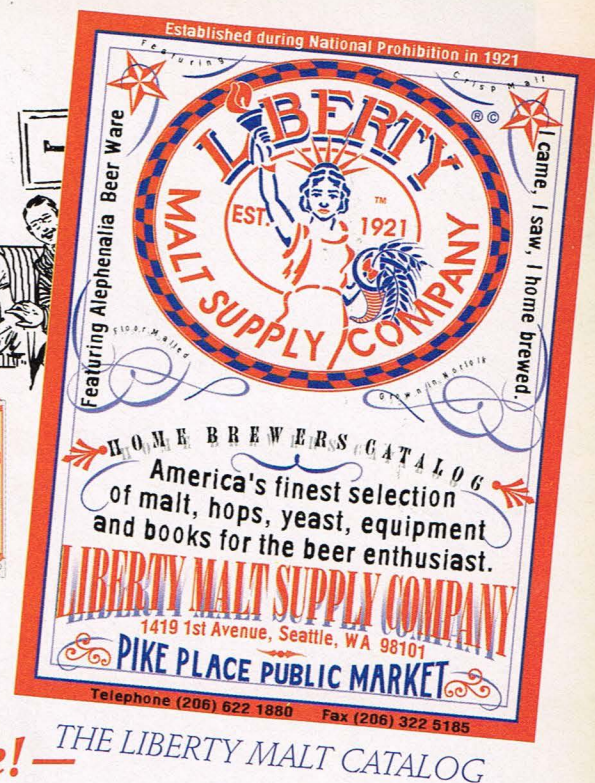
As everyone finished tasting, the room resounded with accolades. I found myself surrounded by excited faces. How my friends carried on! Men shook my hand—wildly congratulating me—pounding me on the back in their enthusiasm! Everybody was exclaiming with delight, plying me with rapid questions. Chuck! Why didn't you tell us you could brew like that? Where did you learn? How long have you been brewing?

"I simply followed the complete instructions included with the Alephenalia Homebrew kit," I replied. "And just a short while ago, I didn't know hops from malt."

"Quit your kidding," laughed Thomas, a real beer enthusiast. "You've been brewing for years. I can tell."

"Only since Rosie gave me an Alephenalia Microbrewery for my birthday, less than three weeks ago. I decided to keep it a secret so that I could surprise all you folks." Then I told them the whole story. "Ever heard of Liberty Malt Supply Company?" A few of my friends nodded. "That's a home brew shop and mail order catalog!" One of the oldest in the entire country!

"Exactly," I replied. "They have a great program for learning how to brew beers like a professional, the Liberty Way."



How I learned to brew without a teacher.

And then I explained how for years I had longed to brew my own beer. I shared that dream with Rosie and when she saw the Alephenalia Microbrewery in the Liberty catalog, she knew it was the perfect gift for me.

A Complete Catalog!

Pointing to the colorful Alephenalia Micro-brewery carton, I explained, "It contains brewing equipment that can be used over and over to brew beers like the professionals." I told them how pleased I was with Brewer's Companion, a real home brewers bible. The Liberty Pack included with the microbrewery contained enough pre-measured, concisely labeled ingredients to brew five gallons of the Pale Ale. I explained that each of the Liberty packs used the highest quality ingredients, exclusive to Liberty Malt and that packs for each of the classic brewing styles are available.

I proudly told them that I have already begun brewing Weekend Weiss, a Bavarian style wheat beer and Liberator Doppelbock, both promptly received by simply dialing Liberty Malt's own toll free number, 1-800-990-MALT (6258).

Favorite brewing styles

"Let's order Liberty's Pils Pils Pack!" Thomas pleaded after seeing the Liberty catalog. He took another sip and said, "Which weekend is that Weiss going to be ready?"

To order or for a free catalog:

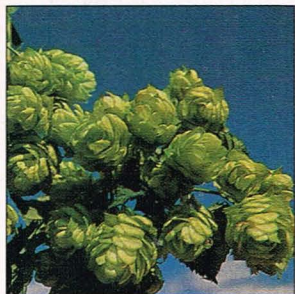
1-800-990-MALT



Bitterness

By Martin Lodahl

Hop farmers separate the cone-like section from the hop plant for use in brewing. American hop farming is centered primarily in the Willamette Valley in Oregon and Washington's Yakima Valley.



quite separate hop effects, and if it's a well-made beer, each will be pleasing.

First there will be the aroma, appetizing and inviting. Next, a beguiling series of flavors, sometimes floral,

The next time you have a glass of beer in front of you, pay very close attention to the hops. You'll get three

sometimes spicy, perhaps herbal, or any of a number of other tastes. Finally there will be the bitterness, supporting and balancing the sweetness of the malt.

Each of these effects is yours to control.

Bitterness

Most hop bitterness is a product of a group of compounds called alpha acids, which won't normally dissolve in beer. Unless they're rearranged at a molecular level (isomerized) into iso-alpha acids, they'll separate out when

the wort cools.

Isomerization is a relatively slow process that occurs naturally when you boil the wort. Even though all of the alpha acids from the hops may have been added at the beginning, the bitterness will continue to increase as the wort is boiled. Most of the isomerization occurs during the first hour.

Not all of the alpha acids will isomerize during the boil, and some of those that do will be lost in later stages of the process. That's why there's not a precisely predictable relationship between alpha acids added to the boil

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and iso-alpha acids (creating bitterness) in the finished beer.

Many different hop varieties (called cultivars) are available to brewers, and each of them has a different set of characteristics. One of the most commonly measured parameters is the percentage of the hop cone (by weight) that is composed of alpha acids. For some years now hop cultivars have been roughly divided into "bittering hops," which have a relatively high alpha acid content, and "aroma hops" with a much lower one.

Not long ago the prevailing theory was that after an hour's boil, all hop flavor components except bitterness would have boiled away, so bittering was best done with the highest-alpha hop you could get. Thus, you'd use less hops than with a lower-alpha variety and so reduce your overall cost.

Many homebrewers have found, however, that it doesn't work quite that way in practice, and the flavor impact of the bittering hop can be dramatic. While bittering with low-alpha hops can be expensive in commercial quantities, at homebrew levels it's a cheap investment in quality to use the best-tasting hops you can get, even if you have to use a lot of it to get the bittering level you want.

This doesn't necessarily mean that

high-alpha hops will produce bad beer. But they can be very tricky to use, as it takes very little to turn a hoppy beer into a harsh beer. Some high-alpha hops also have unique flavors that may not fit your brew, such as the strong grapefruit-like taste of Chinook.

Aroma

Bitterness is just a single dimension of what hops do for beer. A wide range of flavors and aromas are avail-

**Bitterness is just
a single dimension
of what hops do
for beer.**

able through careful hop selection, and getting the best in aroma from hops requires an all together different approach than getting the best bittering.

The best of the hop aromas come from very volatile oils in the hops. These aromas are easily evaporated and lost in the boil. Preserving them in the beer demands a hop addition very late in the boil, or even after the boil. There are three common methods of maximizing hop aroma.

Finishing Hops

Finish hopping is the only one of these methods that involves adding more hops to the kettle. Typically, this is done within the last 15 minutes of the boil. Some brewers pitch finish hops immediately after the boil, while the wort is chilling. This works well if you're chilling the wort in the kettle rather than using a counterflow chiller.

The Hop-Back

The hop-back (also called "hop jack") is a vessel much like a mash tun used to separate wort from the hops and hot trub, the solids left over after mashing and boiling. Brewers discovered long ago that they could improve filtration and add hop aroma by spreading a fresh charge of hops over the slotted bottom of the hop-back vessel before running in the wort and spent hops from the kettle.

All-grain brewers can use their mash tun as a hop-back of sorts, but

this is pretty risky business. Remember, the wort is never more vulnerable than it is from the end of the boil until fermentation is fully established. If you chill in the kettle, the sanitation of your tun needs to be perfect. If you plan to transfer the wort while it's hot, remember that even a little agitation at this stage can plant the seeds of serious oxidation problems later.

Dry Hopping

Perhaps the most popular post-boil method of adding hops is dry hopping. This is nothing more than adding hops to the beer after primary fermentation is complete. At this stage in the life of the beer, the pH has dropped and the alcohol content has risen, making infection much less likely than it was just a few days earlier.

Though your senses might recoil at the thought, you can just toss the hops right in and leave them to soak. Some favor enclosing them in a mesh bag weighted with some easily sanitized object (it must be something that won't oxidize—marbles for example), but it's okay to just drop the hops on top of the beer. They'll sink when they're ready.

Many brewers who dry hop regularly prefer whole hops to pellets. Whole hops seem to give better flavor, and it's easier to rack the beer from the secondary when using whole hops.

Cones, Pellets, and Plugs

Hops are generally available to homebrewers in three forms. Whole hops consist of the hop cones, dried and pressed. They're shipped and stored in bale form, then the bale is broken down into smaller quantities.

The other two forms are both pelletized, known technically as Type 90 and Type 100 pellets but informally called pellets and plugs, respectively. The Type 90 pellets are made by breaking up a bale of hops, pulverizing the hops in a hammer mill, then forcing the resulting gummy powder through an extrusion die. The result looks like pelletized livestock feed and often has a hard and shiny exterior from dried hop resins.

This resin is from the plant's ruptured lupulin sacs. It forms both the binder that holds the pellets together and the seal that protects the pellet's

Choose the Right Hops and Make It Last

Art and science meet in hopping beer. Science helps get hop bitterness on target, but blending the hop flavor and aroma with the other flavors in beer is certainly an art. The beer is our canvas, and our palette includes dozens of available hop cultivars (varieties), each with its own attributes.

An almost endless range of combinations can be created by mixing different hops in varying proportion. A brewer may choose to emphasize bitterness, "front-loading" the hop charge by adding most or all of it at the beginning of the boil. Or he may decide that the malt characteristics of that particular beer are best balanced by a flowery, grassy, or spicy hop nose and flavor, and reserve particularly aromatic hops for the end of the boil.

Brewing for contests can train the brewer in using hops in very specific ways, by imposing the discipline of recognized styles. Imagine brewing an Altbier for a contest. The dry maltiness of this style is offset, in its native Duesseldorf, by a profound bitterness. But it has very little aroma and a flavor that's clearly from the "noble" hops of central Europe.

By the nature of their craft, judges tend to be stylistically conservative, so your recipe will have to be close to that description. To keep hop aroma to a minimum, the whole hop charge will have to be added at the beginning of the boil. But what variety? Tradition says the spicy and refined Saaz, the crisp Spalt, or the herbal Tettnanger.

Use the flowery and citrus-like Cascade and the judges will recognize that something is not right. To use the rough, flowery, and grapefruit-like Chinook would be madness. The challenge is to find a hop with the right basic characteristics but with enough of a difference to make your beer stand out. Perhaps Styrian Goldings ...

Selecting the right hops is one of those processes in brewing that becomes easier over time. Hop teas, and the old method of crumbling a few hop cones between the hands to smell the aroma and feel the resins, can be deceiving; hop flavors tend to change when boiled with wort.

With tables like the one on page 45 as your starting point, try brewing batches that use a single hop variety, use it as a bittering hop, and for both bittering and aroma. After a few batches, you'll often be able to

pick out the hop varieties you're tasting in commercial beers, and when you want a particular flavor in your beer, you'll know exactly how to get it.

This could mean that you end up with something of an inventory of hops. Hops (especially in pellet form) can keep for a surprisingly long time, if some care is taken in their storage. The enemy is oxygen. Oxidation will cause the bitterness of the alpha acids to fade, new (and less tasty) bitterness to develop from oxidized beta acids, and the characteristic hop aromas to be replaced by new ones that are cheesy and worse.

To keep your hops from oxygen, store them in vapor-barrier bags (polyethylene sandwich bags just won't do) or non-gas-permeable containers such as Mason jars. If you're equipped to do so, purge the air from the containers with nitrogen or carbon dioxide gas. Keeping them in the freezer will greatly slow deterioration.

For the very best results always use the freshest hops you can get, but good hops stored well will remain usable for several years. One brewer recently had a tasty "California common" beer on tap now that was made using '89-harvest whole Northern Brewers hops that spent the last five years in his freezer. They don't have the snap they once did, but they're still perfectly usable!

On the other hand, some hops are old enough (or have been mistreated enough) to become unusable within weeks. Most homebrew retailers treat their hops well, but there are exceptions. Though it sometimes means having to buy in a large quantity, some superb hops are available through dealers who specialize in hops or who deal exclusively in hops, including:

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BRING HOME THE GOLD

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A Formula for Figuring Bitterness

Measuring bitterness closely is actually a relatively new concept in brewing. Recipes for both commercial and homebrewers until fairly recently simply named the quantity of hops along with such useless indications as "domestic hops" or "California hops." The hop cultivar (variety) was virtually never named, and recipes published before the 1950s offered no realistic indications of bitterness.

Hop merchants now routinely supply analysis data to their customers, but there are still a few homebrew shops that don't mark the alpha acid content of their hops on the packages, and there are still some recipes being published calling simply for "hops."

The first attempt to make the bittering levels of homebrew more predictable and repeatable was to multiply the weight (in ounces) of hops used by the alpha acid percentage. This was called the Alpha Acid Unit (AAU) by some and the Homebrew Bittering Unit (HBU) by others.

The obvious weakness to this approach is that it only addresses what's going into the batch, making no real attempt to predict what the result will be. And it's batch-size sensitive; if the only change you make in a recipe is to double the batch size, you need something close to double the alpha acid units to maintain the same bitterness level. In other words, if you stick with the same hop variety, you'd have to use twice as much hops. On the plus side, it's easy to calculate alpha acid units, and they do give a measure of repeatability.

In the commercial brewing world bitterness has long been monitored by directly measuring the iso-alpha acid content of the finished beer. The process involves measuring ultraviolet light absorption by iso-alpha acids in degassed, acidified beer. This method determines a figure known as the International Bitterness Unit (IBU) or some-

times just the Bitterness Unit.

The IBU is roughly equivalent to the concentration in milligrams per liter of the iso-alpha acids in the beer. Very few homebrewers have access to a spectrophotometer, so this method is largely out of our reach. However, in recent years attempts have been made to develop a mathematical formula to estimate the bitterness of the beer when working with hops of a known alpha acid content. A standard formula used by commercial brewers looks like this (express in decimals):

$$\frac{\text{Grams of hops} \times (\text{liters of wort}) \times (\text{desired IBUs}) \times (0.001)}{(\% \text{ utilization}) \times (\% \text{ alpha acids})}$$

(One quart=0.946 liters; 28 grams=1 ounce)

Impressive, no? If you were paying attention in algebra class, you can see how to rearrange the formula to solve for the IBUs.

But the terms could use a little explanation. First, the "liters of wort" figure appears to be the volume at the end of the boil.

The "% utilization" is an attempt to quantify the effect of boil time on the isomerization of alpha acids and is expressed in the table to the right.

When a version of this formula was first published by Jackie Rager in 1990, technically inclined brewers seized upon it immediately and spoke confidently of the "IBUs" of bitterness in their batches, unconsciously attributing to the method far more accuracy than it could actually deliver.

In his 1994 book *Using Hops*, Mark Garetz proposed a number of improvements to the formula. But more important, he made it clear that there are definite limits to what can be expected from a method like this.

What happens to alpha acids from the time the hops hit the wort to the finished beer is a very, very complex process, not all of which can be predicted in a formula. The untracked significant factors include the vigor of the boil, mineral content of the water, pH of the wort, hopping rate, vigor of the fermentation, flocculation characteristics of the yeast (how well it settles out during fermentation), pitching rate of the yeast, effects of oxidized beta acids, and much, much more.

This formula, and Garetz' improved version, can be a valuable tool to estimate the hop charge needed to get you close to your target bittering level, especially if you can provide an adjustment factor of your own to "fine tune" for your brewing conditions, but don't expect exactness.

As a practical matter, getting the hops right in a recipe is like getting the rest of it right, a matter of "drilling down": refining the recipe through several successive batches, tasting carefully, and keeping careful notes. A formula can only give you an approximate starting point.

Utilization Table

Boil Time	Utilization
< 5 minutes	0.05
6 - 10 minutes	0.06
11 - 15 minutes	0.08
16 - 20 minutes	0.101
21 - 25 minutes	0.121
26 - 30 minutes	0.153
31 - 35 minutes	0.188
36 - 40 minutes	0.228
41 - 45 minutes	0.269
46 - 50 minutes	0.281
51 - 60 minutes	0.3

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interior from oxidation, which is why pellets tend to store better than whole hops. They are also easier to measure accurately and occupy less storage space. These three reasons may well be why more pelletized varieties than whole are available at retail outlets.

Many brewers feel that fresh whole hops give the best flavor but concede that the difference is not great. Some have reported grassy flavors from pellet hops. No such drawbacks are

reported for plug hops, but their processing has been less drastic. They are whole hops compressed, without grinding, into a half-ounce pill.

Removing Hops

Different forms of hops require different strategies for removing the residue after the boil. Compatibility with your equipment may be the most persuasive argument for using one form over the others.

Other than using a hop-back, there are several ways hops can be removed. Enclosing them in a mesh bag is a good strategy for whole hops. The advantage is that unless the bag breaks, it's relatively easy to separate wort from hops. The disadvantage is that enclosing the hops in the bag reduces the mechanical action of the boil on them, reducing both extraction and isomerization. You'll need to experiment to determine how much larger a hop charge you'll need to compensate.

Remember, also, that hops tend to swell quite a bit after they've been added to the boil; leave plenty of room in the bag! Pellets break into a powdery "spooage," so a bag will need to be of a very fine mesh to be of any help.

If you rack your beer from the kettle, one popular method is to wrap the tip of the racking cane with a kitchen scrub pad. The most commonly used types are of either stainless steel or pure copper. Don't use "steel wool" and whatever you do, don't use a pad that's impregnated with soap!

It's okay to use a plastic scrub pad if you chill in the kettle and so don't need the heat resistance of metal pads. The scrub pad needs to be thoroughly sanitized before use. This method seems to work best with whole hops, but the amount of pellet residue that slips through can be minimized by gently stirring up a whirlpool in the kettle, which will gradually clump the residue in a cone in the center, and then racking from the edge.

One brewer fashioned a racking cane from copper. The cane has a loop at its base that just fits inside his kettle. He drilled many tiny holes along the bottom of the loop and places it in the kettle to sanitize shortly before the end of the boil. This works well even with pellets, but it's important to whirlpool and let the residue settle before racking.

Finally, brewers who have drain valves in their kettles use removable mesh screens of copper or stainless steel mounted a few inches above the bottom. They simply open the valve.

If you want to learn more about hops, there are several excellent books on the subject. But the best way to learn about hops is to experiment. You won't regret it!

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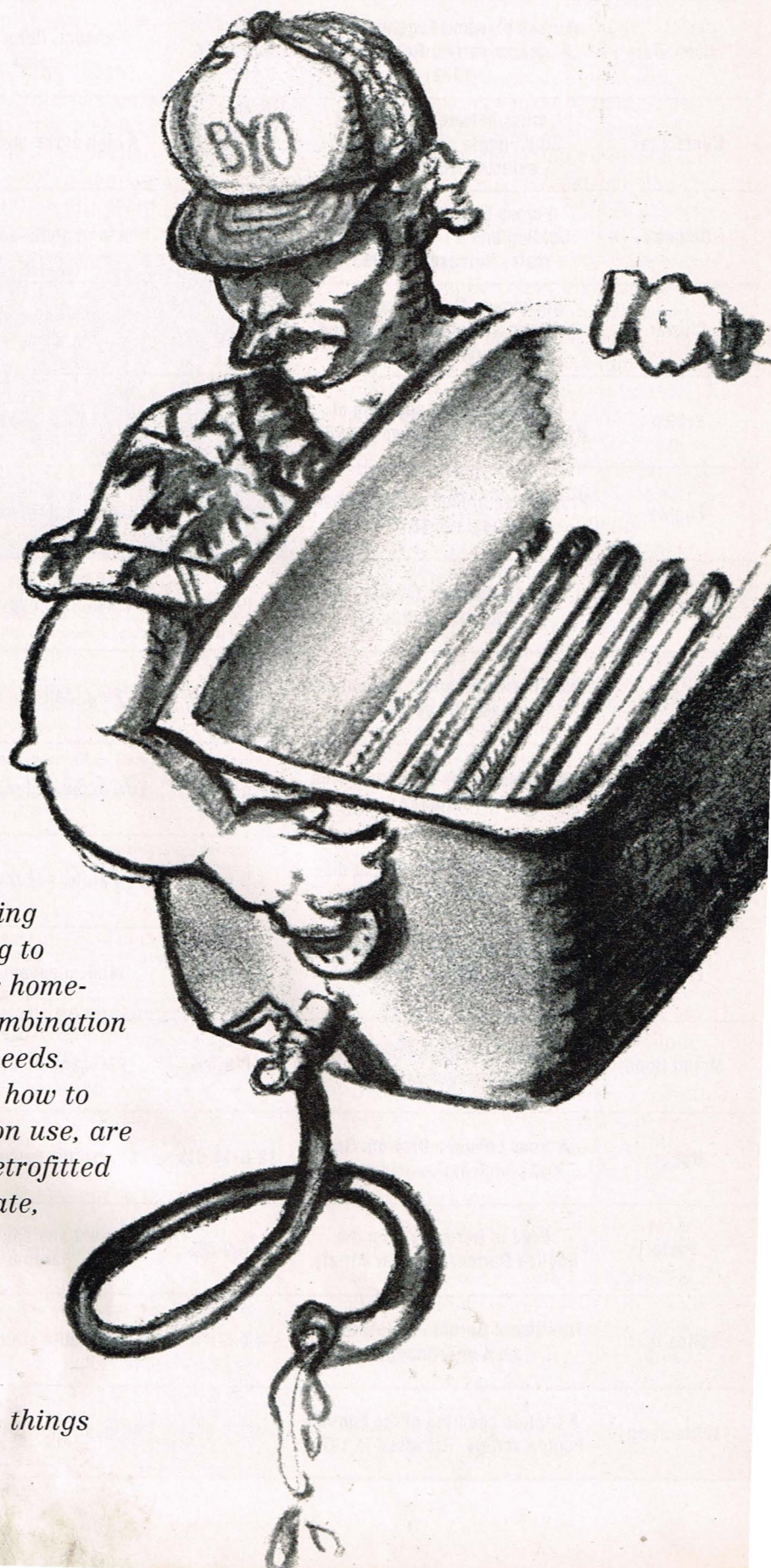
Variety	Pedigree	Alpha Acid Units	Trade Perception	Description
Cascade	A cross between Fuggle and an American native. Released in 1972.	4.5-7.0 %	Pleasant, floral, spicy aroma	Aroma variety with well-balanced bittering potential. A favorite among micro-breweries.
Centennial	A cross between a Brewer's Gold/Fuggle seedling and a selected USDA male.	9.5-11.5%	A high alpha-aroma hop	Popular among microbrewers, this hop was bred for high alpha and aroma. The cones yield a floral or citrus aroma.
Chinook	A cross between a Petham Golding and a USDA-selected male. Released in 1985.	12.0-14.0%	A high alpha-acid hop	Grows well in central Washington, maturing early in the season. Aroma is mild to medium-heavy, spicy.
Cluster	Not known. Possibly a cross between an English variety and an American male hop.	5.5-8.5%	Medium and quite spicy aroma	Oldest grown variety in the US. Excellent general purpose hop with medium and well-balanced bittering potential.
Eroica	Open-pollinated seedling of Brewer's Gold. Released in 1980.	12.0-13.5%	Kettle-type hop	The strong aroma and high alpha is suitable to general bittering. Declining market due to poor storageability.
Fuggle	Propagated in England by Richard Fuggle in 1875.	4.0-5.5%	Traditional aroma hop	Small, compact cones grown primarily in Oregon's Willamette Valley. Mild and pleasant aroma with a low alpha.
Galena	Open pollinated seedling of Brewer's Gold.	12.0-14.0%	Pleasant, "hoppy" aroma	An excellent hop with a high alpha. Balanced bittering properties, widely used in extraction.
Goldings	Not Known. Grown in England for over 100 years.	4.5-5.5%	Fine, delicate aroma	In consistent demand by British brewers, it is a perfect partner for traditional lagers as well as ales.
Hallertauer Hersbrucker	Originated in the Hersbruck area of Germany.	2.5-4.0%	Low alpha and mild aroma	Grown in Germany and the US, it widely replaces the Hallertauer Mittelfrüh because it is less susceptible to wilt.
Hallertauer Mittelfrüh	Originated in the Hallertau district of Southern Germany.	3.0-5.0%	Low alpha and mild aroma	In high demand as an aroma variety, but production is greatly diminished due to susceptibility to Verticillium wilt disease.
Liberty	A triploid seedling of the German Hallertauer variety. Released in 1991.	3.5-6.5%	Mild, pleasant aroma	Small, plump cones that mature mid-season. Characterized by low alpha- and beta-acid content.
Mount Hood	A triploid seedling of the German Hallertauer variety.	5.0-8.0%	Pleasant, clean aroma	One of the higher-producing aroma hops in the US. Marked similarity to the German Hallertauer and Hersbrucker varieties.
Nugget	A cross between Brewers Gold and a high alpha-acid male.	12.0-14.0%	Strong and herbal aroma	A high-alpha bittering hop with a pronounced aroma. Excellent for basic bitterness addition.
Perle	Bred in Germany from the English Northern Brewer variety.	7.0-9.5%	Pleasant and slightly spicy aroma	German-type aroma hop with moderate bittering potential and a higher alpha-acid content than most aroma varieties.
Tettnanger	Traditional German variety developed in Tettnanger.	4.0-5.0%	A true noble aroma variety	Only recently established in the US industry, it has a mild, slightly spicy aroma.
Willamette	A triploid seedling of the English Fuggle variety. Released in 1976.	4.5-7.0%	Mild, slightly spicy aroma	A quality aroma hop named for the Oregon region. Represents about 20% of US production and has fair storageability.

W

hether you're counting your pennies or trying to assemble a world-class homebrewing system, you can build a combination mash tun/lauter tun to meet your needs.

This is a look at three types and how to make them. The first two, in common use, are the double plastic bucket and the retrofitted picnic cooler. The third is the ultimate, tricked-out, gonzo 15- to 20-gallon model. This has some interesting features that you may choose to incorporate into your own dream system at some point.

All mashing vessels have certain things



BUILD A MASH TUN

By Randy Mosher

in common: a chamber, preferably insulated, to hold the grain; a false bottom below the chamber with slots or holes just large enough to prevent the crushed grain bits and husks from falling through; a small space underneath the false bottom; and a drain or spigot to run out the wort from under the false bottom. In addition some method of gently sprinkling hot sparge water on top of the grain bed is needed.

Generally, the more insulation around the tun, the better. Coolers come well endowed. But if you do choose to obtain a double bucket setup, you'll need to arrange some insulation—foam, a blanket, something—or else the heat drop will affect the mash in progress.

Grain depth is important. For the homebrewer eight to 12 inches is probably optimum. You want it deep enough to form a good filter bed to separate wort from the grain and clarify the liquid but not so deep that the flow is difficult. As far as size goes, the volume of the mash you put in the tun will be up to the same volume as the batch you're brewing, with the exception of *really* strong beers—over 1.085 specific gravity—which will be somewhat larger.

You can get by with a five-gallon bucket for five-gallon batches, but the mash will often be right up to the top. With coolers it is probably a good idea to have 50 to 100 percent extra capacity (7.5 to 10 gallons) to allow your sparging device to fit under the insulated lid.

Also, it is a good idea to minimize the volume in the area under the false bottom. This avoids some of the hydraulic problems caused by the suction of wort leaving the vessel. Two inches is the absolute max, but commercial breweries use as little as a quarter of an inch.

The Double Bucket

Materials:

- Two identical 5-gallon buckets
- Spigot with fittings
- Plastic hose
- Drill with 1/8-inch bit
- Insulation
- Or:
- Screen mesh

The double bucket mash/lauter tun is the cheapest to put together and works perfectly well. It's durable and can be used for everything from wheat beers to barley wines. This system is fabricated from two identical five-gallon buckets, the kind they'll sell you for 50 cents at the burger joints (or more upscale food storage containers from the restaurant supply house) nested together. Most people drill about a thousand 1/8-inch holes through the innermost bucket, allowing it to serve as a screen to separate malt from wort. You might prefer to cut out part of the bottom and replace it with screen wire, as this takes one-tenth as much time.

You will need to attach a spigot as low as possible on the

There are many ways to build a basic mash tun. What you end up with depends on what's readily available and on your ingenuity in fitting all the pieces together.



Drill or cut a hole of appropriate size, push the valve through, then tighten the nut down on the rubber washers on the inside to seal. Be sure to tighten well and avoid twisting when hot, as expansion can cause the plastic parts to loosen.

You may find what you need for a spigot at the hardware store, but getting the right fittings to seal tightly through the plastic wall can be a challenge. For valves use ball valves rather than the faucet type, as ball valves open quickly.

To go through the side of the container, you may have luck finding a good bulkhead fitting. The most common bulkhead fittings are flare or compression fittings. These aren't the ideal options for your needs because they complicate your ability to fit a valve on the end. If you can find a short length (two to three inches) of brass 1/4- to 1/2-inch NPT (standard plumbing) pipe, a good hardware or plumbing supply shop ought to be able to thread the whole length of it. The threaded pipe can serve as your bulkhead fitting.

If you want the cheapest possible vessel, drill a very clean hole (a wood-boring brad point works best) through the side where the valve would go. Insert a length of vinyl tubing that is 1/8-inch larger in diameter than the hole, forming a very tight fit. The hose can be pinched shut with one of those plastic shut-off clips. Perfectly functional, just not too sexy.

For the false bottom the most readily available choice is bronze window screen. Cut it 1/4-inch larger than the size desired, and fold the edges under to hide the loose ends. This can be attached to the cut-out bottom of the inner bucket with eight small (3/16- by 1/2-inch) stainless steel machine screws, evenly spaced around the edges. If you can find stainless steel screen material, you can be

assured of having something absolutely inert. It's cheap at the scrapyards but brutally expensive (\$10-plus per square foot) when purchased new.

Once you've got the false bottom and spigot affixed, you'll need to arrange for some kind of insulation. The simplest is a layer of plastic, such as a garbage bag, topped with a heavy blanket or sleeping bag. Those silver "emergency blankets" work nicely, as they are water resistant.

For something more enduring in the wet environs of the brewery, you should think about making something out of foam insulation. The Styrofoam jackets that come on the 6.5-gallon acid-bottle carboys are a good starting point, if you have one of them. Just take a thin serrated knife or keyhole saw and carve the thing up to work for you.

Cut one deep slot down the side to accommodate the spigot as you drop the mash buckets into the jacket. The edges can be finished with duct tape. If you save the portion removed for the spigot and cut off the lower inch or two, you can pop it in place, maybe secured with self-adhesive Velcro strips, to complete the insulation.

You can also use foil-faced building insulation (polyisocyanurate), to fashion any kind of jacket you want. Cut it with a sharp matte knife, and finish edges and assemble with duct tape.

Picnic Cooler Mash Tun

Materials

- Picnic Cooler
- Spigot with fittings or other draining system

Either:

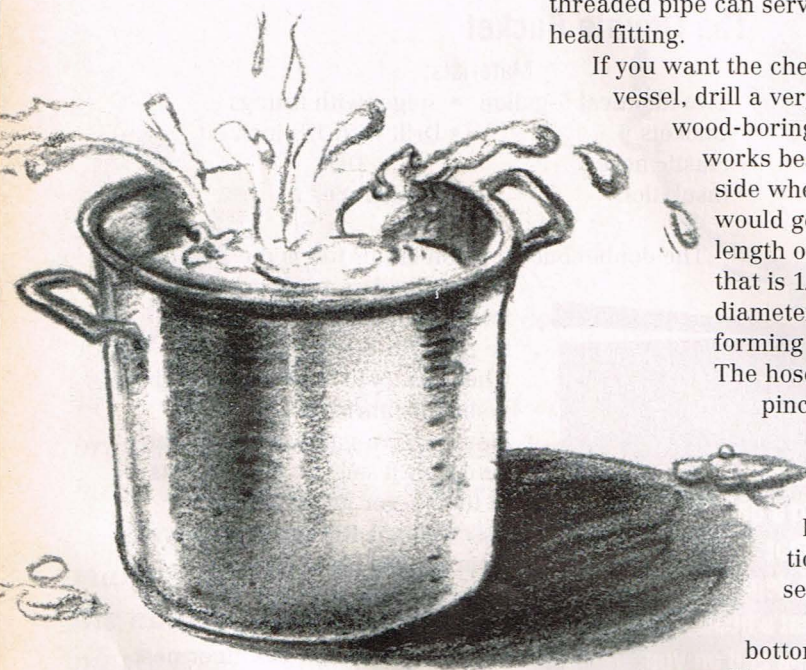
- Copper water pipe
- Copper tees and elbows
- Hack saw or Dremel tool

Or:

- Screen mesh or perf plate
- Sheet stainless steel or sturdy plastic
- Gasket such as vinyl tubing

Picnic coolers are very popular mash tuns and are also quite easy to make. The use of an insulated container with a spigot already in place saves a lot of effort.

Coolers come in many sizes and shapes; you will want one up to twice the size of the batch you're brewing.



side of the outer bucket. Most homebrew supply shops sell a plastic drum tap designed for this purpose. Ideally, the tap should be fitted with a plastic hose so the wort doesn't splash into the receiving bucket below, aerating it and creating the potential for oxidation trouble later.

For five-gallon batches, 36 to 48 quarts is good. This size gives you plenty of headroom for a sparge arm under the lid. Don't go larger than this, or the grain bed will be too shallow for decent filtering action.

Round and rectangular coolers are available. Round ones are somewhat preferable because they keep the mash in a more compact mass, resulting in less heat loss, and you can use a rotating sparge arm. But rectangular ones work fine, too, so it's up to you.

The most common form of the cooler-mash tun uses a copper manifold instead of the usual false bottom. This arrangement is not unique to homebrewing. Anheuser-Busch uses a similar device for lautering, called a strainmaster. An advantage of the copper manifold is that it solves hydrolic problems sometimes caused by too much space under a false bottom.

The homebrew version uses a branching network of slotted copper pipe connected to the spigot. Wort flows from the mash into the slits, through the pipes, and out the spigot. Since every cooler is different, you'll want to customize the design of your manifold to work best in your vessel. The goal is to evenly space the pipes throughout the cooler, about three inches apart.

The common design in a rectangular cooler is a pitchfork-shaped arrangement. In a circular cooler moth antennae may be a better model. It is best to get a big sheet of paper and draw a line to indicate the shape of the inside bottom of the cooler. Locate the spigot, then draw your design. When you start cutting pipe, you can trial-fit the thing together right on the paper.

Use 1/2-inch diameter copper water pipe. This fits neatly into the tees and elbows designed for it, so no solder is required (which is good, since even lead-free solder is bad for beer), and everything comes apart for easy cleaning. If the fittings seem a little loose, they may be tapped gently with a hammer to pinch a little tighter, but don't overdo it.

A hacksaw makes acceptable slots for wort drainage. Saw halfway through the pipe, placing a cut about every half an inch. If you prefer, use a Dremel tool (die grinder) with an abra-

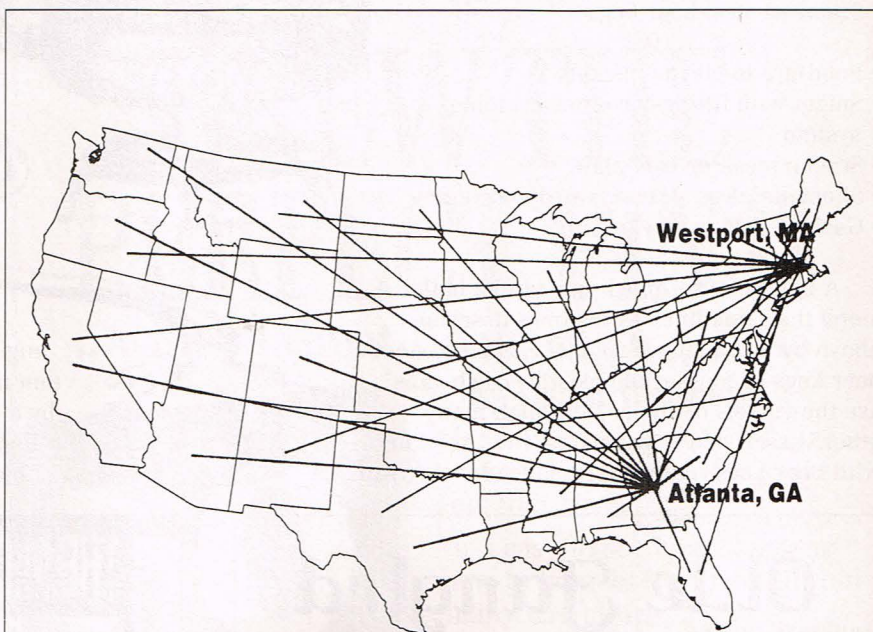
sive cutoff wheel, which will make narrower slots.

Every cooler has a different arrangement for the drain valve—which means you need to use a little ingenuity hooking up the manifold inside and a ball valve outside. You may want remove the existing valve or drain-plug assembly entirely, or simply jam a piece of appropriate size copper tubing into or through the opening. Many times, especially in the round

coolers, the spigot unbolts, leaving a hole just over 1/2 inch through which pipe may be run and sealed with silicone bathtub caulk. By the way, silicone is the only sealant/adhesive readily available that may be used in contact with beer.

If you prefer, a false-bottom works just as well in a cooler as a manifold. (See the discussion below regarding materials and design.)

As you can see, there are many



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ways to build a basic mash tun. What you end up with depends on what's readily available and on your ingenuity in fitting all the pieces together. The next tun is a little more flashy for larger batches, but the add-ons and methods work great for any tun you can think up.

Gonzo Tricked-Out Lauter Tun for 15-20 Gallon Batches

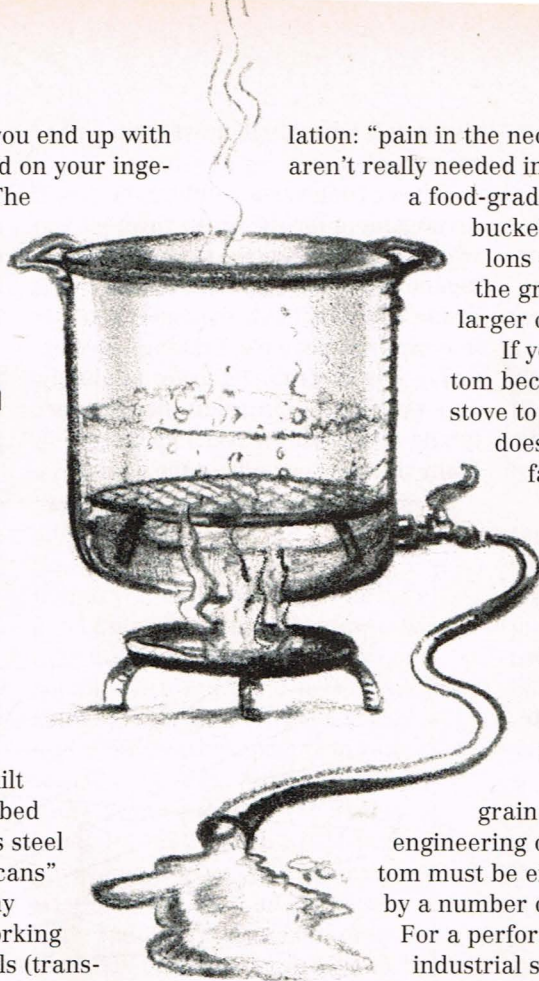
Materials

- Stainless steel beer kegs

Or:

- Food-grade plastic buckets
- Spigot with fittings or other draining system
- Screen mesh or perf plate
- Sheet stainless steel or sturdy plastic
- Gasket such as vinyl tubing

A bigger lauter/mash tun can be built along the same lines as the ones described above by using bigger vessels. Stainless steel beer kegs or food-grade plastic "trash cans" are the vessels of choice, although many other vessels can serve just as well. Working with beer kegs requires specialized tools (trans-



lation: "pain in the neck"), and the properties of kegs aren't really needed in a lauter tun. You're better off using a food-grade plastic container. A 32-gallon bucket is suitable for making 20 to 25 gallons of beer. With brews larger than that the grain bed becomes too deep, and a larger container is required.

If you outfit a beer keg with a false bottom because you think you'll put it on the stove to do a step mash, be advised that this doesn't work very well. Although manufacturers are selling these systems, the screen blocks heat from flowing from the bottom of the pot to the mash on top. The stuff on the bottom can scorch, since there is no way to get in there to stir it up. If you want to do step mashes, you should do them in your brew kettle, then transfer to the lauter tun for runoff and sparging.

The size and weight of the wet grain puts additional demands on the engineering of the large lauter tun. The false bottom must be either pretty sturdy stuff or supported by a number of small legs spaced evenly across it. For a perforated bottom look in junkyards or industrial surplus stores for sheet metal with

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pre-punched holes called "perf plate." If you must, you can make this yourself with sheet metal and a drill. If you're using screen mesh rather than perf for the bottom, it needs to be supported on a piece of sheet stainless steel or sturdy plastic (polypropylene, high-density polyethylene, nylon, polycarbonate) with slots or holes cut out of it.

It is a good idea to put one or two handles on the screen or perf false bottom so that it may be removed from the bottom of the vessel without a fight. Again, make sure the screen is above the level of the valve and its attaching nut. In an ideal world the drain would come off the bottom rather than lowest point on the side, but this complicates things.

If you can figure out a way to do it manageably, this is the best way, as it minimizes the volume under the false bottom. It may be smart to put a gasket around the outside of your false bottom to get a better seal. A length of 1/4- to 3/8-inch vinyl tubing slit along one side works perfectly.

A vacuum gauge is a useful addition to a large lauter tun, because there can be considerable suction if the mash is run off too fast, causing compaction of the mash. With a gauge you can monitor this and cut down the outflow in the early part of runoff, limiting the suction. Later, when the bed is well-established, the tap can usually be opened full bore.

The gauge should be attached to a piece of stiff tubing (plastic, copper, etc.), which goes through the false bottom to the space underneath. One brewer found his gauge at a surplus store; it was originally a pressure gauge from a CPR training dummy. He opened up the case and bent a little wire so the gauge now registers vacuum as well as positive pressure. It's very sensitive, and the needle moves with the slightest drop in pressure under the false bottom.

Easy Additions

Each of the tuns described above can be improved with a few simple additions.

One good idea is to put a swan neck on the spigot. This brings the outflow up to a level above the false bottom, and using it prevents air from

becoming trapped below the screen, creating suction and, thus, outflow problems. This may be a short length of metal tubing that connects to the spigot on one end and the plastic hose on the other. Most times these swan necks can swivel to adjust their height. The same effect can be achieved by just bringing the tubing up to the level of the false bottom before it goes on down to the receiving bucket.

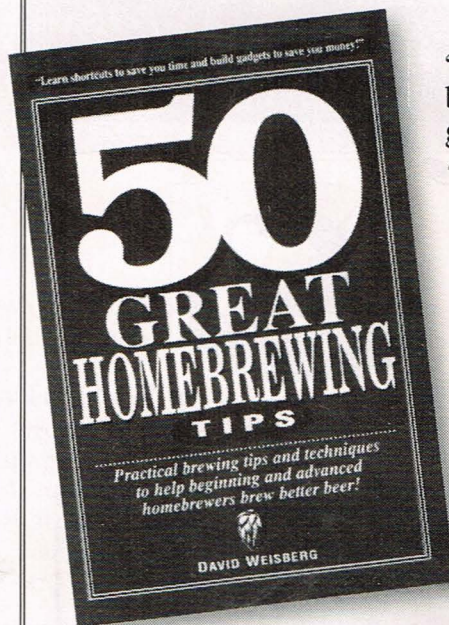
A thermometer probe is another

accessory that makes life easier. One with a short stem interferes less with insertion and removal of the false bottom. A dial-type thermometer can be installed with a compression bulkhead fitting. Just find a fitting of the same size as the stem diameter, and drill it through to allow the thermometer to go all the way in. Attach the thermometer using the metal compression ring; a small rubber O-ring makes a more temporary installation.

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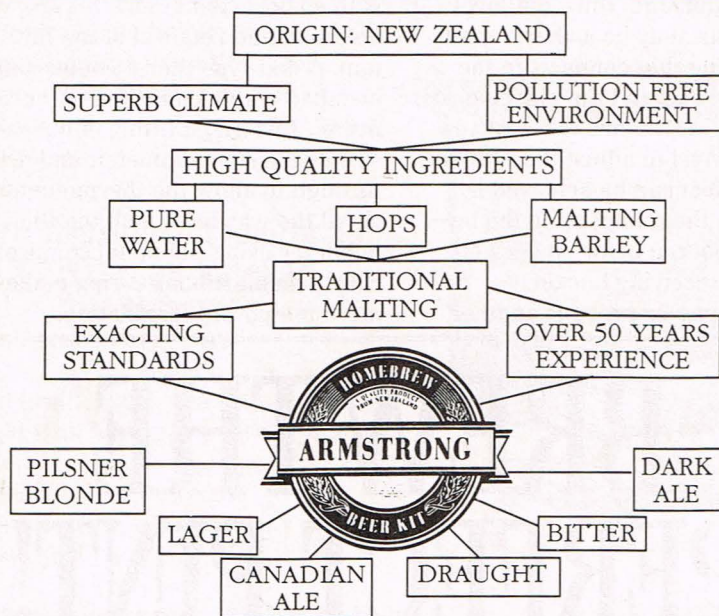
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If you can swing it, another thermometer, inserted into a "tee" fitting just before the sparging arm will display the temperature of the sparge water as it falls on the mash. This will be lower than it is in the hot liquor kettle, and knowing its temperature can be very helpful in maintaining proper sparge temperature.

A 1/4-inch compression tee can be used; a standard laboratory glass thermometer is inserted into one of the sides and sealed with a small rubber O-ring in place of the metal compression ring. Be sure the bulb of the thermometer is just touching the fluid stream. Also, mount the thermometer so it is out of the way and unlikely to get snagged and broken. A dial-type thermometer without the hazards of glass can be used.

Sparge Arms, Sprinklers, etc.

There are many ways to drizzle water on top of your mash bed. The idea is to let the water flow evenly over the top of the bed without disturbing it. A mechanism connects to a container of hot water and is fed by gravity or a pump. It may be built into the lid of the lauter tun or hooked to the sides in some fashion.

The simplest device is 1/4- to 3/8-inch copper tube, bent into a loop that fits the shape of the vessel. Holes or slots on one side allow water to sprinkle out. The smaller the holes, the more spray-like the effect. Drill-holes of 1/32-inch will be about right. Place them about every 1/2-inch.

If you cut slots with a hacksaw, just barely cut through the wall of the tubing. A razor saw, available at hobby or art stores, will make a better, finer cut. Be sure to bend the tube into the appropriate shape before drilling or sawing.

The rotating sparge arms made by Listermann Manufacturing are especially useful. They are simple, durable, and come in a variety of sizes.

Be sure to remember that the first cloudy wort that gets recirculated through the mash has chunks in it that will clog the small holes in your sparge arm. The wort needs to be gently floated on top of the grain bed without disturbing it.

So there you have a number of ways, from simple to complicated, to capture the precious juice of the barleycorn. Whatever variation you choose, your all-grain beer will be delicious.

Brewing for Flavor

A Guide to Beer Ingredients and How They Work

Hops can give your beer a wealth of flavors and aromas, both good and bad. The trick is knowing how to control them.



by Ashton Lewis and Tom Flores

This is the first installment in a three-part series about the sources of flavor and aroma in beer. This month's topic is hops. Next month we'll look at the effects of malt, and the following month we'll look at yeast. Also, check out the story on using hops in your beer, page 36.

The next time you open a beer, fill your glass halfway. Give the beer a good sniff; get your nose way down in there like the wine snobs do and enjoy the aroma.

Does it smell flowery? Fruity? Pine scented?

Now take a drink, just enough to fill your mouth. Consider how the beer tastes on the front of your tongue and on the back of your tongue. Is it bitter? Spicy? Grassy?

These are all qualities, both good and bad, that hops can add to beer. This versatile climbing vine, a relative of the marijuana plant, works in sever-

al ways to add widely differing characteristics to your brew.

What Is a Hop?

Brewer's hops are the fruit or cone of the female hop plant. There are male hop plants, but most hop yards keep the males out because their flowers pollinate the female cones and

result in seeds. Brewers prefer seedless hops, because seeds tend to lend harsh flavors to beer.

Hop cones contain little yellow sacs, called lupulin glands, that hold the bittering compounds and aroma constituents. Some hop varieties have high concentrations of alpha acids, the compounds that give beer its unique, bitter flavor, in their lupulin glands. These varieties are primarily used for bittering.

Hops used to add aroma to beer have high concentrations of oils and low concentrations of alpha acids. Some varieties have a bit of both and can be used for both bittering and aroma.

Hops have been associated with brewing since the eighth century, when they were first used in the Hallertau region of Germany. These beers must have tasted far better than other beers of the period, since the use of hops spread throughout the beer-

Hops are used in beer as both a spice and preservative. Unhopped beer tastes pretty horrid.

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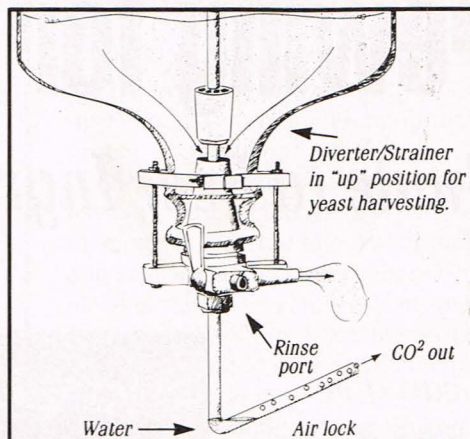
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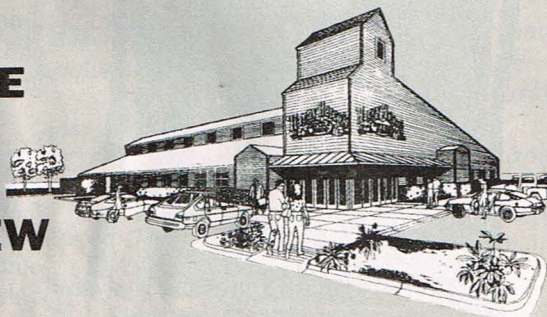


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brewing regions of Europe and by the 1600s were in widespread use. Even the British started using hops sometime between the 17th and 18th centuries.

Today, hops are only used by the brewing industry and a few consumer products companies that put hops in their shampoo (presumably for added flavor!).

Why Use Hops in Beer?

Hops are used in beer as both a spice and preservative. Unhopped beer tastes pretty horrid. Before hops were widely used, other spices such as nettle, coriander, and spruce were used to balance the sweetness of the malt.

The preservative action of hops is a bonus. Hops have been used for centuries to extend the shelf life of beer. The most notable example is the heavy hop rates used in traditional India pale ales. This heavy hop rate helped preserve these fine English ales during their long journey to India so the British soldiers who were busy colonizing the world could enjoy them.

Currently, hops are used mainly to provide bitterness and aroma in beer. Large breweries who wish to extend the shelf life of their products have turned to heat pasteurization. That's because hops only prevent hop-sensitive bacteria. The bacteria that spoil beer are not generally hop sensitive.

Hop Bitterness

As beers became progressively more bland after Prohibition, large brewers were only concerned with the bittering compounds from hops. They wanted no hop aroma in their beer and wanted the bittering to be quite low. This mentality persists today and is apparent in Keystone Light, the least bitter beer in America. Luckily for connoisseurs of beer, some brewers began to put the bitterness back into the mix.

Hop bitterness is chiefly derived from the alpha acids contained in the lupulin glands. Alpha acids are generically known as humulones. Humulones make up 2 to 14 percent of the hop's dry weight, so a hop with 5 percent alpha acids means that 5 percent of its weight is made up of humulones.

This number is taken at harvest and decreases with storage; alpha

acids degrade over time, especially when improperly stored.

Alpha acids aren't soluble in wort. However, boiling causes a chemical reaction called isomerization that transforms them into iso-alpha acids. Iso-alpha acids are soluble, and they are what create beer's bitterness. That's why hop bitterness increases with boil time up to 60 to 90 minutes.

Once iso-alpha acids are in beer they add bitterness, inhibit the growth of certain bacteria, aid in foam retention and cling, and are the source for skunkiness in green- and clear-bottled beers. The skunkiness arises when light runs into an iso-alpha acid, causing it to react with sulfur, which is present in beer. The solution is to bottle your beer in brown bottles or to keep your green and clear bottles in the dark.

The other source of bitterness in hops comes from the beta acids, also known generically as lupulones. Beta acids have little significance to what brewers call "brewing value," but their aging products do. During storage, beta acids degrade due to oxidation.

Unlike alpha acids, however, their oxidation products are bitter. This means that oxidized beta acids make up some of the bittering lost by alpha-acid oxidation during storage.

Oxidized beta acids also have an aroma: cheese. This cheesy aroma is due to volatile fatty acids released from oxidized beta acids. These volatile fatty acids are identical to compounds found in aged cheeses, such as parmesan and romano.

Hop merchants are skilled at the sensory evaluation of hops and are always on the lookout for cheesy hops. This works for homebrewers too. If you smell your hops and start thinking about a big plate of linguini and marinara, snap out of it! Hops should smell like hops. If they're cheesy, don't use them.

Hop Aroma

It seems like many of the commercial breweries have forgotten that hops smell wonderful. Hop aroma compounds are lumped into the category known as essential oils. These oils

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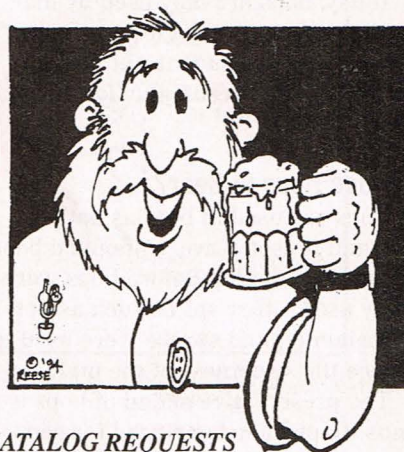
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make up 1 to 1.5 percent of the hop's dry weight.

Although there are more than 200 essential oils found in hops and their distributions can be used to "finger-print" a variety, only four essential oils are commonly referred to: myrcene, humulene, caryophyllene, and farnesene. These compounds are known as terpenes. Terpenes are responsible for not only the aroma of hops but the aroma of fruits, flowers, herbs, and the like. Hop terpenes are very volatile and most are lost during the kettle boil. However, some survive, especially if they are added late in the boil.

Terpenes also change during storage. These compounds change chemically (mainly due to oxidation) and become less volatile. This means that beers made from these hops with a high percentage of terpenes (essential oils) have better aroma retention. That's one of those contradictions that keep homebrewers hopping; oxidation may improve aroma retention but will damage other hop flavors.

Terpenes lend myriad aromas to beer. Some of the common hop aromas can be described with terms such as lemon, grapefruit, fruity, woody, resinous, piney, cedary, spicy, geranium, perfumey, rose petal, and hoppy!

Hop aroma is an essential attribute of the hop, and you must be careful if you want to keep it in the wort. Late hopping, steeping (adding hops to hot wort after the boil), and dry hopping are all methods intended to add hop aroma to beer.

If you like Sierra Nevada Pale Ale, Anchor Liberty, and good German pilsners such as Bitburger, you like hop aroma. Knowing that, you probably want to work to keep some of these essential oils in your brew.

Other Hop Flavors

Besides aroma and bitterness, hops are capable of giving other characteristics to beer. These are flavors not associated with the lupulin gland. They come from the plant portion of the hop cone, the leaves.

If you start using copious amounts of hops in your brews, you will begin to extract large quantities of leaf compounds. If you're unlucky these compounds will be detectable in the fin-

ished beer. The most common flavor attributed to hop leaves is grass. As the name implies, this smells like freshly cut grass—not exactly a fine hop nose. These beers may also be quite astringent.

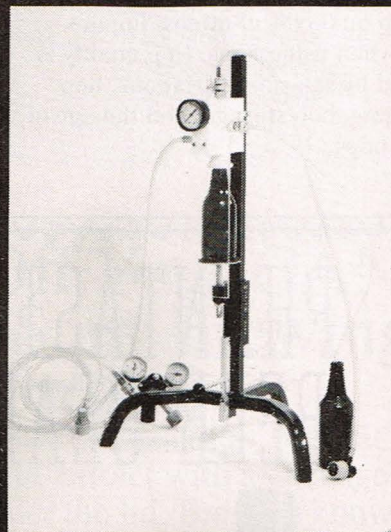
The easiest way to avoid grassiness is to use low-alpha hops for aroma and not for bittering. Many brewers argue that fine aroma hop varieties are superior to other hop varieties in all aspects. Those brewers believe that

the reason large breweries use high alpha varieties for bittering is to save money.

Other brewers disagree. Fine-aroma varieties produce exquisite aromas but typically have low concentrations of alpha acids. This means that if you bitter your beer with aroma hops, you'll need to use much more to achieve the same bitterness level. When you do this, you're adding large quantities of hop leaves that can

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impart grassy flavors.

While using aroma hops for bittering has drawbacks, using bittering hops for aroma purposes is fair game. The reason commercial breweries don't normally do this is that they wouldn't think of wasting alpha acids. Keep in mind that they don't go after aroma too much. Craft brewers, on the other hand, have a long history of using bittering hops for aroma.

Cascade is the classic example of this practice. This variety was used solely as a bittering hop by American brewers until Fritz Maytag dry hopped his Anchor Liberty Ale with it in 1975. Thanks to the unconventional use of this hop by Anchor, the Cascade has come to symbolize many microbrewed beers.

Hop Quality

Hop quality is of utmost importance when using hops. Hop quality is affected by seasonal variations, hop packaging, hop storage, and the age of stored hops.

Seasonal variations—the differences from one harvest to the next—are documented by hop growers in “hop specifications.” These sheets contain information on the alpha acid content, total oil and the concentrations of the four principle terpenes, the aroma description, and general trade perception. Some brewers look at all of this information, while others only note the alpha-acid content for use in calculating their hopping rate.

Most of the information relates to varietal features and doesn't change much from year to year. For example, variety X may have 1.5 percent total oil this season and 1.2 percent next season, but the distribution of the various oils stays constant (remember, this distribution is the hop's fingerprint).

This means that knowing the aroma and flavor of a given variety is sufficient. If you become familiar with a particular variety's aroma and flavor, percent alpha, the name of the variety, and, perhaps, the total oil content is all the information you need from the

supplier.

Before buying hops, study their color and aroma. Hop pellets should have an olive-green color. Hop cones (whole hops) should be a little brighter green. If the color is pale yellow to ivory, don't take the gamble. These paler colors suggest that the hops are too well aged.

Buy only hops stored in a refrigerator. Hop deterioration is directly related to temperature. Cold hops last longer than warm hops. At Coors they store their hops at 28° F and keep a three-year supply on hand (at least that's what the tour guide said). The point is that cold storage greatly extends the hops' shelf life.

Hops should not be exposed to air, since oxygen breaks down alpha acids and causes beta acids to smell like parmesan. Hops are compressed into hop plugs, hop bales, or pellets to minimize oxygen damage. However, these preparations still require packaging. Some of the best packages on the market are vacuum-packed or nitrogen-

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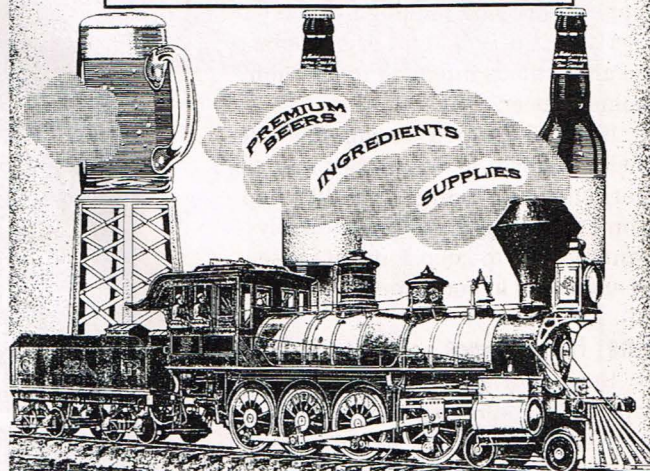
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packed bags that do not allow oxygen to enter. Plastic storage bags, for example, *do* allow oxygen to enter the package.

Experimentation

The best way to get to know different hops is to experiment. You can brew five gallons of wort and split it into several small kettles to play with different varieties, concentrations, or times of addition. Likewise, you can brew a five-gallon batch and split it into several vessels for dry hop trials.

Just remember that every good experiment needs a control or "no treatment" group. If you don't include a control, you'll never know if a change actually added that funky flavor or if the funky flavor was from another ingredient.

Using hops to improve your brew isn't difficult. Buy healthy looking and smelling hops, experiment, take notes, use different varieties, and enjoy the many tastes and smells hops provide.

Typical Hop-Induced Characteristics

Characteristic Aroma	Problem	Solution
Skunky	Light affected the alpha acids.	Bottle beer in brown bottles or keep green and clear bottles in the dark.
Cheesy	Oxidized beta acids released volatile fatty acids.	Smell hops before you use them and toss out the ones that smell like parmesan.
Grassy	Large quantities of hop leaves slipped in with the hop cones.	Use low-alpha hops for aroma only, not bittering.
No hop aroma	Essential oils are lost in the kettle boil.	Experiment with late hopping, steeping, and dry hopping.

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Beer Overboard!

Don't Let Unruly Foam Ruin Your Brew

By L. Michael Sabo

Picture yourself in the kitchen. You're about to open the first bottle of your latest batch of beer, an amber ale.

Brewing went well, you hit your target gravity, and the wort tasted great when you siphoned it from the fermenter into bottles. You're rightfully expecting another ringing success.

You pull out your lucky bottle opener, the one with the ceramic bulldog head on the end. You position the bottle between the bulldog's teeth and pop off the top.

Suddenly, a rising tide of foam spills out of the bottle and over the sides. The bulldog gets wet. Your hands get sticky. The four-color Amber Sunrise label you painstakingly drew with felt-tip pens begins to run. Your long-awaited ale cascades onto the rug.

Okay, it's not a disaster. There's still plenty of beer left in the bottle. You can't share this batch with your friends, at least without fair warning (more for you—that's not necessarily bad). But still, you had high hopes for this brew.

Something went wrong, very wrong...

The Natural Way

A distinguishing quality of a fine hand-crafted beer is proper carbonation for its style. While correct carbonation will not turn a marginal beer into a great beer, an otherwise great beer is certainly unappealing if it's flat or if it bursts out of the bottle onto the floor. With a little care and a good procedure,

you can easily create properly carbonated beer—avoiding the problems of both under-carbonation (flat) as well as over-carbonation (the dreaded gusher).

Homebrewers typically carbonate their beer using a process called natural conditioning. Natural conditioning is a secondary fermentation that occurs directly in the bottle or initial keg. The process can begin once the beer has fermented out. Additional fermentable sugar (typically corn sugar) is mixed with the beer just prior to bottling or kegging. This is called priming.

Natural conditioning relies on residual yeast suspended in the beer that didn't settle out during fermentation. The yeast consumes the priming sugar and releases carbon dioxide. Because the bottle or keg is capped, the carbon dioxide is not able to escape. Over time the trapped carbon dioxide dissolves into the beer, naturally carbonating it. Typically the carbonation process requires two to three weeks to complete.

Priming Procedure

Successful priming requires knowing how much priming sugar is necessary to achieve the proper carbonation for the beer style. In addition the brewer must adhere to a procedure that results in consistent and sanitary priming.

The first step is to pick the ingredients. Several varieties of priming sugars are available to the homebrewer. Corn sugar and malt extract are by far the most common. However, it is possible to prime with molasses, table sugar, and even honey.

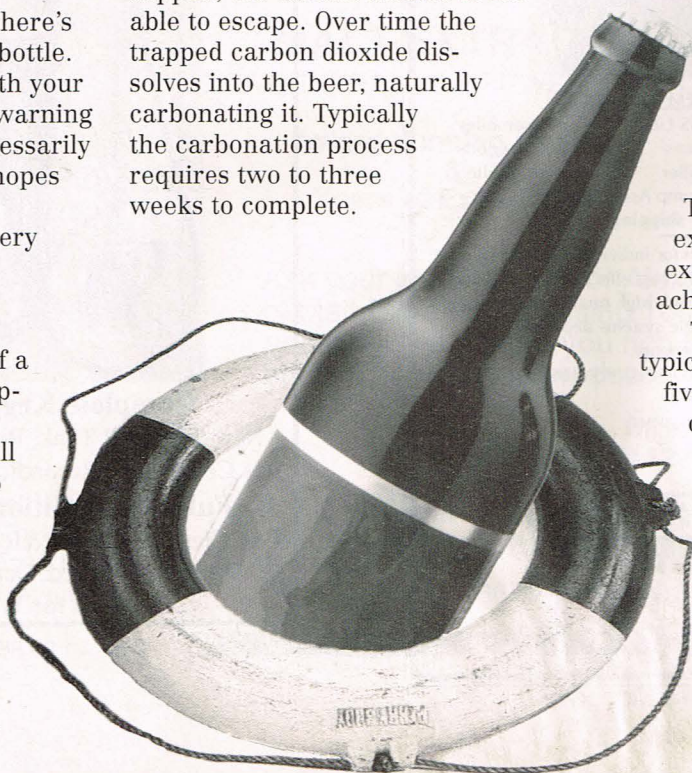
All-malt purists often insist on the use of malt extract over corn sugar for priming. As a practical matter, however, corn sugar is inexpensive and provides consistent results. Corn sugar also has the advantage of being 100 percent fermentable, whereas malt extract is not.

The amount of fermentable sugars in malt extract will vary by brand. Therefore, some amount of experimentation with a specific extract may be required to achieve the desired carbonation.

The box on page 62 depicts typical priming amounts for five-gallon batches to naturally condition beer in bottles.

Reduce these priming levels by 50 to 60 percent when kegging. You can use these figures as rules of thumb and make adjustments on subsequent batches.

If you want to be more precise with your priming,





prime with eight grams of sugar per liter (3.2 grams times 2.5 grams per liter). Five gallons contains 18.92 liters, so you will need a total of 151.36 grams of sugar.

Bottle Priming

Bottle priming is the process of adding corn sugar or dried malt

extract directly into each bottle prior to filling with beer. Typically, one teaspoon of corn sugar for each 22-ounce bottle is sufficient. A small, sanitized funnel is useful to speed the process.

The advantages of bottle priming are that it is relatively fast and it enables you to rack directly from the

you will have to determine the amount of priming sugar necessary to reach a particular volume of CO₂. This does involve some math.

Here are the rules: Approximately 3.2 grams of corn sugar will yield one volume of CO₂ per liter, a low level of carbonation. Multiply 3.2 grams of sugar by the volumes of carbonation you want in your beer. Then multiply that total by the number of liters of beer you've brewed.

For example: If you wanted to achieve 2.5 volumes of carbonation for your five-gallon batch of pale ale,

Typical Priming Amounts for Naturally Conditioning Beer in Bottles

Low carbonation:

- Approximately 2.2 volumes of CO₂.
- Use 1/2 cup of corn sugar or 7/8 cup of dried malt extract for priming five gallons of beer.
- Suitable for barley wine, fruit ales, porters, special bitter, and stout.

Medium carbonation:

- Approximately 2.2 to 2.5 volumes of CO₂.
- Use 3/4 Cup of corn sugar or 1 1/4 cup of dried malt extract for priming

five gallons of beer.

- Suitable for altbier, Belgian abbey, English pale ale, Oktoberfest, and pilsner.

High carbonation:

- Approximately 2.5 to 4 volumes of CO₂.
- Use 7/8 cup of corn sugar or 1 1/2 cup of dried malt extract for priming five gallons.
- Suitable for American light, Belgian lambic, weisse, and wheat beer.

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secondary fermenter into the bottles. The disadvantages are that it is difficult to achieve consistent results between bottles, and it is difficult to maintain sanitation.

Many homebrewers who keg their beer will often bottle prime two or three bottles from each batch. They are then able to give the beer to friends or easily transport the beer to parties. While bottle priming is certainly effective, most homebrewers prefer batch priming.

Batch Priming

Batch priming involves adding a sugar syrup to the entire batch of beer prior to bottling or kegging. Batch priming has many advantages over bottle priming. The process is more sanitary and because the priming sugar is syrup, the beer is better able to mix with the sugar. Therefore, results are more consistent with little chance of contamination.

Here's how to batch prime five gallons of beer:

1. Once fermentation is complete, rack (siphon) the beer into a sanitized bottling bucket. A six-gallon food-grade bucket with a valve at the bottom makes an excellent bottling bucket.

2. Remove a pint of the beer and place it in a four-quart stainless steel sauce pan. Optionally, you could use a pint of water instead of beer.

3. Add the recommended amount of corn sugar or dry malt extract to the sauce pan. Generally 3/4 cup of corn sugar or 1 1/4 cup of dried malt extract will do the trick. Most recipes specify the priming amounts.

4. Bring the mixture to a boil while constantly and slowly mixing. Be careful not to allow the mixture to boil over.

5. Continue the boil for at least five minutes and not more than 10 minutes. Remove the sauce pan from the heat. Place a cover on the sauce pan to keep out contaminants.

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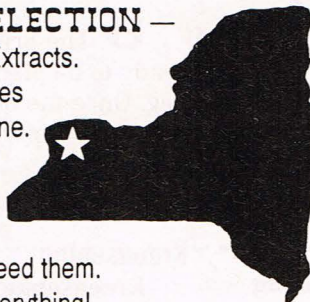
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6. Allow the priming solution to cool to room temperature. To quickly cool the solution, run cold tap water around the outside of the pan.

7. Once cool, add the priming mixture into the bottling bucket. Be careful not to splash when adding the priming solution. You don't want to add additional air that can lead to oxidation of the finished beer. To avoid aeration, slowly pour the priming mixture along the side of the bottle bucket then slowly stir the primed beer with a sanitized racking

cane or long spoon.

If dried malt extract is being used, you will notice the sauce pan has semi-solidified material at the bottom. Be careful not to pour this gunk, called break material, into the bottling bucket. Break materials can impart off flavors to the finished beer.

8. The primed beer is now ready to be placed into bottles or a keg. Once the beer is primed, store it at room temperature for two to three weeks.

Kraeusening

Kraeusening means to add fermenting wort (krausen) to a beer to cause a secondary fermentation. A commercial brewery may use the kraeusening process prior to cold storing (lagering) beer in a secondary. To the homebrewer kraeusening is an advanced form of batch priming. Kraeusening is useful for priming beer that has been lagering

for an extensive period of time.

After several months in storage, the yeast may not be active enough to consume the priming sugars. To counter that situation, add a small amount of yeast in 1 1/4 to 1 1/2 quarts of the original unfermented wort. When used as a priming malt, the wort is referred to as gyle. When the gyle and pitched yeast combination reaches full fermentation (krausen stage), it is added to the beer as a primer.

While kraeusening may seem intriguing, it is certainly not for the faint of heart. It is often difficult to achieve the desired specific volume of carbonation. Extensive trial-and-error experimentation may be necessary to determine the amount of gyle needed for proper carbonation.

Problems

On occasion you may find that an entire batch of beer did not carbonate properly. Assuming you did not forget to prime the beer, flat beer is

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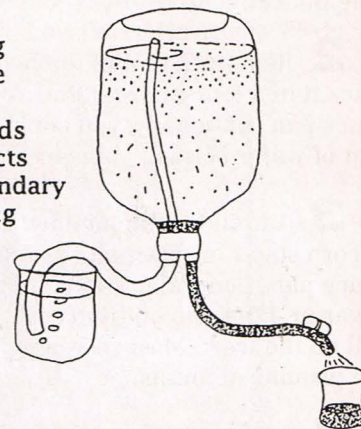
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likely the result of carbonation leaking from poorly capped bottles. Other probable causes of flat beer are:

- Not enough priming sugar
- Inactive yeast
- Not allowing enough time for the yeast to consume all of the sugar
- Storing the primed beer at a temperature too low for the yeast to work.

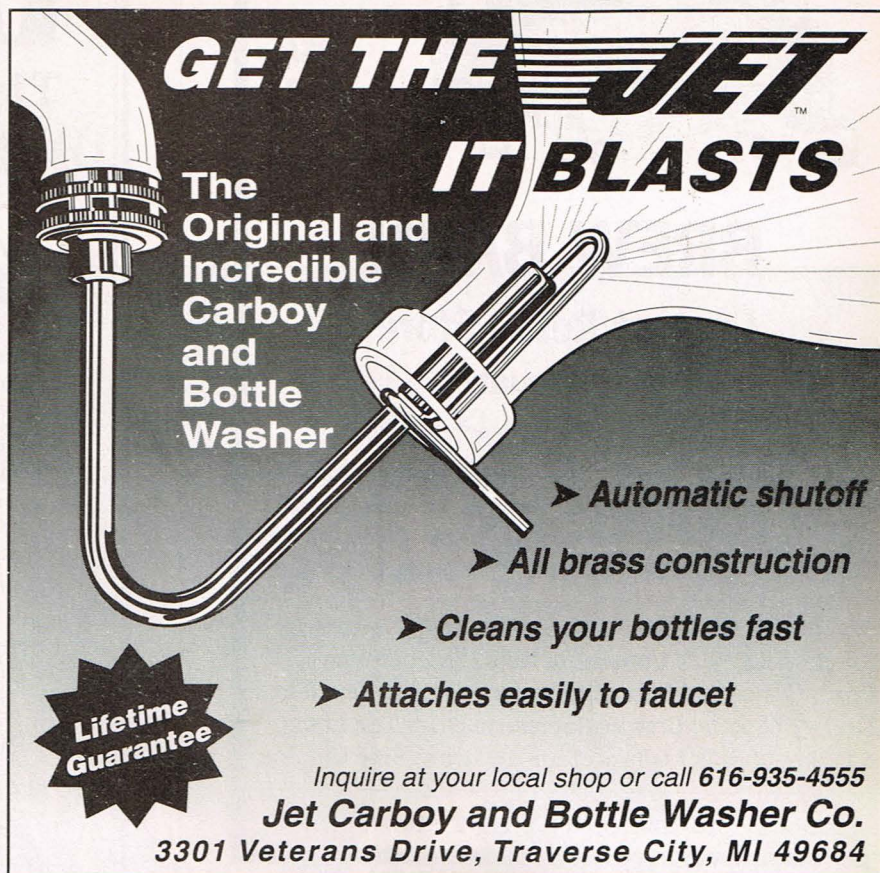
The solution to under-carbonation is to add additional priming sugar and a small amount of rehydrated dry yeast to each bottle.

The other possible carbonation problem is over-carbonation—the gusher. Over-carbonation is likely the result of over-priming. Too much fermentable sugar allows the yeast to produce too much carbonation. Over-carbonation can also result from not allowing the beer to completely ferment out. In that case the beer, once primed, contains far too many fermentables.

Bacterial or fungal infection can also cause over-carbonation. Micro-organisms release various gases in addition to the carbonation being created by the yeast. Infected beer is normally discarded.

Like flat beer, over-carbonated beer can often be salvaged. Begin by chilling the beer. The lower the temperature the better, but don't freeze it. Cold beer is able to hold the carbon dioxide in solution, temporarily preventing the beer from foaming over. Next, loosen the caps to let the gas escape. Allow the beer to stand for 30 minutes and recap with new sanitized caps. Store the beer for several days. If the beer remains over-carbonated, repeat the process.

Natural conditioning produces carbonation in the old style of brewing. By contrast artificial carbonation is a much faster process, allowing you to enjoy your beer immediately. Many homebrewers, however, feel that the extra effort involved in natural conditioning, as well as a little sediment in the bottom of the bottle, seems a fair tradeoff for the results achieved. ■



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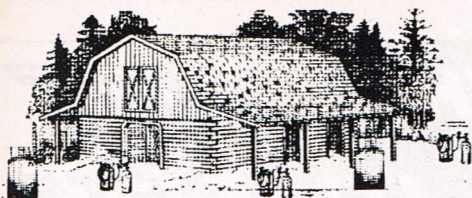
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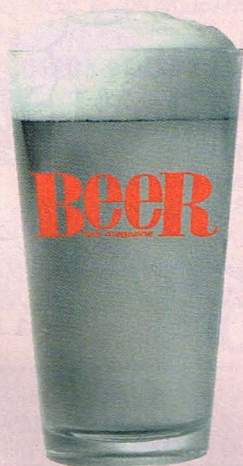
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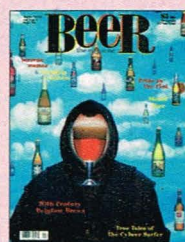
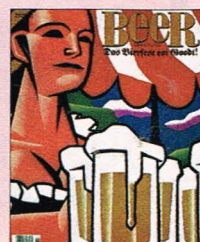
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Moonlight Brewing

by Steve Johnson

You have heard of the legendary brewing pioneers who started the American beer renaissance. Their names trip off the tongue . . . Fritz Maytag, Jack McAuliffe, Bill Owens, Ken Grossman, and Paul Camusi.

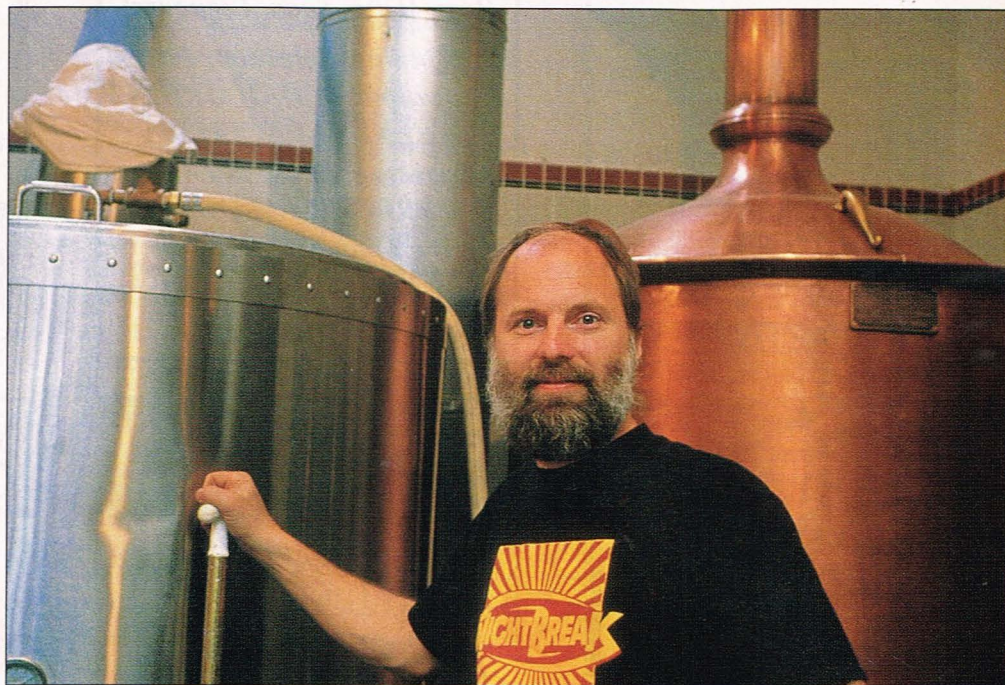
They are just as important to the beer renaissance as Christopher Columbus, Sir Francis Drake, Hernán Cortez, and Lewis and Clark were to the age of exploration. Yet there were many others who made contributions—some fell by the wayside, others managed to survive.

Brian Hunt is one of those unheralded pioneers who goes back almost to the beginning. How far back does he go? Well, when Bill Owens was installing his brewing equipment at Buffalo Bill's Brewpub in 1983, who do you think he called for technical advice? Brian Hunt.

But due to some bad luck, Brian was not one of those to open the first brewpub. Where others would have thrown up their hands in frustration, Brian held to his dream, and he survived. Because of his tenacity, Brian still does what he likes best—make beer.

Brian Hunt's love affair with beer goes back to his high school days in Sacramento when he and a friend would sneak out to the garage and "ferment any living thing." He learned to take a more scientific approach while studying brewing at University of California, Davis. While almost all of the students were in the wine-making program, Brian decided he wanted to make beer.

Upon graduation in 1980, he went to work for Schlitz in Milwaukee. Brian says of the experience, "What I most appreciated about Schlitz was the old brewery, where beer was still important. On slow shifts, like second and third shifts, I would walk in the old cellars. Some had wooden tanks and open fermenters. They were all falling in, hadn't been used in 30 or 40 years. There was so much brewing history there. And it was done by tradition. Everything was done for a reason. Often you didn't know what the reason was, but there was a reason. Most of the brewers, the actual union brewers, had other jobs before World War II. They came back from the war and that was their job and they



Brian Hunt, one of the forgotten pioneers of the American beer renaissance, splits his time between Downtown Joe's and his own brewing barn, Moonlight Brewing.

STEVE JOHNSON

knew what they were doing. I learned a lot from them."

The year 1981 was momentous: Schlitz closed and Brian lost his job. Shortly after that he attended the Great British Beer Festival, where he discovered the magic of ale. He tried his first glass of English ale, and with the second he says, "It was like 'pow!' I was hooked on the flavor, and it's been like that ever since."

Brian returned to California and experienced a series of brewing misadventures. First, he worked on a project to open a brewery in Berkeley, which failed due to lack of capital. Then he tried the Xcelsior Brewery in Santa Rosa, which closed within a couple of years. Finally in 1987 things clicked, and Brian landed the job as head brewer at the new Willett's Brewing Co. (now Downtown Joe's) in Napa. About the same time, he served as consulting brewer for the start-up Anderson Valley Brewing.

Being a scavenger at heart, Brian collected bits and pieces from different breweries over the years. Word got out that he was looking for equipment. When he was getting close to opening his own brewery, a stranger drove up in a truck one day with 50 used kegs and asked him if he wanted to buy them. Brian bought the kegs and went into business for himself in September of 1992. The brewery is located in the barn behind his house (which, ironically, sits

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in the middle of a vineyard). He guesses that up to 15 different breweries are represented in different pieces of equipment in his brewery.

Brian's pride and joy is the grist mill, a genuine piece of brewing heritage. Don Barkley first showed it to me at Mendocino Brewing in 1987 and explained that it was the original grist mill from Jack McAuliffe's New Albion Brewery. When I returned to Mendocino in 1992, they had a new grist mill. When I asked owner Michael Laybourn what had happened to the original, he winked and said it was stashed away for safe keeping. Imagine my surprise when I walked into Brian's garage in 1994—the first thing I saw was the New Albion grist mill.

Brewing four or more times a week between the two breweries (Downtown Joe's and his own), Brian brews at odd hours at home; hence the name "Moonlight" Brewing. He brews on a seven-barrel system about twice a week, with production running around 500 barrels a year. He uses well water, does not filter his beers, and packages all of them in kegs.

Brian jokingly says he likes to make beers with so much character that they can only be appreciated by a small cadre of hardened beer lovers. Otherwise, his beers might become too popular, thereby requiring him to work harder.

True, some of his beers are robust, but others are very soft, such as his Trick-or-Treat Ale, which is fruity, malty, and mellow, and the Fruit Medley, a very fruity, smooth, and drinkable brew that, by the way, has no fruit in it—Brian has a strong aversion to putting fruit in beer.

One of his most interesting beers is Old Combine 4-Grain, made with oats, rye, wheat, and barley. It has an earthy, soft character with an indescribable, something special to it. The Moonlight Pale Lager is aged for five or six weeks and has a fresh hoppiness, a good malt-hop blend. It is immensely drinkable.

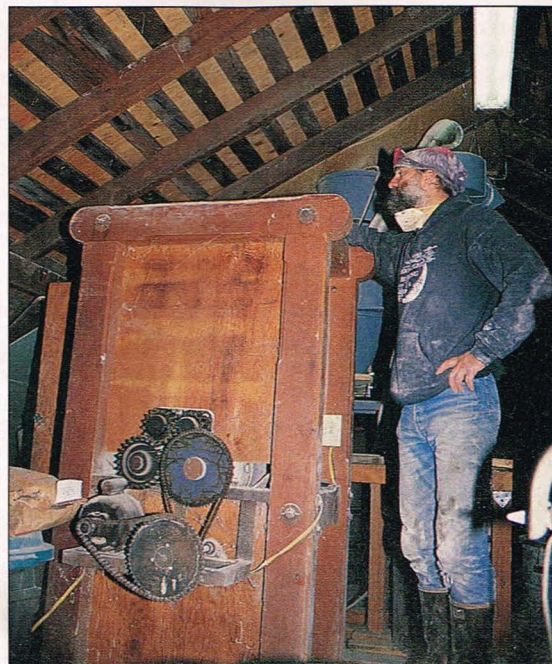
The more he-man-type

beers include Death-and-Taxes Black Beer (a black lager with rich coffee notes), Twist-of-Fate Bitter Ale (with a sharp hop palate and a long Cascade finish), and Bombay-by-Boat India Pale Ale. I didn't sample the latter, but guess that Brian would hop up an IPA pretty well. As you can tell, not only does Brian put character in his beers, but in their names as well.

Beer tourists are advised to stay away from the brewery due to Brian's hectic schedule and the cramped quarters. It is perhaps the most cluttered brewery I have ever visited. But Brian seems to know where everything is. You would be better off visiting one of the pubs that carries Brian's beers, such as Gaffney's on Mendocino Avenue in Santa Rosa or the Inn of the Beginning on the Old Redwood Highway in Cotati.

If you really insist on seeing Moonlight Brewing, it is located several miles north of Santa Rosa. Call Brian either at Downtown Joe's or at his brewery, (707) 528-2537, to make an appointment and get directions. ■

Steve Johnson, a resident of Clemson, South Carolina, is author of two brewery guidebooks: On Tap: a Field Guide to North American Brewpubs and Craft Breweries, and On Tap New England.



Brian Hunt works with the New Albion grist mill.

STEVE JOHNSON

Lagering *continued from p.29*

proteins. You will have a much better beer for your efforts.

Lager Yeast

Yeast choice in lager brewing, as in all other types, is important. First, you must start with a true lager yeast. These are known by the scientific name *Saccharomyces carlsbergensis* or *S. uvarum*. Most commercial lager yeasts are sub-strains of a type known to the trade as Weihenstephan-3470.

Lager beers must be pitched with plenty of yeast. This is also true for ales, but the cold temperatures used for lager make fermentations even more sluggish when not enough yeast

is used.

Although there are quality dry lager yeasts, you may have more luck with liquid strains. If you're starting with a yeast pack, break the inner seal, then wait one to two days for the package to swell to one or two inches. Next, create a yeast starter with three cups of water to 1/4 cup malt extract, boiled and cooled.

Add the contents of the sanitized pouch into a sanitized quart jar with the starter wort and thoroughly aerate—shake it, don't break it. Cover with a stoppered airlock or a piece of tin foil. Place in a warm area (70° to 75° F). Let it sit two to three more days before you brew.

These simple steps ensure you will

have a healthy colony of yeast beasts ready to do their job on brew day.

Avoid Stale Taste

When your beer is exposed to oxygen after fermentation has begun, the first thing to go is fresh flavor. Oxygen pickup can be caused by not being careful during transfer of your homebrew from one container to another. If you are blessed with a carbon dioxide tank and kegging system, here are a few ways to reduce the chance of oxidation when moving beer.

When racking from primary to secondary, purge the receiving container (soda keg or glass carboy) with CO₂. With a carboy you can add the CO₂ by running a sanitized hose (attached to the CO₂ tank) into the carboy at five psi for 10 to 15 seconds. It's even easier with a soda keg—just attach the CO₂ to the gas intake quick connect and purge the same way.

Now when you rack (siphon) the wort/beer from primary to secondary, you minimize most of the risk of oxygenation.

Bottling Lagers

Fully carbonated lagers that have been conditioned in a keg can be bottled. The best way to do this is with a counter-pressure filler. These fillers can be made at home or purchased through equipment companies.

If you're bottle conditioning a lager that has been aged cold for several weeks but not carbonated, corn sugar is your best bet. Using corn sugar is more predictable, while adding unfermented wort (gyle) when bottling is a hit-or-miss proposition. Unless you make the same beer all the time, it's going to be hard to hit the carbonation level just right.

Brewing note: If you're using dry malt extract instead of corn sugar for priming, you may introduce protein (and you don't want that!). To avoid this, make sure you boil the extract long enough (10 to 15 minutes). Next, chill the solution, then separate it (by siphoning) from any proteins that settle out.

If you want to brew a good lager, be patient and pay attention to the details. You will end up with a delicious creation. ■

Advertiser Index

	Page No.	Circle No.
Above the Rest Homebrew Supplies	62	1
Advanced Brewing Technology	16	2
Alternative Beverage	20	3
American Brewers' Guild	14	4
Antrom Associates	18	5
Assembly Required	68	67
Beer and Wine Hobby	34	68
Beer in a Box	28	69
Beer Unlimited	59	8
Beer: The Magazine	66	-
Beverage People, The	66	9
Bier Garten, The	68	10
Boston Beer Co.	Cov. II	70
Brew By You, Inc.	69	11
Brew Co.	64	12
Brew King	43	71
Brew Store, The	32	-
BrewCrafters	52	72
Brewers' Coop	68	13
Brewers Resource	11	14
Brewers Warehouse	15	15
Brewferm/Farma Imports	7	16
Briess Malt	68	17
Brimhall Brew Barn	66	73
California Concentrate Co.	63	66
Cedar Vintage	18	74
Consolidated Beverage/Coopers	Cov. IV	18
Crafty Fox, The	60	19
Crosby & Baker	49	-
Cymba, Inc.	29	75
Discovery Channel	2	76
Edme Limited	5	21
Fermentap	54	23
Filter Store Plus	19	24
F.H. Steinbart	25	22
Fun Fermentations	56	25
Great Lakes Brew Supply	28	26
Happy Harry's Bottle Shop	54	77
Heartland Hydroponics	65	27
Home Brewer's Software	34	28
Home Brewery, The	9	29
Homebrewing Depot	58	30
Hoptech	60	31
Hopunion USA, Inc.	50	32

	Page No.	Circle No.
James Page Brewing Co.	22	33
Jet Carboy and Bottle Washer Co.	65	34
Jim's Home Brew Supply	60	35
Joseph Cerniglia Winery	14	78
LD Carlson	23	36
Lampman Brewing Publications	51	37
Liberty Malt	35	38
Liquid Bread, Inc.	24	79
Listermann Manufacturing Co.	58	39
Malt Shop, The	68	40
Market Basket, The	44	41
Mayer's Cider Mill	12	42
Medicine Rock Div. - Dakota Sup. Co.	64	43
Merchant Du Vin	Cov. III	44
Mid America Brewing Co.	68	46
Morgan's Brewing Co.	38	47
Mr. Beer Microbrewery	1	48
Mr. Radz Homebrew Supply	68	49
Munton & Fison	33	-
Napa Fermentation Supplies	29	50
Niagara Tradition	63	51
Northwest Taps Magazine	69	-
Olde Fangled Fermentations	50	52
Premier Malt Products	41	53
Quoin	24	54
Rapids Wholesale Equipment	55	55
Red, White & Brew	54	-
Regent Software Co.	56	56
Renaissance Pleasure Faire	69	81
Ryecor Ltd.	52	57
SABCO Industries	56	58
Schumacher & Associates	62	59
Siebel Institute of Technology	16	60
Specialty Products International	26	61
Stella Brew	68	62
Tkach Enterprises	26	63
Vinotheque	57	64
Williams Brewing	26	-
Wind River Brewing Co., Inc.	59	82
Wine & Brew By You	68	65

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True Confessions of a Hardware Junkie

by Tighe Wooldridge

The biggest gift under my friend Jamie's Christmas tree was an all-inclusive beer making kit. It included everything you should need to make great homebrew: a 32-quart kettle, five-gallon bucket, carboy, siphon tube, fermentation lock, dry malt, yeast, and hops.

To prepare for our first brew, Jamie and I both ran out and bought copies of Charlie Papazian's *The New Complete Joy of Homebrewing*.

We brewed that first batch, a pale ale, on the stove in his warehouse loft. We followed the directions that came with the kit as if they were Captain Kidd's guide to buried treasure, supplementing them at times with advice we remembered, or thought we did, from Papazian. Except for the boil over, things went smoothly.

While the beer was fermenting, we went out and bought 20 Newcastle Brown Ale bottles, caps, and a capper. Two weeks after bottling, we tasted our creation. The fruity, off taste of the beer was pretty bad. We got drunk, but we resolved to do better next time.

In-depth analysis over many beers led us to the "obvious" conclusion about our brew: The problem was the equipment. Who can make decent beer with tools like that? Not us (although everyone else seems to do just fine). We threw out the whole kit with the exception of the hydrometer and carboy. Then we went shopping.

First, we bought every brewing magazine and book we could lay our hands on (\$100). Next, we bought a few necessities: a CO₂ draft system (\$100); two Cornelius kegs (\$50 each); a King Cooker (\$60); a 15-gallon half keg (\$40) that we retrofitted into a cooking pot by cutting off the top, fitting it with a lid, and having a welding shop attach spuds for a spigot and a thermometer (\$60 for the welding); and a *really* big wooden spoon (\$10).

Now more prepared, we attempted our second brew—a porter. When tast-

ing time came around, we discovered that our purchases had paid off; it was really pretty good. We saw an obvious correlation between the amount of money spent on a particular brew and the brew's quality. If you count the price of the kit, our first (bad) brew cost around \$70. The equipment for the second (good) brew cost us about \$370.

Now that we knew the formula, we couldn't stop there. We figured with a little more equipment, we could be making a first-class beer. Actually, by the time the porter had fermented out, Jamie had already bought himself a separate draft system (\$65) and a couple of Cornelius kegs (\$45 each) so we could brew 10-gallon batches and keep five gallons at each of our homes.

By the time we'd moved from our second to our seventh brew, we had acquired six more Cornelius kegs; a new hydrometer with a large, free-standing Pyrex tube (\$25); seven 6 1/2-gallon carboys (\$20 each); a digital thermometer (\$25); an original, custom-built wort chiller (\$40 in parts); more magazines and books (\$100); two refrigerators (one for free, one for \$75) with taps in the doors (\$45 each); a 2000 ml Erlenmeyer flask for yeast propagation (\$28); and a second 2000 ml Erlenmeyer flask for yeast propagation (\$28)—I broke the first one.

With seven full beers on our resumes and a cadre of new equipment, we decided it was time to abandon extract brewing for all-grain.

In preparation we bought another 15-gallon beer keg and had it retrofitted with the spigot, thermometer, and a sight tube (\$130); more carboys and Cornelius kegs (don't ask); a 10-gallon Glatt insulated cooler for our mash/lauter tun (cooler \$60, retrofitting \$20); a Glatt grain mill (\$130) with a gear reduction motor to speed up the grinding (\$60); miscellaneous grain bags; fermentation locks, carboy carriers, CO₂ manifolds, siphon tubes, etc. (\$150); a digital scale for hops

(\$120); and a produce scale for grain (\$60).

Before we could launch our eighth but first all-grain brew, we realized we needed to build a tower system for all of our new gonzo equipment.

We bought steel (\$80) and casters (\$70) for the frame; a MIG welder (\$500), bottle of argon (\$25), a grinder (\$80), and plenty of chop saw blades (\$15) for construction; and three King Cooker burners (\$75), three 20-pound propane bottles (\$75), propane hose fittings (\$30), and two regulators (\$30) to set it up.

After about a week of heated debate about the design, we proceeded to build our two-piece tower system on wheels. The wheels came in handy when Jamie's girlfriend decided to kick us out of the warehouse loft they shared, and we had to roll the whole thing over to my place. When my girlfriend wouldn't even let us into the door of the kitchen, we rolled our beautiful tower toward my garage.

We were determined to be all-grain brewers, but first the garage needed a little work if it was going to become our brewery. We started with insulation, Sheetrock, electricity, plumbing, a power ventilation system, and a raised ceiling to accommodate the nine-foot tower. During the early stages of the remodel we decided we needed a new nail gun, taping tools, matte knives, drop cloths, etc.

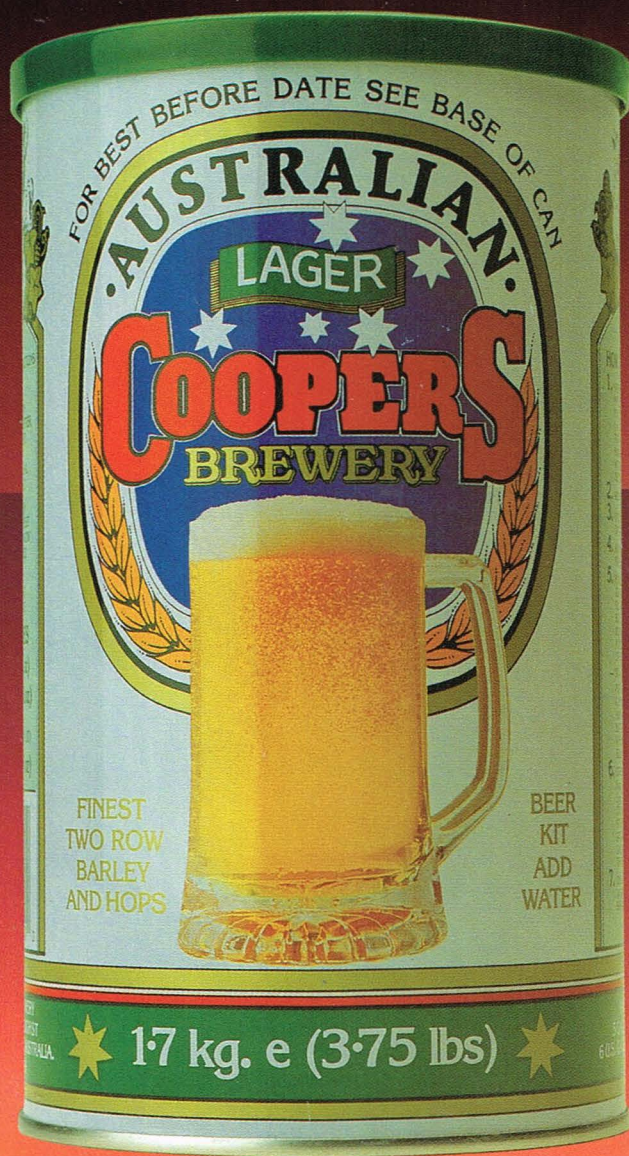
During the renovation we talked about brewing all the time, although we haven't exactly gotten to the eighth brew yet. But the 100 pounds of grain in the garage is ready whenever we are.

You see, brewing has been on hold for almost a year now. The garage isn't quite finished because my new vegetable garden took up some of my time. But it's going to be a really nice garden. We have about \$200 worth of soil, a soil testing kit (\$45), 35 tomato plants (\$3 each)... ■

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