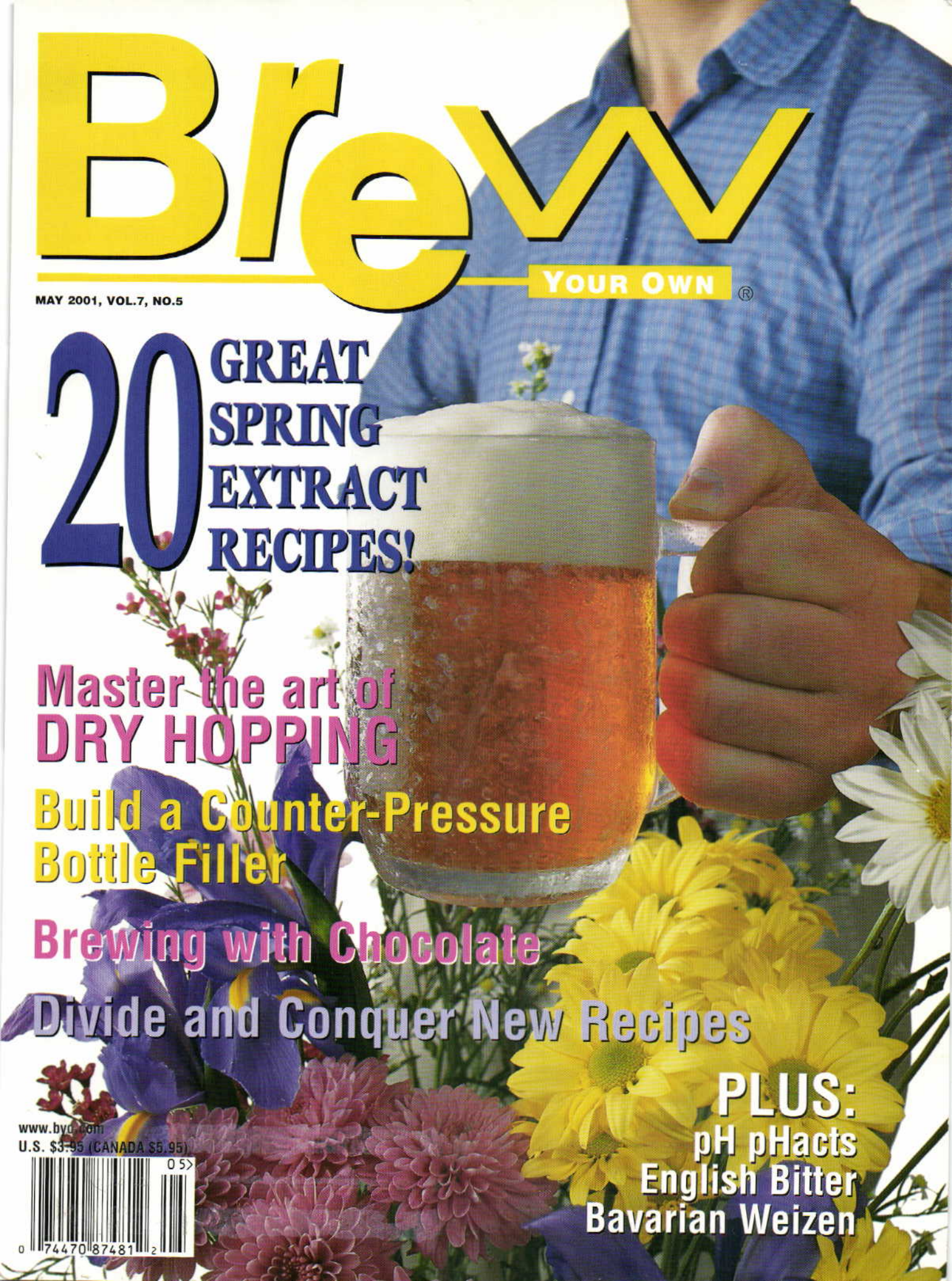
Brew Your Own®

MAY 2001, VOL.7, NO.5



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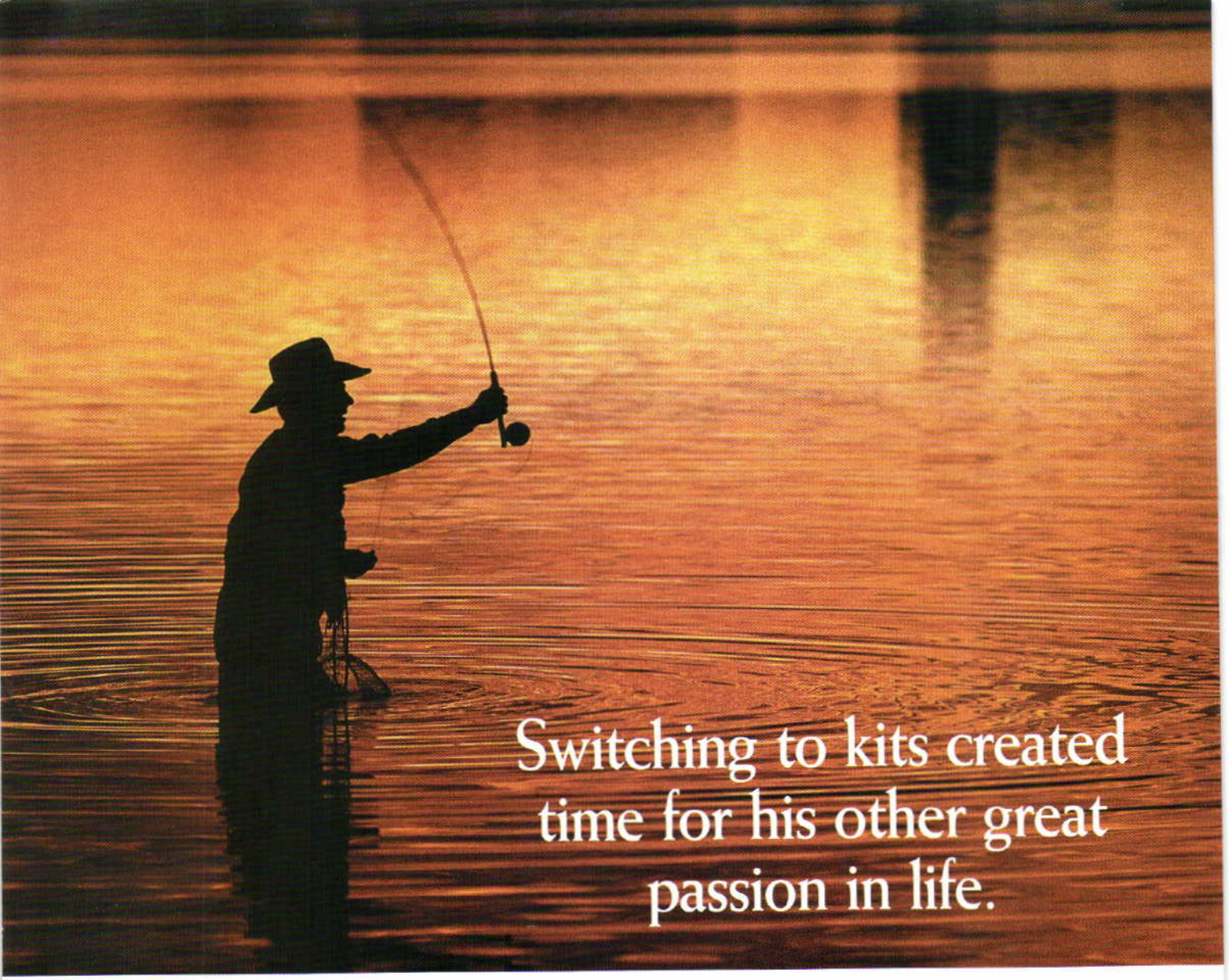

"It tasted just as good - if not better - than many a pint I've drunk in London pubs."

Richard Neill
'Weekend Telegraph' (April 99)

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

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

"It resulted in as good a home-made beer as I have ever tasted"

Maximum 5-point rating in kit review
'Bizarre' magazine (September 99)

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CIRCLE 26 ON READER SERVICE CARD

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Cover photo: Charles A. Parker/Images Plus

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Editor's Note

Springtime sap beer

I woke up early one Saturday morning to find my husband gone. No, he hadn't absconded to some Caribbean island. He had gone to the hardware store, bright and early, to buy maple taps, sap buckets and a hand drill. By the time I'd finished my coffee, he had tapped four maple trees in our Vermont backyard.

Brad collected about six gallons of sap that day. I thought we should make some maple syrup, but he had other ideas. He wanted to brew a batch of beer, using sap instead of water in the boil. How could I argue with that? So we poured all six gallons of sap, which tastes as crisp and pure as Vermont in springtime, into the brewkettle. Our first batch of sap beer, a maple porter made with malt extract and specialty grains, was one of the finest homebrews we've ever made.

Every year since then, we've celebrated spring by brewing a batch of maple beer. It's an optimistic thing to do, since sugaring season — when the weather warms up just enough during the day to encourage the sap to rise — precedes the actual arrival of spring by six weeks or so. Truth be told, we won't be wearing shorts and T-shirts around this office until our sap beer is ready to drink.

In this issue, we celebrate the vernal season by offering 20 excellent extract recipes. The story was written by Joe and Dennis Fisher, homebrewing brothers extraordinaire and authors of "Great Beer from Kits" (Storey Books, 1996). By digging deep into their recipe files, they've come up with an inspiring array of styles for spring, from Vienna to weiss, from bitter to bock. Offbeat ingredients include melted snow, lilacs, oak chips, sweet woodruff, elderflowers and, you guessed it: sap.

Here's to spring!

KATHLEEN

Contributors

Thom Cannell began homebrewing four years ago at the prodding of a friend who astonished him with his excellent beers. Cannell lurked on several online homebrewing forums to accumulate knowledge about the hobby and soon discovered that it "wasn't much more difficult than making your own barbecue sauce."

Thom began writing for *BYO* in 1999. His first article was "Build a Mash Tun for $50" *(September 1999)* and he took over our "Projects" column last May. An automotive writer and editor for more than 25 years, Thom has had stories published in every major automotive-enthusiast magazine in the United States. He is the technical and aerospace editor for "eMOTION Magazine" and is the U.S. correspondent for Germany's "Auto Magazin" and "4Wheel Fun."

Thom combines his knowledge of mechanics and his love of homebrewing to brainstorm and design many useful (and inexpensive!) do-it-yourself projects for *BYO*.

Brew Your Own
THE HOW-TO HOMEBREW BEER MAGAZINE

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Vodka Shots

In the March issue of BYO *("Help Me, Mister Wizard")*, John O'Brien had a problem with mold growing in his 10-pound container of malt. Every time I open a container of extract, I put in a shot of vodka to prevent this from happening. I buy the 33-pound containers of extract and have never had a problem with mold. He might just use half of a shot for his smaller container.

Steve Foreman
Westville, New Jersey

Periodic Poster

I loved the "Periodic Table of Beer Styles" in the January issue! This would make a great poster. Do you offer (or ever plan to offer) this as a poster?

Brian Newell
via e-mail

Andrei Chapoval, who created the table, says: "I am happy to announce that the 'Periodic Table of Beer Styles' is now available in a 19" x 24" wall poster for only $7.99 mailed anywhere in the U.S. or $8.99 to Canada. Get one for yourself and send them to your brewing buddies! They are distributed by the Von Klopp Brew Shop in Pine Island, Minnesota. Call (800) 596-2739 or go to www.makewineandbeer.com to order. Visa, Discover and Master Card are accepted."

Got Milk?

I have been waiting for a Sam Adams Cream Stout clone for a very long time. Thank you for publishing one in the February issue *("Style Calendar")*. I just have one question about the recipe: How come there is no cream, milk or lactose listed in the ingredients?

Matthew Underwood
via e-mail

Style maven Tess Szamatulski says: "Sam Adams Cream Stout does not actually contain any cream, milk or lactose. It has minimal bittering units to emphasize the malt sweetness and big body. Some sweet, cream or milk stouts do contain lactose to provide additional residual sweetness, but it is not essential. A cream stout is simply a dark, sweet, full-bodied ale."

Sassafras Search

Great article on root beer in the January 2001 edition of BYO. Variety is the spice of life and your sodamaking features are a treat. There's just one problem: Why is sassafras root bark so impossible to find? Our local homebrew shop doesn't carry it. On-line homebrew supply houses don't have it. None of my catalogs offer it. Health food stores and co-ops don't have it. I've heard explanations ranging from "it's a carcinogen" to "it's a precursor chemical for the drug Ecstasy." Short of using commercial extracts with artificial flavoring, do we have any other options?

Ronda and Andrew Statz
Madison, Wisconsin

Author Stephen Cresswell responds: "Several years ago, the FDA expressed dismay that laboratory rats developed cancer at a somewhat elevated rate when they were fed large quantities of pure saffrole. Saffrole is the active ingredient in sassafras root, and the Food and Drug Administration (FDA) yanked sassafras from 'prepared' food products. Most herbalists refuse to believe this traditional tonic ingredient is a carcinogen, and, at least in my home state of West Virginia, it is widely available. Try an on-line herbalist. One source to try is www.planetherbs.net. Good luck!" ■

How To Reach

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Special Subscription Offer:
10 issues for $29.95

Web Site:
www.byo.com

Brew Your Own (ISSN 1081-826X) is published monthly except July and August for $44.95 per year by Battenkill Communications, 5053 Main Street, Suite A, Manchester Center, VT 05255; tel: (802) 362-3981; fax: (802) 362-2377; e-mail: BYO@byo.com. Periodicals postage rate paid at Manchester Center, VT and additional mailing offices. Canada Post International Publications Mail Product Sales Agreement No. 1250469. Canadian Mail Distributor information: Express Messenger International, P.O. Box 25058, London BC, Ontario, Canada N6C6A8. POSTMASTER: Send address changes to ***Brew Your Own***, P.O. Box 469121, Escondido, CA 92046-9121. Customer Service: For subscription orders call 1-800-900-7594. For subscription inquiries or address changes, write ***Brew Your Own***, P.O. Box 469121, Escondido, CA 92046-9121. Tel: (800) 900-7594. Fax: (760) 738-4805. Foreign and Canadian orders must be payable in U.S. dollars plus postage. The subscription rate to Canada and Mexico is $55; for all other countries the subscription rate is $70.

The Secret in the Shed

One family's historic tale of brewing Choctaw beer

Pat Virgin
Broken Bow, Oklahoma

Choctaw beer originally was brewed in east-central Oklahoma, back when it was called "Indian Territory." The recipe has been handed down.

BACK IN THE DAY, money was as scarce as hen's teeth. What little there was went for bare necessities. To my Aunt Evie, bare necessities did not include beer, but my Uncle Dean had a different perspective. He had a real taste for the spirits and not much pocket change, so he had to resort to more basic measures. Brewing beer and keeping Auntie in the dark at the same time was no easy task.

"Unk" decided that his little shed was a perfect spot to brew in because Auntie was sure that place was full of copperheads and the like. He soon had a churn covered neatly with a white feedsack that Auntie had raveled and bleached to use as a dishtowel, bandage or whatever. I doubt, however, that the "whatever" included brewing.

With kids around, secrets aren't so easily kept. When we were bored, finished with our chores, and the swimming hole had lost its charm (back when there wasn't even electricity, let alone a TV), we couldn't help but notice Unk's frequent trips to the shed. We also observed that he seemed much more jolly each time he returned from the shed. We decided to investigate one day while he was out and to our delight we tried our first cup of "Choc Beer." Our trips also became more frequent and Unk eventually became suspicious that someone was sipping his brew. Unk brooded for a while and then came up with a perfect plan — or so he thought. He put his "intimidating" bulldog, named Bud, in the shed and closed the door.

We had a real horse-laugh about that because we played with Bud every day and he was glad to see us after being alone in that shed a few hours. But we indulged too often. My brother drank too much and eventually Mama figured out our little secret.

This story always comes up at our family get-togethers. Recently we got the idea that we should try to recreate this beer, so I pulled Granny's churn out of the attic, put together the ingredients and brewed up some Choc. After it worked off, I poured it into jars. I placed a large jar in the refrigerator and called everyone over to try it out.

We all sat down to a friendly card game, downing large glasses of cold brew. My cousin Johnny kept coming back for more. Johnny excused himself to go to the bathroom and we realized about 30 minutes later that he hadn't come back. We found him out cold on the bathroom floor with his big cowboy boots wedged tight against the door. We had a terrible time getting that door open. So let me leave you with a bit of advice: If you try this old family recipe, don't over-indulge until you see just how well you did.

Choctaw Beer

Choctaw beer originated in Oklahoma, where members of the Choctaw tribe most likely learned how to make it from European traders. The name later became connected with Prohibition-era brews.

The Virgin family's old recipe called for Blue Ribbon malt extract, which is no longer available. You can substitute any hopped pale malt extract syrup. This makes five gallons.

Ingredients

3.3 lbs. hopped pale malt extract syrup
3 to 5 lbs. corn sugar (based on desired strength)
5 gallons water
1/2 cup cornmeal
1 pint raisins
1 packet yeast (Fleischmann's or ale yeast)

Step by Step

Put the malt extract and sugar in a large pot with 1 gallon of water and heat gently. Stir to dissolve. Pour this mixture into a clean 6-gallon crock or fermenting bucket. Add the remaining water, cornmeal and raisins, and stir. For this recipe, baker's yeast traditionally would be used, but you'll get better results with ale yeast. Add the yeast and stir well. Let the beer sit in a warm place, covered with a piece of cheesecloth. (Or ferment in a carboy with an airlock.) After a week, fermentation should be complete. Skim off the foamy head (or the head may sink on its own once fermentation slows down). Prime and bottle as usual.

Frontier Brew

In keeping with the "pioneer brewing" theme in this month's Pot Shots, we offer an excerpt from "The Way It Was: The North Dakota Frontier Experience, Book Two" (The Grass Roots Press, 1998). The book is based on interviews conducted with surviving homesteaders in the 1930s by researchers from the federal Works Progress Administration. This excerpt, from an interview with Albert Hoiland, describes the methods that his pioneer family used to prepare beer in the late 1800s.

Special thanks goes to Brew Your Own reader Alan Grindberg of Bismark, North Dakota for sending us this book excerpt. His parents were homesteaders.

Father made beer for home consumption. Malt for beer brewing was prepared by putting one bushel of barley in a grain sack. The sack was then tied shut, fastened to a rope and submerged in the Sheyenne River and allowed to soak for three days. This soaking so swelled the barley that it made a whole sackful.

Clean cloths were now spread on the upstairs floor when it was warm. The barley was spread on the cloth about three-inches thick to sprout. When the sprouts were one-inch long, the barley was put in large pans four-inches deep. These were then put in the oven to dry the barley quickly. Care had to be taken in drying so that the barley did not burn, which would give a bitter taste to the beer.

The dry barley, sprouts and all, was then coarsely ground on a common feedmill in Valley City. A 50-gallon syrup barrel was prepared in the same manner that the salt barrels were prepared for storing and leaching ashes, except that the chips were carefully selected — clean oak — and no hay was necessary. The barrel was filled with round, dry malt. Boiling water was poured on the malt until the barrel was full. It was then allowed to stand for six hours. The liquid was drained off the malt in this barrel and poured into a boiler on the kitchen stove and heated to a boil.

Then enough hops were added to make a three-inch layer in the boiler. It was then boiled for 30 minutes, during which the contents were stirred constantly. Then it was strained to remove the hops. The liquid was added to that in the second barrel and brewing yeast was added. When cool, it was put into beer kegs or cider barrels, which were left uncorked for three weeks.

The beer was then ready to be served. It makes a wholesome refreshing drink, especially in the summer, for it corrected the reactionary effect of the river water. ■

Cool It

Some chilling advice from three pros

by Thomas J. Miller

Wort chilling is a simple concept. Brewers are attempting to drop the wort temperature from boiling to fermentation temperature (55° F for lagers, 65° F for ales) as quickly as possible so they can pitch the yeast. Pitching the yeast quickly helps to avoid off-flavors and reduces the chance of infection.

Typically, this technique is accomplished by running the wort through a heat exchanger, such as a counterflow wort chiller, as it is transferred from the brew kettle to the fermenter. Homebrewers also might use an immersion chiller. That's a long copper coil that connects to the cold water tap and is submerged directly into the kettle. You run cold water through it until the wort is chilled.

Wort chilling is an invaluable technique that leads to better beer. The benefits of wort chilling apply to all homebrewers, whether they choose to brew with extract or with grains.

This month's pros offer some practical wort-chilling advice, including the why's and the how's of getting it done. There are also some thoughts on making a wort chiller, the need for conducting a whirlpool, and how to test your heat exchanger for contamination.

Brewer: Peter Licht of Coast Range Brewing Company in Gilroy, California. Peter went to the U.C. Davis Master Brewer's Program, and has been at Coast for six years.

There are three reasons for chilling wort. First, you want to cool the wort down to the appropriate temperature for fermentation. This is the main reason, and I think most brewers are on the same page with this.

Second, by chilling the wort you encourage "cold break." This is the precipitation of polyphenol protein compounds and the jury is out as to what impact these might have on your finished beer. Some think that by separating out the cold break, you'll get a beer that clarifies better. You might also end up with some fusel alcohol if you transfer too much cold break over to the fermenter. Fusel alcohols are any alcohol of higher molecular weight than drinking alcohol. They impart a harsh bitterness. I think these are unnecessary concerns and don't think it's worth the effort to separate the cold break out from my batches of beer.

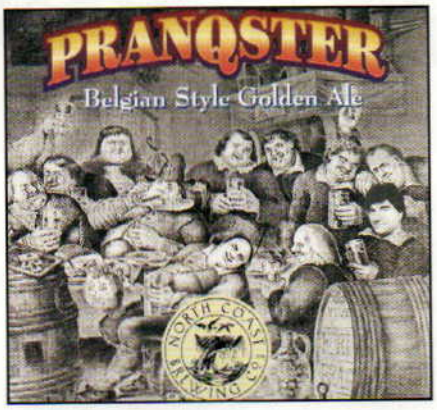
If you do want to separate it out, you can do it two ways. When the wort gets to the fermenter, the cold break will drop out and you can rack your wort off of it. Be careful doing this, since the wort is very susceptible to infection when it's chilled but not fermenting. Or, if you chill your wort in the brew kettle with an immersion chiller, the cold break should settle at the bottom of the kettle. You just rack into the fermenter, straight from the kettle, leaving the cold break behind.

The third reason for wort chilling is oxygen solubility. It's a simple truth that oxygen is more soluble in cold water and you want to oxygenate the wort in order to encourage fermentation.

It's extremely important to avoid pumping solids through your heat exchanger. To prevent this, you'll want to whirlpool the wort for at least five minutes at the end of the boil before transferring. You should have excellent results with the whirlpool. The solids move to the sides, drop to the bottom and settle in the center of the kettle, provided that you have a kettle with little friction built into it (screens or other protrusions that could interfere with whirlpooling).

You shouldn't use a pump to create a whirlpool, where you're pumping air into the wort to get it spinning. This can cause hot-side aeration, which can promote the formation of staling compounds that make your beer taste old.

As soon as the wort is chilled, introduce oxygen by stirring vigorously with a sterile spoon. You might also aerate the wort as it enters the fermenter by injecting pure oxygen with a sterile tube extended all the way to the bottom of the fermenter. If you oxygenate with pure oxygen, you'll get high levels of saturation quickly. Air takes longer but it does the job. This also introduces nitrogen, which neither hurts nor helps your wort.



Brewer: Mark Ruedrich of North Coast Brewing in Fort Bragg, California. Mark started homebrewing in the mid-1970s in England. When back in the U.S. in 1988, he opened North Coast Brewing.

You're trying to do two things during wort chilling. First, you want to transform the hot wort into a good environment for yeast growth. This means you want a suitable wort temperature, which on average should be about 63.5° F. Second, you want the wort at a good temperature for the saturation of oxygen. Oxygen helps feed the yeast and thus encourages fermentation. We use pure oxygen, instead of air, to do this. Most homebrewers, however, will use air by either shaking or stirring their wort. This won't saturate the wort with oxygen as quickly.

Warmer wort has less capacity for holding oxygen. The gases will dissolve out more easily. Of course, this means that the oxygen will also dissolve into warmer solutions better, but it won't hold unless the liquid is cold. We often explain that cold water holds more oxygen by using the "trout stream" analogy. Colder water has more oxygen, and that's why you'll always find trout in the water that's nice and cold.

We shoot for the same pitching temperature for ales and lagers: 63.5° F. This seems to give us a nice, gentle start for fermentation so that by the next morning things are perking along very nicely.

To chill the wort, we use a big cold liquor tank. The water in the cold liquor tank is chilled with glycol, a refrigerant that can be circulated through pipes to chill the water. It's a 2,000 gallon tank and after going through the glycol chill, the water temperature falls to 38° F. We use that liquid to chill the wort with the counterflow method.

The cold water goes into the heat exchanger and comes out at about 190° F. We direct this to a hot liquor tank, and it's used for the next brew cycle. Homebrewers might want to try this for brewing multiple brews, since they'll capture all that hot liquid and save lots of time. The catch is that you probably won't want to use water straight from the tap, so you might have to design a cold liquor tank where you can store and treat water.

Brewer: Noel Acre of Golden Valley Brewery in McMinnville, Oregon. Noel homebrewed for three years, then started at Golden Valley as an assistant. He then became the head brewer and has held that position for a year and a half.

Wort chilling is about getting the wort down to a good fermentation temperature as quickly as possible. The quicker you can pitch the yeast and start fermentation, the less chance you have of infection.

When I was a homebrewer, I built my own counterflow chiller. I used 25 feet of one-quarter inch copper tubing and one-half inch plastic hose. I pushed the copper tube through the plastic tube. This wasn't easy, but then I got the idea of soaping up the copper. I capped each end to make sure soap didn't get inside the copper tube and then it slid through the plastic quite easily. My heat exchanger got me a wort temperature of 50° F, which was far better than I expected.

At the brewery, we shoot for 65° F for ales and 52° F for lagers. We have a plate exchanger that runs off of city water. Plate exchangers have coolant and wort flowing on alternate sides of many plates of metal with gasket spacers. They offer massive surface area, which speeds up wort chilling. During the winter, that water can get as cold as 45° F, so we can get the low temperatures without a problem. In the summer, our lagers might come in a bit warm but I've never had a problem with off-flavors.

Another method if you're getting warmer-than-desired temperatures is to put your fermenter in a refrigerator after running your wort through a chiller. Try to get the temperature down before you add the yeast but try not to wait too long before pitching. I pitch as I'm moving beer into the fermenter and homebrewers should add yeast as they are running into the carboy. But, if you need to drop the temperatures a bit before pitching, do it. Whirlpool the wort for 20 minutes, then let it rest for 15 minutes before transferring. This will help to avoid running solids into your heat exchanger.

Heat exchangers can be tough to clean. A good way to determine if your heat exchanger is contributing bacteria to your beer is to run a "wort-force test." Take a small wort sample as it comes out of the heat exchanger (before pitching). Make sure the container is clean and sterile and stopper the container. After several days, any sign of fermentation is an indication that you have some kind of contamination in the heat exchanger. This force test can also be interpreted by looking for cloudiness. Turbidity is a sign of bacterial growth. ■

"Help Me, Mr. Wizard"

Temperature Check

Keg longevity, bottle conditioning and alcohol content

Mr. Wizard

What's the best way to check the temperature of a mash? I use a five-gallon, round picnic cooler (Rubbermaid). The first time I did an all-grain brew, I followed "The New Complete Joy Of Homebrewing" by Charles Papazian (Avon Books, 1991). It says to raise the temperature of the water about 12° to 17° F above the desired mash temperature. I did this and the mash temperature dropped to 144° F; I was targeting a temperature of 152° F. I checked it with a dial thermometer. I also used 170° F sparge water. What is the temperature drop of sparge water?

Gilbert Korrubel
The Hague, Netherlands

The best way to check mash temperature is with a calibrated-dial or alcohol-filled thermometer. The easiest way to calibrate a thermometer is by filling a glass with ice cubes and then filling the glass with water. In a few minutes the water temperature will drop to 32° F. If the thermometer is a dial-type, it most likely has an adjustment screw or the face can be rotated. Simply adjust the thermometer so that it reads 32° F (0° C). Alcohol-filled thermometers cannot be adjusted and are typically more reliable than dial thermometers because they are calibrated when made and don't change over time.

The rule of thumb printed in "The New Complete Joy of Homebrewing" works well if you use 0.79 gallons of water per pound of grain (3 liters per kilogram). If the mash tun is at the same temperature as your target mash temperature and the malt is at room temperature, it works out so that 12° F added to the water temperature is perfect. For example, if you want a mash temperature of 150° F and are using 10 pounds of malt at 68° F (20° C), then 7.9 gallons of water at 162° F works.

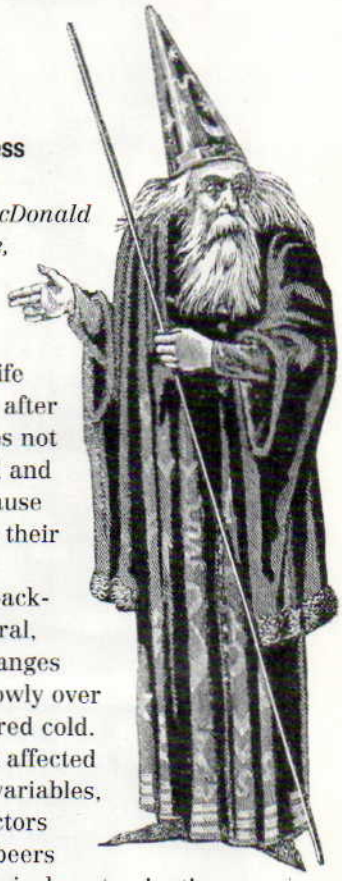
Your problem could be the result of several factors. To begin with, your thermometer could have been out of calibration. If the malt you used was cooler than 68° F, then the malt will cool the water down more than the 12° F rule allows. The easiest way to avoid this problem is to store your malt at room temperature or bring it into a warm room the day before you plan on brewing. Finally, the cooler also cools the mash down. I pre-heat my mash tun to compensate for that particular problem.

The sparge water cools as it flows from the hot water pot to the sparge device, but it will cool much less than 12° F because it's not being cooled by a large mass of malt. The best way to reduce heat loss in sparge water is to minimize the distance from the water pot to the sparge device. A typical temperature drop is 2° to 5° F.

Mr. Wizard

I am thinking of kicking the bottle habit and kegging my beer instead. My biggest concern is storage temperature and how long my beer will stay good in a keg. I've seen some articles that say the beer will only stay "fresh" for 45 days. Depending upon my brewing and travel schedules, I've had some beers in bottles more than 45 days and they stayed good. Do I have to dedicate a refrigerator to maintaining a constant beer temperature and drink it all in less than 45 days?

David MacDonald
White Lake, Michigan



The topic of beer shelf-life and freshness after packaging does not have any hard and fast rules because beers differ in their ability to stay "fresh" after packaging. In general, beer flavor changes much more slowly over time when stored cold. "Freshness" is affected by numerous variables, but the key factors for unfiltered beers are microbiological contamination, oxidation and yeast autolysis.

Microbiological spoilage is a concern of all brewers regardless of size. Off-flavors associated with wild yeast and wort bacteria manifest themselves very rapidly and are usually detectable within a week after wort production. These beers are frequently surrendered to the porcelain god and never make it to the bottle or keg stage of their lives. Other contaminants, such as lactic acid bacteria (*Lactobacillus* and *Pediococcus* species), grow much slower and can take weeks or months to rear their ugly heads. When they have grown enough to be detected, the contaminated beer may taste sour and have a very noticeable diacetyl aroma. Clean yeast, short fermentation lag times and excellent sanitation practices greatly reduce the risk of having

beer contaminated with these sorts of organisms.

Many commercial breweries add an additional level of security and either sterile-filter their beer to remove bacteria that may be present or pasteurize the beer prior to or after packaging to kill any bugs that may be lurking around. Pasteurizing in the bottle or can is the most effective method of protecting beer from microbiological spoilage and about 85% of the bottled or canned beer volume sold in the United States is pasteurized in the package. Some brewers pasteurize the beer prior to packaging, using similar technology to a milk pasteurizer, but the beer can be re-contaminated during packaging (like sterile filtered beer), making this technology more challenging to use. Homebrewers and most craft brewers do not use pasteurization or sterile filtration because these methods can be expensive and can alter beer flavor when used improperly.

While microbiological contaminants radically alter beer flavor, oxidation makes beer taste stale or old. Oxidation causes beer to lose that "brewery-fresh" flavor that is the hallmark of all exceptional beers. Oxidation has been the focus of brewery research for decades and is a very well-understood topic. Brewers today address oxidation beginning at the milling stage and stay focused on the issue during all stages of beer production. However, there is no step of the brewing process more sensitive to oxidation than packaging because beer is transferred into a bottle or keg full of air (modern commercial fillers address this problem, but homebrewers have few options). Any foaming or splashing during filling causes air pick-up and the headspace of gas in the package is another source of air. This headspace does not get displaced by carbon dioxide and is much different than the headspace of a secondary fermenter in this respect. Instead, the oxygen slowly works its way into the beer, reacts with assorted com-

pounds and causes oxidation. Certain metal ions, like iron and copper, can do the same thing. This explains why stainless steel is the metal of choice.

Finally there is yeast autolysis. Bottle-conditioned beers certainly have their benefits. Yeast are able to absorb some oxygen and help to reduce oxygen levels. Bottle-conditioned beers typically have a creamy, tight foam and the method is traditional with its own special feel. However, yeast will autolyze in the bottle given sufficient time and the result is a distinctive flavor. If the yeast load is low in the bottle, the flavor can be very appealing, as is the case with champagne, but if there is too much yeast in the bottle the beer will begin to develop the aroma of decaying yeast. Yeast autolysis also might smell like soy sauce or Vegemite.

I'll avoid your question a little bit longer, if you don't mind! Big brewers have a pretty good idea how long their beer will stay fresh because they can control how their beer is handled in distribution and have a lot of history tracking shelf-life. Anheuser-Busch (AB), Miller and Coors give their beers between 110 and 140 days on the market before they are supposed to be taken from the shelves — yes, old beer is supposed to be pulled from the shelves and returned to the brewery, where it is destroyed. I believe AB has been pretty clever with their "born-on" date because they are calling the bluff of small brewers who tout fresh beer as the best beer. Sadly, many microbrewed beers are far from fresh when purchased and AB has lured some brewers who cannot properly control their beer in the market into putting a freshness date on their bottle. Most small brewers opt for a longer "best-before" period because they lack the turnover of the major players and don't want their beers to seem old based upon a date stamp. To make matters worse, the big guys usually have better bottle fillers than the little guys and pasteurize their beer. In other words, they are beating many small brewers at the "brewed local, fresh beer" game that the little guys invented.

You are in a much stronger position to monitor freshness than commercial brewers are because you have absolute control over the beer. Use clean yeast, keep the brewery clean, minimize air pick-up during bottling and you will be well on your way to producing a beer that will stay fresh for at least 60 days after packaging. Store it hot and this period will be reduced, store it cold and it will become longer. In my experience, refrigerated homebrew can taste excellent 4 months after packaging. The thing to do is to taste your beer and develop your own theory on the subject. You can then improve shelf-

life by simply focusing on those techniques in your process that can use improvement.

Mr. Wizard

I keg most of the beer I make because it's convenient, fast and I prefer draft beer to bottled beer. But this makes it difficult to share beer with friends and to enter contests. What I would like to do is bottle condition four or five bottles of every batch by adding corn sugar directly into a sanitized bottle and then filling the bottle. I'm nervous about how much sugar to add.

John Husted
Houston, Texas

Corn sugar (glucose) and invert sugar (equal mixtures of glucose and fructose) produce the same results when used for carbonation. Both types of sugars produce 0.489 grams of carbon dioxide per gram of sugar (dry weight) when completely fermented by yeast. Sucrose (table sugar) yields 0.515 grams of carbon dioxide per gram of sugar (dry weight). Dry malt extract and wort yield a wide range of carbon dioxide levels because wort fermentability depends on the mashing schedule. I will answer this question based on the use of corn sugar, invert sugar and sucrose.

The answer to this question is easy to explain, but it is much more difficult to carry out the task. Beers range in carbonation levels. A good range to examine is from 2 to 3 volumes of carbon dioxide. Many past articles in *BYO* have covered this odd unit of measure, but in simple terms, 2 volumes seems flat, 2.5 volumes is typical of most bottled beers and 3 volumes is on the high side for most beers (some weizen beers are up around 5 volumes). Another scale is to express carbonation in terms of grams of carbon dioxide per liter of beer; 4, 5 and 6 grams/liter correspond to 2.05, 2.55 and 3.05 volumes, respectively.

Suppose you want to carbonate your bottles of beer to a typical level of 5 grams/liter. You need 1.775

grams of carbon dioxide per 355 mL bottle (5 g/l * 0.355 l = 1.775 g). If you are using corn sugar or invert sugar, you would use 3.6 grams per bottle (1.775 / 0.489 = 3.6). If using table sugar, 3.4 grams will produce the same result. If the amount of corn or invert sugar is reduced to 2.9 grams per bottle, the beer will contain 4 g/l of carbon dioxide and 4.4 grams per bottle will yield a beer with 6 g/l of carbon dioxide. If this is put into weights we typically use, we see that 0.10 (1/10) ounce of corn sugar per bottle produces an under-carbonated beer, 0.13 (1/8) ounce hits the target and 0.16 (1/6) ounce is on the high side.

The challenge is accurately weighing these small quantities of sugar. I purchased a digital kitchen scale that displays weight in 1/10 ounce increments; this was the best I could find for less than a hundred dollars. The best this scale can do is give a range. You really need a laboratory scale but these start at about $150 and go up from there.

An easier method would be to carefully transfer 2.13 liters (72 ounces or the equivalent of 6 bottles) of beer into a small, calibrated container. The amount of sugar required for this volume is 21.8 grams (0.78 ounce) and is much easier to weigh with a kitchen scale. Dissolving sugar in a small volume of boiling water makes it easier to dissolve with minimal stirring. Transfer from this mini-bottling bucket into your bottles, cap, condition and send it off for judging.

Mr. Wizard

I have a question regarding brewing chili beers. After perusing through the rec.crafts.brewing newsgroup on-and-off for the last 5 years, I have come across many stories about fermenting pepper in a beer bottle being a good medium for botulism (if the whole pepper remains intact in the bottle). I did a quick check and only found a few references. Do you feel this may be a problem with chili beers, and could slicing the chili pepper in half remedy the problem (by disinfecting the inside portion)?

Phil Steele
Windsor, Ontario

I am all for food safety and strongly believe people need to be responsible with their cooking and food handling practices at home in order to minimize the incidence of food-borne illnesses. Botulism is an illness caused by the growth of the anaerobic, spore-forming bacteria *Clostridium botulinum*. This organism is widely distributed in nature and is found in most soils. This makes vegetables, such as chili peppers, one of the most common carriers of *C. botulinum* spores. When the spores are in a suitable growth environment, cell growth can begin and with growth there is toxin production. Botulinal toxins (there are several types) are the most toxic natural substances known. The reported toxicity of purified type A toxin is 30,000,000 mouse LD50/mg. This means that one milligram of this toxin will kill 50 percent of a population of 30 million mice.

One of the features of "Bot," as it is affectionately called, is that it does not grow in acidic foods. The entire food industry is defined by the pH 4.5, below which Bot does not grow. Actually, the reported minimum pH of various strains is pH 4.7 and the 4.5 cut-off has some safety margin built into it. Foods with a pH less than 4.5 are called high-acid foods and those with a pH above 4.5 are low-acid foods. The classic case of botulism is with improperly canned home vegetables (most veggies are low-acid foods). The canning process creates an anaerobic environment, the heating stress kicks the spores into a growth mode (that is when the heat treatment is insufficient to kill the spores) and the veggies give the nutrients that the cells need for growth. Toxin is released and consumed when the can is opened.

Luckily for us brewers, most beers have a pH below 4.5. It also seems that the organism cannot

grow and produce toxin in the presence of large numbers of other microorganisms.

I have never read any documented case of botulism from beer flavored with any herb, vegetable or fruit. It does seem possible that a problem could arise if you added chili peppers to a beer with a pH greater than 4.5. Incidentally, milk has a pH near 7 and does not have a history of carrying Bot toxins and is not processed in an attempt to destroy Bot spores.

One gourmet food product that is of some concern to me is olive oil flavored with peppers, garlic and other herbs. These products are ubiquitous in gourmet stores and they look as if they would be very easy to prepare at home. However, they must be properly processed in order to ensure safety.

Supposing that Bot spores could grow in beer and produce toxins, slicing the pepper would not alter that fact and would be as risky as whole peppers. Based upon my review of my college Food Microbiology text ("Modern Food Microbiology," Third Edition, James M. Jay) I don't consider chili beers to be a health concern with respect to botulism. If this were a problem, the FDA would probably be all over the breweries that sell these products commercially.

Foods that have a history of killing people with botulism are very carefully regulated and must be properly processed (heat-treated) to eliminate the potential risk. If beer were processed like a can of beans it would be so cooked that it would be undrinkable.

An alternative to putting chili peppers in the beer would be to add them to the wort during the boil. This would destroy any bacteria that may be on the peppers. This probably would extract more of the hot stuff and drive more of the aromas away from the peppers than adding the pepper to the bottle.

I tasted a very nice chipotle pepper porter at the GABF two years ago. The brewer added the dried peppers to the mash. Another possibility is to add a pepper sauce to the beer. A little dash of habeñero sauce would add a kick to most brews! ■

Do you have a question for Mister Wizard? Write to him c/o Brew Your Own, 5053 Main Street, Suite A, Manchester Center, VT 05255 or send your e-mail to wiz@byo.com. If you submit your question by e-mail, please include your full name and hometown. In every issue, the Wizard will select a few questions for publication. Unfortunately, he can't respond to questions personally. Sorry!

The Replicator

Oberdorfer Weissbier and Clearwater Light

by Dawnell Smith

Dear Replicator:

I have had the pleasure of sampling an Oberdorfer Weissbier, one of Germany's exquisite beers, and I would love to replicate it. Can you help me out?

Marty Cowart
Mildenhall, England

The Bavarian hefeweizen you love comes from a brewery known for its delectable wheat beers since 1897. Today, the family-run Privatbraurei Franz Joseph Sailer in Bavaria produces nearly 350,000 barrels of various beers a year and cranks out thousands of swing-topped bottles full of Oberdorfer Weissbier every day.

The unfiltered Weissbier has all the attributes of the style, including a fizzy head, clove aroma, banana flavor and smooth, lush body.

To emulate these qualities in an all-grain recipe, you need a hefty portion of wheat malt (at least 50 percent of the grain bill), rounded out with pale malt and balanced with noble hops and a Bavarian or hefeweizen yeast strain. My clone recipe *(below)* calls for Briess wheat extract and Hallertauer hops. You can make this hefeweizen and then compare it with an Oberdorfer. Increase the wheat to 60 percent for a stronger wheat character or finish with Saaz instead of Hallertauer.

Yeast makes an enormous impact on this style. The closer you get to the real thing, the better. You can cultivate yeast from a few bottles of Oberdorfer, but remember that they might use a different strain for bottle conditioning than they use for primary fermentation.

For more information go to www.nobleunion.com/sailer/ or contact the brewery directly at info@sailer-braeu.de or by phone at 49-08342-9647-0.

Oberdorfer Weissbier
(5 gallons, extract)

OG = 1.052 FG = 1.055 IBUs = 15

Ingredients

8 lbs. Briess bavarian wheat liquid malt extract
3 AAUs Hallertauer pellet hops (0.75 oz. at 4% alpha acid)
2 AAUs Hallertauer pellet hops (0.50 oz. of 4% alpha acid)
1 package Bavarian Weizen (Yeast Culture Kit A50) or Hefeweizen Ale (White Labs WLP300)
7/8 cup corn sugar for priming

Step by Step

Add extract to 3 or more gallons of hot water and bring to a boil for 30 min. Add 0.75 ounces of Hallertauer hops. Boil 58 min. and add the rest of the Hallertauer hops. Boil 2 min., remove from heat. Cool to about 60° F and add water to yield about 5.25 gallons in the fermenting vessel. Pitch yeast. Note: You can also cultivate yeast from a commercial hefeweizen, though many are bottle conditioned with a secondary ale or lager strain. Ferment at the low end of the recommended temperature range (from 60° to 66° F) until complete (7 to 10 days). Transfer to a secondary vessel or rack into bottles/keg with more corn sugar than usual to help create that signature fizz. Let condition at room temperature for a few weeks, then store it in a cool place or the refrigerator a few more. Refrigerate before serving.

All-Grain Option: Omit extract and mash 4.5 lbs. of wheat malt and 4.25 lbs. of pale malt in 10 quarts of water to get a single infusion mash temperature of 152° F for 45 min. Sparge with hot water of 170° F or more to get 5.5 gallons of wort. Bring to boil. Use above hopping and fermentation schedule.

Step-Mash Option: For a step-mash, add 2 gallons of hot water to the grain and hold at 122° to 125° F for 30 min., stirring every once in a while. Then add 3/4 gallon of boiling water to the liquid and hold that temperature (about 152° F) for another 30 minutes. Sparge and proceed as usual.

Dear Replicator:

Recently my wife and I dined at a Hops Restaurant, Bar and Brewery. The food was good but the Clearwater Light Beer was even better. I was wondering if you could help me clone this beer. I have been taking notes and trying different things but have not come up with anything close.

Rob (aka "Hoss")
via e-mail

For those of us with a summertime-sized thirst or burgeoning beer belly, the Hops Restaurant, Bar and Brewery designed a low-calorie brew called Clearwater Light.

The company's corporate brewmaster, David Richter, described Clearwater as a blend of about 85 percent pale malt with the rest of the grain bill split between wheat malt and carapils. The beer has a low starting gravity of 1.041, so it only takes 17 IBUs of Hallertau hops for bittering to balance the flavor. Then they add a bit of Saaz for finishing qualities.

Richter did not suggest a yeast strain, but it makes sense to use something clean and neutral like American Ale (Yeast Culture Kit A01, Siebel BRY 96) or London Ale (Wyeast 1056). Just find a strain that imparts little flavor, yet finishes crisp, and you should do fine.

While waiting for your own version of Clearwater, try some of the other Hops brews like Lightning Bold Gold, Hammerhead Red and Alligator Ale. It shouldn't be too difficult to find a Hops near you. Hops now operates in 16 states from Kentucky and North Carolina to Minnesota, Ohio and Rhode Island. It all started in 1989 in Clearwater, Florida, but Avado Brands of Madison, Georgia now owns 74 Hops locations nationwide.

For more information, contact the home office in Tampa at (813) 282-9350 or check out the Web site at www.hopsrestaurants.com. ■

Clearwater Light
(5 gallons, extract with grains)

OG = 1.041 FG = 1.010 IBUs = 17

Ingredients
4.5 lbs. Northwestern Gold pale malt extract syrup
12 oz. wheat malt
12 oz. carapils
4 AAUs Hallertauer pellet hops (1 oz. at 4% alpha acid)
1 AAU Saaz pellet hops (0.25 oz. of 4% alpha acid)
1 tsp. Irish moss
1 package American Ale (Yeast Culture Kit A01, Siebel BRY96) or London Ale (Wyeast 1056).
3/4 cup corn sugar for priming

Step by Step
Steep specialty grains in 3 gallons of water at 150° F for 45 min. Remove grains, add extract and bring to a boil for 30 min. Add 1 oz. of Hallertauer hops. Boil for 50 min. and add Saaz hops. Add Irish moss in last ten min. of the boil. Boil 10 min. more, remove from heat. Cool to 70° F and add water to yield about 5.25 gallons in the fermenting vessel. Pitch yeast. Ferment at 66° F until complete (7 to 10 days). Transfer to secondary or rack into bottles or keg with corn sugar. Warm condition for a few weeks at room temperature and store cold.

All-grain option: Omit extract and mash 8 lbs. of pale malt along with specialty malts in 12 quarts of water to get a single-infusion mash temperature of 155° F for 45 min. Sparge with hot water (at least 170° F) to get 5.5 gallons. Bring to a boil and use the hopping and fermentation schedule above.

ReaderRecipes

Fern Creek Cream Ale
(5 gallons, extract w/grains)
OG = 1.048 FG = 1.014
SRM = 3.8 IBUs = 18

Here's a recipe that is easy to make. It produces a medium- to light-bodied beer that's malty and hoppy but easy to drink and very nicely carbonated.

Stephen M. Dobbins
Fern Creek Brewery
Louisville, Kentucky

Ingredients
3.3 lbs. light malt extract syrup
1 lb. light DME
2 lbs. brown sugar
0.5 lbs. malto-dextrin
3.3 AAU Cascade hops (1 oz. of 3.3% alpha acid) (bittering)
5.6 AAU Cascade hops (1 oz. of 5.6% alpha acid) (finishing)
American Lager yeast (Wyeast 2112)

Step by Step
Bring 1.5 gallons of water to a boil. Add extract syrup, DME, malto-dextrin and brown sugar. When boil returns, add bittering hops. Boil for 60 minutes. In the last 5 minutes of the boil, add finishing hops. Pitch yeast. Ferment 10 to 12 days, rack into secondary and condition cool (50° to 60° F) for at least 2 weeks. Prime with 2/3 cup corn sugar and bottle.

Share Your Beer With 78,000 People

Send your favorite recipe to edit@byo.com. Be sure to include your full name and address.

Bitter and Bavarian Weizen

Brew a proper English bitter and a refreshing wheat beer

by Tess and Mark Szamatulski

A crisp English bitter and an easy weizen are appropriate styles to brew in May. These refreshing beers will carry you through the summer, quench your thirst and are so diverse in taste that you won't get bored. The bitter is brimming with English hops that complement whatever you throw on the grill. The weizen is summer in a glass. It's perfect after a strenuous game of beach volleyball or served as an apéritif for a summer's eve party under the stars. Whatever the occasion, here are two wonderful beers for a summer to remember.

BEST BITTER

OG = 1.039 to 1.045 FG = 1.009 to 1.014 ABV = 3.7% to 4.8%
IBUs = 20 to 45 SRM = 6 to 14

English bitters were originally draught ales served very fresh from the cask. They are among the traditional "real ales," meaning that they undergo a second fermentation in the same vessel from which they are served. This is accomplished by putting the still-fermenting ale into the cask and sometimes dosing it with yeast or sugar to provide the natural, light carbonation. They are dispensed either by gravity or a hand pump. In this form you can detect the fruitiness of the yeast, the dryness and flavor of the hops and the sweetness of the malt. A bitter that has been cask-conditioned in oak is heaven. Real ale should be served at cellar temperatures (approximately 55° F) to fully appreciate the flavors.

There are three types of bitters: ordinary (1.030 to 1.038 OG), special or best (1.039 to 1.045 OG) and strong (1.046 to 1.065 OG). "Best bitters" have a more pronounced malt profile than an ordinary bitter.

Our rendition of a best bitter pours with an off-white head over an amber beer. The rich, spicy hop nose is balanced with malt. The palate is firm with a grainy, round malt profile. The finish is long, dry and clean with refreshing bitter notes. The epitome of a session beer, this beer is highly drinkable with no shortcuts in flavor.

Commercial Beers To Try

There are many versions of this delicious style. Try Young's Ramrod, Fuller's London Pride, Adnam's Suffolk Extra, Goose Island Honkers Ale, Spanish Peaks Black Dog Ale and Gritty McDuff's Best Bitter.

The hop aroma can range from high to none. Diacetyl and crystal aroma is none to moderate with moderate levels of fruitiness with some malt aroma. The color ranges from medium gold to medium copper-brown. Very little head is acceptable, but bottled versions can have moderate levels. The flavor should contain little if any diacetyl and fruitiness. The malt flavor should be apparent with medium to high bitterness that doesn't overpower the malt. There can be some flavor from crystal malt along with moderate amounts of hop flavor.

Hops, Malt and Yeast

English hops should be used. For bittering use Progress, Challenger, Fuggles, Target, Admiral, Northern Brewer or

THE YEAR IN BEER

JANUARY:
Baltic Porter & German Pilsner

FEBRUARY:
Cream Stout & Dark Lager

MARCH:
Oktoberfest & American Brown Ale

APRIL:
American IPA & Old Ale

MAY:
Weizen & English Bitter

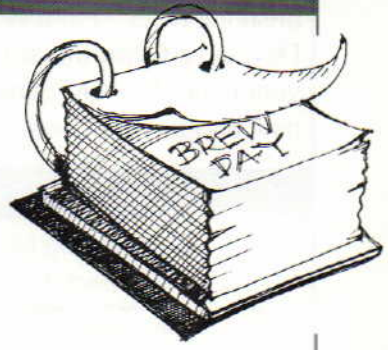
SUMMER:
Fruit Ale & Belgian Strong Dark Ale

SEPTEMBER:
Kölsch & Robust Porter

OCTOBER:
Celebration Ale & Pale Lager

NOVEMBER:
Strong Scotch Ale & Vienna Lager

DECEMBER:
English Barleywine & Doppelbock



Northdown. For flavor and aroma, a combination of the following can be used successfully: East Kent Goldings, Whitbread Goldings, Fuggles, Challenger, Styrian Goldings, First Gold and Target.

Malt should be primarily British two-row pale malt (83 to 100 percent of the grain bill) with Maris Otter considered a superior malt. British crystal malt (55° to 60° L) should be the dominant specialty grain, comprising up to 10 percent of the grist. Torrified wheat and small amounts of flaked maize can also be used to impart body, creaminess and aid head retention. In some recipes, a smattering (1/4 to 2 ounces) of British chocolate malt or British roasted barley are used to provide color and depth. The chocolate malt or roasted barley will provide color so the brewer can cut back on the crystal malt. When using malt extract, extra light and light British brands should be used. Some invert sugar (Lyle's Golden Syrup) is also acceptable.

Our yeast choices are Ringwood Ale (Wyeast 1187), British Ale (Wyeast 1098), London Ale (Wyeast 1028) and Irish Ale (Wyeast 1084). If you desire a maltier bitter, use London ESB (Wyeast 1968) or British Ale (White Labs WLP005).

Serving Suggestions

Serve at 55° F with rich, spicy dishes such as spicy-hot Indian vegetable curry served over couscous.

Best Bitter

(5 gallons, extract with grains)
OG = 1.046 FG = 1.011 to 1.012
SRM = 10 IBU = 33 ABV 4.4%

Ingredients

10 oz. British crystal malt (55° Lovibond)
8 oz. torrified wheat
5.25 lb. Muntons extra light DME
7.5 AAUs Fuggles (1.5 oz. of 5% alpha acid) (bittering)
3.75 AAUs East Kent Goldings (0.75 oz. of 5% alpha acid) (flavor)
1 tsp. Irish moss
1.25 AAUs East Kent Goldings (0.25 oz. of 5% alpha acid) (aroma)
1.25 AAUs Styrian Goldings (0.25 oz. of 5% alpha acid) (aroma)
London Ale (Wyeast 1028) or Burton Ale (White Labs WLP023)
1-1/4 cup Muntons extra light DME

Step by Step

Bring 1/2 gallon of water to 155° F, add crushed grain and hold for 30 min. at 150° F. Strain the grain into the brewpot and sparge with one gallon of 168° F water. Add the dry malt extract and bittering hops. Bring the volume to 2.5 gallons. Boil for 45 min., then add the flavor hops and Irish moss. Boil for 13 min., then add the aroma hops. Boil for 2 min., remove from stove. Cool wort for 15 min. Strain into primary and add water to obtain 5-1/8 gal-

lons. Add yeast when wort has cooled to below 80° F. Oxygenate-aerate well. Ferment at 68° F for 7 days then rack into secondary. Ferment until target gravity has been reached and beer has cleared (3 weeks). Prime and bottle. Carbonate at 70° to 72° F for 2 to 3 weeks. Store at cellar temperature.

Partial-Mash Option: Acidify the mash water to below 7 pH. Mash 1.75 lbs. British two-row pale malt and specialty grains in 1 gallon of water at 150° F for 90 min. Sparge with 1.5 gallons of water at 5.7 pH and 168° F. Follow the extract recipe, omitting 1.75 lbs. of Muntons DME from the boil.

All-Grain Option: Acidify the mash water to below 7 pH. Mash 7.67 lbs. British two-row pale malt and the specialty grains in 3 gallons of water at 151° F for 90 min. Sparge with 4.5 gallons of water at 5.7 pH and 168° F. Top up to 6.5 gallons. The total boil time is 90 min. Add 6.2 AAUs of bittering hops for the last 60 min. of the boil. Add remaining hops and Irish moss as indicated by the extract recipe.

Helpful Hints: If your water is soft (below 50 ppm hardness), add 1.5 tsp. gypsum and 1/4 tsp. non-iodized table salt to adjust. If it's moderate (between 50 to 200 ppm) add 1 tsp. gypsum and 1/4 tsp. non-iodized table salt. If it's hard (greater than 200 ppm) add 1/4 tsp. non-iodized table salt and 1/4 tsp. Epsom salts. Ready as soon as it's carbonated, it will peak between 1 and 3 months and will last for up to 6 months at cellar temperatures.

BAVARIAN WEIZEN

OG = 1.040 to 1.056 FG = 1.010 to 1.014
ABV = 4.3 % to 5.6%
IBUs = 10 to 20 SRM = 2 to 9

Wheat beers are one of the easiest and quickest-maturing styles to brew. They are best fresh and can be served as soon as they are carbonated. Variations can be made with the addition of fruit. Raspberry and blueberry are the most popular.

Our summer wheat beer has a thick, tall white head upon a blond beer. The classic yeasty aroma is an enticing mixture of wheat, fruit and spices. This leads to the highly charged palate with a soft body and a touch of grainy wheat coupled with a pleasant lemon tang. It ends with a clean, bright finish.

Commercial Beers to Try

Bavarian weizens are German wheat beers that use hefeweizen yeast strains. Don't confuse them with American wheat beers, which use standard ale strains, are more bitter and contain fair amounts of flavor and sometimes aroma hops. Hefe means "yeast" and the unfiltered versions of wheat beer are

labeled hefeweizen. Some classics are: Paulaner Hefeweizen, Pschorr-Brau Weisse, Weihenstephaner Hefeweissbier, Spaten Club-Weisse and Franziskaner Hefe-Weisse.

The aroma should contain clove-like phenols and fruity esters of apples and banana with no hop aroma. Some wheat aroma can be evident. Color ranges from pale straw to dark reddish-gold. The head is thick and lasting. This style is deliberately cloudy from the suspended wheat sediment and the protein content. Wheat flavor is essential and hop bitterness is very low. A tart profile can be present. Spicy clove phenols, fruity esters, banana and sometimes apple are usually evident. There is no diacetyl. High carbonation and wheat provide a creamy fullness leading to a light finish.

Hops, Malt and Yeast

Hops are used primarily for bittering with an occasional small amount used for flavor. The bittering is very low (3 to 4.5 AAUs). If a flavor hop is used, the amount shouldn't exceed 0.50 ounce. Classic German hops, such as Hallertau Hersbrucker, Hallertau Tradition Spalt, Perle and Tettnang are best. At least 50 percent of German malted wheat heads the grain bill, coupled with German two-row pale or pilsner malt. Homebrewers can add small amounts of acid malt (1 to 4 oz.) for tartness and aromatic malt (1 to 4 oz.) for increased malt aroma. Acid malt has been treated with lactic acid and is used to lower pH. German wheat malt extracts are hard to find but Muntons wheat DME makes great weizens!

Yeast is one of the most important weizen ingredients because it produces a spicy, fruity character during warm fermentation temperatures (68° to 72° F). Our first choice for yeast is Weihenstephan Weizen (Wyeast 3068). Bavarian Wheat (Wyeast 3056) and German Wheat (Wyeast 3333) are also appropriate.

Serving Suggestions

Serve at 48° F with sour cherry and barbecued smoked duck tamales.

Bavarian Weizen

(5 gallons, extract with grains)
OG = 1.055 to 1.056 FG = 1.011 to 1.012
SRM = 4 IBU = 16 ABV = 5.6%

Ingredients

6.25 lbs. Muntons wheat DME
2.5 AAUs Spalt (0.50 oz. of 5% alpha acid) (bittering)
2.3 AAUs German Hallertau Hersbrucker (0.50 oz. of 4.6% alpha acid) (bittering)
Weihenstephan Weizen (Wyeast 3068) or Hefeweizen IV (White Labs WLP380)
1-1/4 cup Muntons wheat DME for priming

Step by Step

Bring 1.5 gallons of water to a boil. Add the dry malt and bittering hops. Bring the total volume to 2.5 gallons. Boil for 60 min., then remove the pot from the stove. Cool wort for 15 min. Strain into the primary and add water to obtain 5-1/8 gallons. Add yeast when wort has cooled to below 80° F. Oxygenate-aerate well. Ferment at 68° F for 7 days then rack into secondary. Ferment until target gravity has been reached and beer has cleared (3 weeks). Prime and bottle. Carbonate at 70° to 72° F for 3 to 4 weeks. Store at cellar temperature.

Partial-Mash Option: Acidify the mash water to below 7 pH. Mash 1 lb. German two-row pilsner malt, 1.5 lbs. German wheat malt and 4 oz. rice hulls or oat hulls in 1 gallon of water at 150° F for 90 min. Sparge with 1.5 gallons of water at 5.7 pH and 168° F. Follow the extract recipe, omitting 1.75 lbs. of Muntons wheat DME from the boil.

All-grain option: Acidify the mash water to below 7 pH. Mash 5 lbs. German two-row pilsner malt, 5.5 lbs. German wheat malt and 8 oz. rice hulls or oat hulls in 3.75 gallons of water at 149° F for 90 min. Sparge with 4.75 gallons of water at 5.7 pH and 168° F. The total boil time is 90 min. Add 3.9 AAUs of bittering hops for the last 60 min. of the boil.

Helpful Hints: If your water is soft (below 50 ppm), add 1/3 tsp. gypsum to adjust. If it's moderate (between 50 to 200 ppm), dilute it 50/50 with distilled water. If it's hard (greater than 200 ppm), use bottled water and add 1/3 tsp. gypsum. This weizen is ready to drink as soon as it's carbonated. It will peak between 1 and 3 months and will last for up to 7 months at cellar temperatures. ■

Tess and Mark Szamatulski are the authors of "Beer Captured" (Maltose Press, 2000). All recipes are adapted from their book.

PHOTO BY CHARLES A. PARKER

BREWING WITH CHOCOLATE

by SCOTT RUSSELL

COCOA BEANS, HERSHEY BARS?

You can use chocolate to make your beer more complex! Tips, techniques and recipes: Bitter Chocolate Imperial Stout, Mocha Brown Ale, White Chocolate Pale Ale, Black Forest Lager and Milk Chocolate Märzen.

In my experience as a homebrewer, the manager of a homebrew shop and a writer for *Brew Your Own*, I have learned many things. But there remains one enigma: Why do homebrewers insist on messing with success? Why can't we be satisfied with a great pale ale or a perfect pilsner? Why do we insist on adding that one extra ingredient — or giving some oddball technique a try — at the risk of brewing something undrinkable? I don't know the answer, but I'm willing to guess that it has something to do with why we began homebrewing in the first place.

One of the ingredients with which I often have experimented over the years is chocolate. With slightly more success than failure, I am proud to say. I will spare you the gruesome details and ugly results, and merely give you tips on doing it right and doing it well.

Chocolate: How to Brew With it

Chocolate begins with the cacao tree, which grows in the tropics of America. The beans of this small evergreen are roasted, husked and ground into cocoa powder. The natural fat, which is called cocoa butter, is removed. (The tree is spelled "cacao," while its byproducts are more commonly spelled "cocoa.")

The types of chocolate available to the consumer usually have sugar, oils and other flavoring and smoothing agents added. A chocolate bar, for example, is made from cocoa powder, sugar, cocoa butter and (often) other fats; the more cocoa butter it contains, the more awesome the mouthfeel!

If you can find pure, untreated **cocoa beans** (good luck!) you can use them in your homebrew like you would coffee beans — roasted, crushed like a specialty grain, and added in small amounts as a steeping grain or in the mash.

Otherwise, you must deal with the added ingredients that I mentioned above. Each poses a slightly different challenge, but each of the available kinds of chocolate can be used with great success in your homebrew, provided you do it with reasonable care.

First and foremost, do not confuse what we are discussing with chocolate malt. Chocolate malt is malted barley, kilned to a dark brown color (anywhere between 200 and 400 SRM, usually). It can give beer a roasty, chocolate-like aroma and taste, but it is definitely not a cocoa-based product. Many commercial brewers use the word chocolate in the names of their beers, but only a few actually use real chocolate. Several of the recipes below use chocolate malt as well, just for fun!

Ground cocoa — in other words, unsweetened and pure cocoa — can be used in the mash or in the boil. In the mash, simply sprinkle the desired amount into the grain bed at the beginning of the sparging process, or for a strong cocoa taste, add it to the grains during the mash itself. Ground cocoa will lend a dark and bitter flavor to the beer. It may not be recognizable as chocolate, but it will add a layer of complexity. (Note: Don't confuse ground cocoa with hot chocolate mix or chocolate milk powder, which are sweetened and often have powdered milk added. Ground cocoa is the defatted powder made from the beans, with nothing else added.)

Baker's chocolate is the same as ground cocoa, except that oils have been added — or, in some cases, not removed — to make a solid "cake" of unsweetened bitter chocolate. These oils, whether added or natural, cause a minor inconvenience for the brewer. Any beer made with these and other types of oil-containing chocolate must include a long and vigorous boil time to volatilize the oils, otherwise the beer will suffer from poor head retention.

Most baker's chocolate is unsweetened or bittersweet, but it is now also possible to find **milk chocolate** and **white chocolate** in the same basic format — they will act the same, but will obviously be sweeter. All of these should be broken or chopped into small pieces and added to the boil with any syrup or dry malt extracts. Care should be taken to stir well, making sure the chocolate is not burning onto the bottom of the kettle.

A slight further refinement is the **chocolate chip** — sweetened, high-quality chocolate chips (semi-sweet, milk chocolate or white chocolate) are still more cocoa than additives. They should be used in the same way as the chopped baker's chocolate, above.

All **candy bars** are not created equal — if your goal is to add a chocolate flavor to your brew, be

sure to use a candy bar that contains only chocolate — coconut, caramel, nougat, mint or little bits of crushed cookie may go well in the chocolate, but they will most definitely detract from the beer. Candy bars, if only chocolate, can be used like the chocolate chips.

Some of the best chocolate flavor in a beer can come from something you add at the end, at bottling or kegging. **Extracts** for making homemade liqueurs (white or dark-creme de cocoa, for example), can be added along with the priming sugar, with little or no effect on the carbonation, body and color of the beer. The liqueurs themselves, since they are largely sugar-based, can be added to replace a part of (or all of, in some cases) the priming sugar.

Oh, one last item — **chocolate syrup**, or as my wife's family calls it, "slurp." The kind you stir into your milk, or drizzle over your ice cream, or use for baking. This one is tricky, because it's a sweetened, souped-up chocolate product, for the most part. Ordinarily, I would steer you away from using it, but, as you will see below, I have a secret recipe in which a little slurp does wonders.

A final word of caution: Don't use chocolate pudding, chocolate ice cream, brownie mix or **chocolate body paint**. Under any circumstances. You have been warned.

The following recipes are extract-based recipes with small quantities of specialty steeping grains. Each yields 5 gallons.

Bitter Chocolate Imperial Stout

OG - 1.070 FG - 1.022 IBU - 45

Ingredients:

4 oz. black malt
4 oz. chocolate malt
4 oz. roasted barley
7 lbs. dark dry malt extract
2 oz. unsweetened baker's chocolate, broken
8 AAU Target hops (1 oz. of 8% alpha acid)
4 AAUs Fuggles hops (1 oz. of 4% alpha acid)
1 pint starter of English ale yeast (White Labs WLP002 or Wyeast 1968)
3/4 cup dry malt extract for priming

Step by Step:

Steep the black and chocolate malts and the roasted barley in 2.5 gallons of cold water. Gradually raise heat to 150° F, hold 30 minutes. Remove grains and rinse them back into the pot with hot water. Stir in dry malt and baker's chocolate, bring to boil. Boil 15 minutes, add Target hops. Boil 45 minutes, add Fuggles hops. Boil 15 minutes, remove from heat, cool 15 minutes. Add to fermenter along with enough chilled, pre-boiled water to make 5.25 gallons. Cool to 70° F, pitch yeast. Seal and ferment for ten days, rack to secondary and age in a cool dark place for a month. Prime with dry malt and bottle. Bottle condition cool and dark for a month or more.

Mocha Brown Ale

OG - 1.038 FG - 1.014 IBU - 16

Ingredients:

8 oz. medium crystal malt (50 to 60° Lovibond)
2 oz. chocolate malt
2 oz. roughly cracked coffee beans
4 lbs. amber dry malt extract
2 tbsp. ground unsweetened cocoa
4 AAUs Goldings hops (1 oz. at 4% alpha acid)
1 pint starter of Irish Ale yeast (White Labs WLP004 or Wyeast 1084)
2/3 cup dry malt extract to prime

Step by Step:

Steep the crystal and chocolate malts and coffee beans in 2.5 gallons of cold water. Gradually raise heat to 150° F, hold 30 minutes. Remove grains and rinse them back into the pot with hot water. Stir in dry malt and ground cocoa, bring to boil. Boil 15 minutes, add half the hops. Boil 30 minutes, add the rest of the hops. Boil 15 minutes, remove from heat, cool 15 minutes. Add to fermenter along with enough chilled, pre-boiled water to make 5.25 gallons. Cool to 70° F, pitch yeast. Seal and ferment for seven days, rack to secondary and age in a cool dark place for ten days. Prime and bottle. Bottle condition cool and dark for two weeks.

White Chocolate Pale Ale

OG - 1.048 FG - 1.012 IBU - 24

Ingredients:

8 oz. light crystal malt (30° Lovibond)
4 oz. malted wheat
5 lbs. light dry malt extract
8 oz. white chocolate chips
4 AAU Cascade hops (2/3 oz. of 6% alpha acid)
4 AAU Willamette hops (2/3 oz. of 6% alpha acid)
2 AAU Tettnang hops (1/2 oz. of 4% alpha acid)
1 pint starter American Ale yeast (White Labs WLP008 or Wyeast 1272)
1/2 cup dry malt extract to prime
1 cup white creme de cocoa

Step by Step

Steep crystal and wheat malts in 2.5 gallons of cold water. Gradually raise heat to 150° F, hold 30 minutes. Remove grains and rinse them back into the pot with hot water. Stir in dry malt and white chocolate chips, bring to boil. Boil 15 minutes, add Cascade. Boil 20 minutes, add Willamette. Boil 20 minutes, remove from heat. Add Tettnang, steep 15 minutes. Remove hops. Add wort to fermenter with enough chilled, pre-boiled water to make 5.25 gallons. Cool to 70° F, pitch yeast. Seal and ferment for seven days, rack to secondary and age in a cool dark place for two weeks. Prime, add creme de cocoa and bottle. Condition cool and dark for a month.

Black Forest Lager

OG - 1.038 FG - 1.010 IBU - 22

Ingredients:

4 oz. black malt
4 oz. dark crystal malt (90° Lovibond)

4 lbs. amber dry malt extract
4 AAU Hallertauer hops
(1 oz. of 4% alpha acid)
2 AAU Saaz hops
(2/3 oz. of 3% alpha acid)
1 pint starter Munich Lager yeast
(White Labs WLP838 or Wyeast 2308)
1/2 cup corn sugar for priming
1 cup dark creme de cocoa
1 cup cherry liqueur

Step by Step:

Steep black and crystal malts in 2.5 gallons of cold water. Gradually raise heat to 150° F, hold 30 minutes. Remove grains and rinse them back into the pot with hot water. Stir in dry malt, bring to boil. Boil 15 minutes, add Hallertauer hops. Boil 45 minutes, add Saaz hops. Boil 15 minutes, remove from heat, cool 15 minutes. Add to fermenter along with enough chilled, pre-boiled water to make 5.25 gallons. Cool to 65° F, pitch yeast. Seal and ferment for two weeks at 65° F, then rack to secondary and age in a cold dark place (45° F) for a month. Prime with corn sugar, add liqueurs and bottle. Bottle condition cold (40° F) and dark for two months or more.

Milk Chocolate Märzen

OG-1.050 FG-1.020 IBU-35

Ingredients:

4 oz. Vienna malt
4 oz. Munich malt
8 oz. medium crystal malt
(50° Lovibond)
5 lbs. amber dry malt extract
16 oz. milk chocolate candy bars
6 AAU Perle hops
(3/4 oz. at 8% alpha acid)
4 AAU Spalter hops
(1 oz. at 4% alpha acid)
1/2 cup chocolate syrup
1 pint starter Bavarian lager yeast
(White Labs WLP820 or Wyeast 2206)
3/4 cup corn sugar for priming

Step by Step:

Steep the Vienna, Munich and crystal malts in 2.5 gallons of cold water. Gradually raise heat to 150° F, hold 30 minutes. Remove grains and rinse them back into the pot with hot water. Stir in dry malt and candy bars, bring to boil. Boil 30 minutes, add Perle hops. Boil 30 minutes, add Spalter hops. Boil 30 minutes. Add chocolate syrup, remove from heat, cool 15 minutes. Add to fermenter along with enough chilled, pre-boiled water to make 5.25 gallons. Cool to 65° F, pitch yeast. Seal and ferment for two weeks, rack to secondary and age in a cool dark place for a month. Prime with corn sugar and bottle. Bottle condition cold and dark for six weeks. ■

Scott Russell is the author of several homebrew books, including "North American Clone Brews" (Storey Books, 2000).

20 GREAT EXTRACT RECIPES FOR SPRING

The beers of spring. What exactly are they? While the other three seasons have many typical brews (think Oktoberfest, winter warmers and all of those tasty summer ales), spring seems to have been overlooked. Brewed in winter to be enjoyed in spring, bock is the only beer with a genuinely "springy" theme.

Traditionally, spring was more a time for brewing than for quaffing. It was the tag end of the cold-weather brewing season, the last time when you could safely brew without getting a lot of bothersome, souring microbes in your beer. So this was when the potent beers of fall were brewed and put away in the ice cave. Märzen, the malty red mainstay of Oktoberfest, was brewed in March. Most of the low-gravity beers of summer, the thirst-quenching pale ales and saisons, would have been brewed the previous winter.

We feel that this ancient inequity of seasonal brewing needs to be corrected. So here are 20 spring beers that go way beyond bock. Each of these easy extract recipes makes five gallons of beer (except the Nottingham Maple Ale, which makes 5.5). Have fun!

PHOTO BY CHARLES A. PARKER

BY JOE AND DENNIS FISHER

DOING THE EXTRACT SWAP

IN EVERY RECIPE, WE recommended a malt extract brand. You may prefer other extracts, or you may not be able to find the kind we used. That's why we included alternatives at the end of many recipes. If you can't find the extract you're looking for, ask at your homebrew supply shop. Not all brands are interchangeable, and they can recommend a brand that works with the recipe.

One thing to keep in mind: Most liquid extract contains about 20 percent water, while dry extract contains only 1 percent. The difference in water content will change a recipe. If you're swapping liquid for dry — or vice-versa — you need to remember that three pounds of dry malt equals 3.7 pounds of liquid. (If you're exchanging dry for dry or liquid for liquid, the amount would stay the same.) Similarly, if the recipe calls for hopped extract, and you substitute unhopped, you'll have to increase the hops. Ask at your homebrew shop about adjusting the hop amounts.

SNOWMELT STRONG ALE

OG: 1.075 FG: 1.016 IBU: 53

Snowmelt is a Scots style strong ale with smoked malts substituting for Scottish malt. You could use melted snow in this recipe, but make sure to get the clean stuff.

Ingredients

0.5 lbs. peat-smoked malt
0.75 lbs. British crystal malt (60° Lovibond)
0.3 lbs. German crystal malt (80° Lovibond)
0.3 lbs. chocolate malt
2 oz. Briess Special B malt
2 oz. roasted barley
6.6 lbs. Northwestern Gold malt extract syrup
2.5 lbs. Briess amber dry malt extract
1 lb. Morgans dark crystal malt extract syrup
16 AAU Fuggles hops (4 oz. of 4% alpha acid)
Wyeast 1728 (Scottish Ale) or White Labs WLP028 (Edinburgh Ale)
2/3 cup corn sugar for priming

Step by Step

Add grains to 2.5 gallons water at 160° F. Hold at 150° F for 45 minutes. Strain out grains and sparge with 0.5 gallon 180° F water. Add extracts and bring to a boil. Add Fuggles, boil 90 minutes. Strain out hops. Cool wort, pour into fermenter and top up to 5 gallons. Pitch yeast. Ferment at ale temperature (60° to 70° F). Prime and bottle when fermentation is complete.

Alternatives: Substitute 6.6 lbs. Briess pale (gold) malt extract syrup for the Northwestern Gold syrup.

VERNAL WEISS

OG: 1.048 FG: 1.010 IBU: 11

This weiss is as refreshing as a sunny day in March and the crystal malt reminds us of the clear streams of the Maine woods.

Ingredients

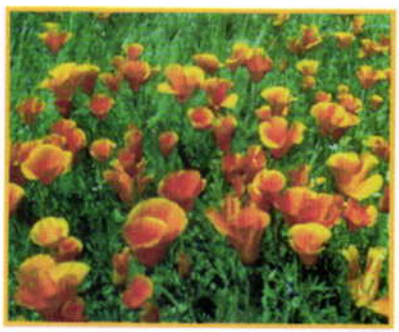
0.25 lbs. German crystal malt (40° Lovibond)
0.5 lbs. wheat malt
3.3 lbs. Muntons wheat malt extract syrup
1.5 lbs. Muntons light dry malt extract
1 lb. Muntons wheat dry malt extract
2.5 AAU Hallertauer Hersbrucker hops (0.5 oz of 5% alpha acid)
Wyeast 3056 (Bavarian Wheat) or White Labs WLP30 (Hefeweizen)
3/4 cup corn sugar for priming

Step by Step

Add grains to 1.5 gallons water at 160° F. Hold at 158° F for 30 minutes. Strain out grains and sparge with 0.5 gallon 180° F water. Add extracts and bring to a boil. Add Hallertauer Hersbrucker, boil 60 minutes. Strain out hops. Cool wort, pour into fermenter and top up to 5 gallons. Pitch yeast when cool. Ferment at ale temperature (60° to 70° F). Bottle when fermentation is complete.

Alternatives: Substitute Cooper's wheat malt extract syrup for the

SPRING



Muntons syrup. Or substitute 7 lbs. Briess weizen syrup for the Muntons syrup, light DME and wheat DME.

RESOLUTION BROWN ALE

OG: 1.055 FG: 1.008 IBU: N/A

If your spring resolution is to brew a Flanders brown ale, try this one. (The manufacturer says Brewferm kits shouldn't be boiled. But we'll vouch for this beer!)

Ingredients

6 oz. Briess Special B malt
0.3 lb. Belgian aromatic malt
0.3 lb. Briess Special Roast malt
6.6 lbs. Brewferm Old Brown Ale syrup malt extract kit
0.5 oz. Styrian Goldings hops
Wyeast 1214 (Belgian Ale) or White Labs WLP550 (Belgian Ale)

Step by Step

Add grains to 1.5 gallons water at 160° F. Hold at 158° F for 30 minutes. Strain out grains and sparge with 0.5 gallon 180° F water. Add extracts and bring to a boil. Boil 40 minutes. Add Styrian Goldings, boil 5 minutes. Strain out hops. Cool wort, pour into fermenter and top up to 5 gallons. Pitch yeast . Ferment at ale temperature (60° to 70° F). Bottle when fermentation is complete.

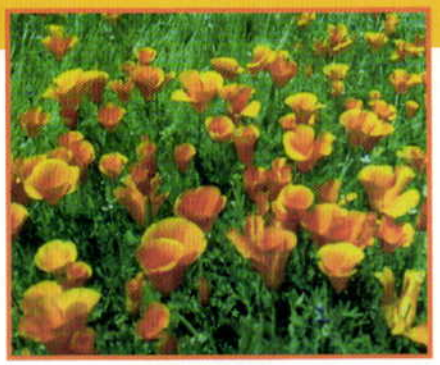
BUD-BREAK BITTER

OG: 1.044 FG: 1.008 IBU: 44

We like our bitter bitter, and this is a pretty bitter one. Bud-break is a copper ale with a nice hop finish.

Ingredients

2 oz. chocolate malt
0.25 lbs. British crystal malt (60° Lovibond)
3.3 lbs. Muntons extra-light malt extract syrup
2 lbs. Muntons hopped light dry malt extract
4 AAU Fuggles hops (1 oz. of 4% alpha acid)
5 AAU East Kent Goldings hops (1.25 oz. of 4% alpha acid)



2 AAU Fuggles hops (0.5 oz. of 4% alpha acid)
2.5 AAU East Kent Goldings hops (0.5 oz. of 5% alpha acid)
0.5 oz. Willamette hops
Wyeast 1968 (London ESB Ale) or White Labs WLP002 (English Ale)
2/3 cup corn sugar for priming

Step by Step

Add grains to 2.5 gal. water at 160° F. Hold at 150° F for 30 minutes. Strain out grains and sparge with 0.5 gal. 180° F water. Add extracts and bring to a boil. Add first Fuggles and East Kent Goldings, boil 45 minutes. Add Fuggles and Goldings, boil 15 min. Turn off heat, add Willamette, steep 5 minutes. Strain hops. Cool wort, pour into fermenter and top up to 5 gal. Pitch yeast. Ferment at ale temperature (60° to 70° F). Bottle when fermentation is complete.

BIRRA PRIMAVERA LAGER

OG: 1.048 FG: 1.012 IBU: 26

This is a pilsner-type lager of medium gravity.

Ingredients

0.25 lb. Vienna malt
0.5 lb. pale malt
2 oz. German crystal malt (40° Lovibond)
3.3 lbs. Muntons unhopped light malt extract syrup
2.5 lbs. Laaglander extra light dry malt extract
6 AAU Liberty hops (1 oz. of 6% alpha acid)
0.5 oz. Tettnang hops
Yeastlab L31 (Pilsner Lager)
3/4 cup corn sugar for priming

Step by Step

Add grains to 2.5 gallons water at 160° F. Hold at 158° F for 30 minutes. Strain out grains and sparge with 0.5 gallon 180° F water. Add extracts and bring to a boil. Add Liberty, boil 60 minutes. Turn off heat, add Tettnang, steep 5 minutes. Strain out hops. Cool wort, pour into fermenter and top up to 5 gallons. Pitch yeast when cool. Ferment at lager temperature (40° to 50° F). Lager 6 to 8 weeks before bottling.

Alternatives: Substitute 3.3 lbs. John Bull light unhopped malt extract syrup for Muntons light malt extract syrup. Use Wyeast 2007 (Pilsen Lager) or White Labs WLP800 (Pilsner Lager).

BELTANE BREW

OG: 1.044 FG: 1.014 IBU: 46

Bill Sutton, an engineer from Georgia, gave us this recipe. He writes: "Beltane is the Celtic celebration of the beginning of summer. In the modern calendar, it corresponds to May Day. The traditional drink for May Day was a May Wine, a lighter-bodied wine that had sweet woodruff soaked in it. I came up with this beer recipe to create a beer with the same character. I have substituted Muntons extra light liquid for the Alexander's. This yields a darker and heavier (OG 1.052) wort but seems to ferment better (FG 1.004)."

Ingredients

4 lbs. Alexander's pale malt extract syrup
3 lbs. clover honey
7.5 AAU Willamette hops (1.5 oz. of 5% alpha acid)
7.5 AAU Willamette hops (1.5 oz. of 5% alpha acid)
0.5 oz. Willamette hops
1.25 oz. dried sweet woodruff
1 packet Danstar Nottingham dry yeast
2/3 cup corn sugar for priming

Step by Step

Boil 4.5 gallons water, add

extract and honey. Add Willamette, boil 45 min. Add Willamette, boil 15 min. Add sweet woodruff, boil 15 minutes. Add Willamette, boil 5 minutes. Cool with wort chiller. Pitch yeast and ferment at ale temperature (60° to 70° F). Bottle when fermentation is complete.

Alternatives: Use Wyeast 1084 (Irish Ale), Wyeast 1098 (British Ale) or White Labs WLP001 (California Ale).

EASTER EGGENBIER

OG: 1.052 FG: 1.014 IBU: 24

A dark amber lager, this is a medium-bodied Vienna with just the right amount of hops.

Ingredients

0.5 lb. German crystal malt (40° Lovibond)
0.3 lb. dextrin malt
0.25 lb. Munich malt
0.25 lb. cara-Munich malt
4 lbs. Muntons amber (medium) dry malt extract
2 lbs. Muntons light DME
5 AAU Hallertauer Hersbrucker (1 oz. of 5% alpha acid)
2.5 AAU Hallertauer Hersbrucker (0.5 oz. of 5% alpha acid)
0.5 oz. Tettnang hops
Wyeast 2308 (Munich Lager)
3/4 cup corn sugar for priming

Step by Step

Add grains to 2.5 gal. water at 160° F. Hold at 150° F for 30 minutes. Strain grains and sparge with 0.5 gal. 180° F water. Add extracts and bring to a boil. Add Hallertauer Hersbrucker, boil 45 minutes. Add Hallertauer Hersbrucker, boil 15 minutes. Turn off heat, add Tettnang, steep 5 minutes. Strain out hops. Cool wort, pour into fermenter and top up to 5 gallons. Pitch yeast when cool. Ferment at lager temperature (40° to 50° F). Lager 6 to 8 weeks before bottling.

Alternatives: Substitute 2 lbs. Coopers light DME for the 2 lbs. Muntons DME. Use White Labs WLP838 (Southern German Lager).

MAY FLOWER MILD

OG: 1.034 FG: 1.008 IBU: 34

Oak chips add some interesting flavors to this English mild, suggesting cask conditioning on oak.

Ingredients

0.25 lbs. British crystal malt (60° Lovibond)
0.5 lbs. chocolate malt
3.3 lbs. Muntons dark plain malt extract syrup
0.5 lbs. Laaglander extra light dry malt extract
5 AAU Fuggles hops (1 oz. of 5% alpha acid)
2.5 AAU of East Kent Goldings hops (0.5 oz of 5% alpha acid)
3/4 oz. oak chips
Whitbread ale yeast or Wyeast 1968 (London Ale)
2/3 cup corn sugar for priming

Step by Step

Add grains to 1.5 gal. water at 160° F. Hold at 150° F for 30 minutes. Strain out grains and sparge with 0.5 gal. 180° F water. Add extracts and bring to a boil. Add Fuggles and East Kent Goldings in hop bag, boil 40 minutes. Add oak chips, boil 20 minutes. Remove hop bag. Chill wort with oak chips, pour into fermenter and top up to 5 gallons. Pitch yeast when cool. Ferment at 60° to 70° F. After primary, rack off oak chips into secondary fermenter. Bottle when fermentation is complete.

Alternatives: Substitute 3.3 lbs. John Bull dark malt extract syrup for the Muntons syrup. Use White Labs WLP002 (English Ale).

SPRING FEVER HERBAL ALE

OG: 1.065 FG: 1.018 IBU: 22

This is our take on Mount Hood Brewery's inimitable spring offering, Illumination Herbal Ale. Head brewer Jon Graber describes his seasonal beer as: "deep violet red in color and moderately high in alcohol, Illumination is a beer with a lot of flavors competing for your attention, with none of the flavors overpowering the others."

Ingredients

0.25 lbs. cara-Munich malt
0.25 lbs. carapils malt
0.5 lbs. British crystal malt (60° Lovibond)
0.5 lbs. German crystal malt (40° Lovibond)
6.6 lbs. Northwestern Gold malt extract syrup
1 lb. wild rasperry honey
0.5 oz. fresh grated ginger
3 oz. dried elderberries
5 AAU Cascade hops (1 oz. of 5% alpha acid)
5 bags Twinings Black Currant tea
1 bunch fresh lilac flowers
Edme ale yeast
2 oz. fresh elderflowers
2/3 cup corn sugar for priming

Step by Step

Add grains to 1.5 gallons water at 160° F. Hold at 150° F for 30 minutes. Strain out grains and sparge with 0.5 gallon 180° F water. Add extracts, honey, ginger and elderberries and bring to a boil. Add Cascade in a hop bag, boil 45 minutes. Meanwhile, bring 0.5 gallon water to a boil. Add tea bags and steep 20 minutes. Strain out tea bags and add 0.5 gallon tea to wort. Turn off heat, add lilacs, steep 15 minutes. Remove lilacs and hop bag. Cool wort, pour into fermenter and top up to 5 gallons. Pitch yeast when cool. Ferment at ale temperature (60° to 70° F). When primary fermentation slows, add elderflowers. Dry hop with elderflowers for 5 to 10 days. Bottle when fermentation is complete.

Alternatives: Substitute 6.6 lbs. Briess pale (gold) malt syrup or John Bull plain (light) malt syrup for the Northwestern syrup. Use Wyeast 1056 (American Ale), Wyeast 1275 (Thames Valley) or White Labs WLP001 (California Ale).

PUNXSUTAWNY PILS

OG: 1.048 FG: 1.014 IBU: 35

We conceived this as a lager-like ale for brewing on Groundhog Day and drinking on the first day of spring. That may be too short a time to get the clean taste and clarity this beer needs. So drink it on April Fools' Day.

Ingredients

0.5 lbs. two-row pale malt
0.25 lbs. Munich malt
3.3 lbs. Muntons extra light malt extract syrup
3 lbs. Laaglander extra light dry malt extract
7.5 AAU Cascade hops (1.5 oz. of 5% alpha acid)
2.5 AAU Cascade hops (0.5 oz. of 5% alpha acid)
0.5 oz. Cascade hops
Red Star ale yeast or Yeastlab A07 (Canadian ale)
2/3 cup extra light dry malt extract for priming

Step by Step

Add grains to 2.5 gallons water at 160° F. Hold at 150° F for 30 minutes. Strain out grains and sparge with 0.5 gallon 180° F water. Add extracts and bring to a boil. Add Cascade, boil 45 minutes. Add Cascade, boil 15 minutes. Turn off heat, add Cascade, steep 5 minutes. Strain hops. Cool wort, pour into fermenter and top up to 5 gallons. Pitch yeast. Ferment at ale temperature (60° to 70° F). Lager 4 weeks at 40° to 50° F before bottling.

Alternatives: Use Wyeast 1272 (American Ale II) or WLP051 (California V Ale).

GRENZACH LENTEBOK

OG: 1.072 FG: 1.016 IBU: 36

Lentebok, or spring bock, is a fairly new style, brewed in the winter for spring drinking. The coriander seed is an interesting addition reminiscent of some Belgian beers. This is not as heavy as some bocks; it's a light, bright beer.

Ingredients

1 lb. Munich malt
0.5 lb. aromatic malt
0.5 lb. cara-Hell malt
0.3 lb. cara-Munich malt
4 lbs. Ironmaster Special Lager kit (hopped malt extract syrup)
4 lbs. Laaglander extra light dry malt extract
0.5 lb. Briess light dry malt extract
1/4 oz. coriander seed
10 AAU Northern Brewer hops (1.25 oz. of 8% alpha acid)
1 AAU Saaz hops (0.25 oz. of 4% alpha acid)
Yeastlab L32 (Bavarian Lager)
3/4 cup corn sugar for priming

Step by Step

Add grains to 2.5 gallons water at 160° F. Hold at 150° F for 30 minutes. Strain out grains and sparge with 0.5 gallon 180° F water. Add extracts and bring to a boil. Add Northern Brewer, boil 45 minutes. Add Saaz, boil 15 minutes. Add coriander to final 10 minutes of boil. Strain out hops. Cool wort, pour into fermenter and top up to 5 gallons. Pitch yeast when cool. Ferment at lager temperature (40° to 50° F). Lager 6 to 8 weeks before bottling.

Alternatives: Substitute 4 lbs. Muntons extra light dry malt extract for the Laaglander malt. Substitute Coopers Pilsner kit (hopped liquid extract) or Edme Classic Pilsner kit for the Ironmaster kit. Use Wyeast 2206 (Bavarian Lager) or White Labs WLP820 (Oktoberfest/Märzen).

MAY DAY MAIBOCK

OG: 1.068 FG: 1.014 IBU: 29

Lighter colored and "less big" than Lentebok, Maibock is brewed in late winter. The first keg of maibock is traditionally tapped by the mayor of Munich on May Day.

Ingredients

0.5 lbs. pilsner malt
0.6 lbs. Munich malt
0.25 lbs. carapils malt
4 lbs. Laaglander Dutch light lager kit (liquid extract)
3.3 lbs. Muntons light DME
1 lb. clover honey
3 AAU of Hallertau hops (0.5 oz. of 6% alpha acids)
3 AAU of Magnum hops (0.3 oz. of 9% alpha acids)
3 AAU of Hallertau hops (0.5 oz. of 6% alpha acids)
Yeastlab L32 (Bavarian Lager)
3/4 cup corn sugar for priming

Step by Step

Toast pilsner malt for 10 minutes at 350° F. Cool and crush. Add grains to 2.5 gallons water at 160° F. Hold at 150° F for 30 minutes. Strain out grains and sparge with 0.5 gallon 180° F water. Add extracts and honey and bring to a boil. Add Magnum and Hallertau, boil 45 minutes. Add Hallertau, boil 15 minutes. Strain out hops. Cool wort, pour into fermenter and top up to 5 gallons. Pitch yeast when cool. Ferment at lager temperature (40° to 50° F). Lager 6 to 8 weeks before bottling.

Alternatives: Substitute John Bull light liquid malt extract for the Bierkeller. Use Wyeast 2124 (Bohemian Lager), Wyeast 2206 (Bavarian Lager) or White Labs WLP810 (San Francisco Lager).

MAZIN' MÄRZEN

OG: 1.066 FG: 1.019 IBU: 26

Okay, it's not really a "spring" beer. But now is definitely the time to get ready for Oktoberfest.

This beer has a fine amber color and good maltiness.

Ingredients
0.5 lb. German crystal malt (40° Lovibond)
0.25 lb. German crystal malt (80° Lovibond)
0.25 lb. cara-Munich malt
0.5 lb. Vienna malt
2 oz. roasted barley
3.3 lbs. Brewferm Scotch Ale kit (liquid extract)
3 lbs. Laaglander extra light dry malt extract
6 AAU Perle hops (0.6 oz. of 9% alpha acid)
0.5 oz. Tettnang hops
Yeastlab European lager yeast

Step by Step

Add grains to 2.5 gallons water at 160° F. Hold at 150° F for 30 minutes. Strain out grains and sparge with 0.5 gallon 180° F water. Add extracts and bring to a boil. Add Perle, boil 60 min. Turn off heat, add Tettnang, steep 5 min. Strain out hops. Cool wort, pour into fermenter and top up to 5 gallons. Pitch yeast. Ferment at lager temperature (40° to 50° F). Lager 6 to 8 weeks before bottling.

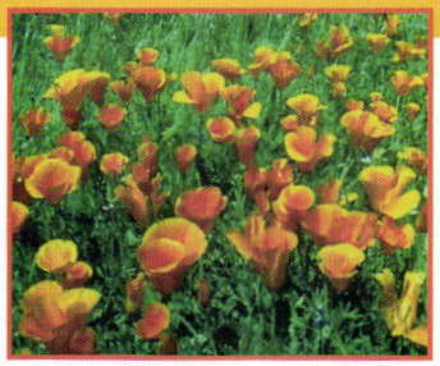
Alternatives: Use White Labs WLP820 (Oktoberfest/Märzen) or Wyeast 2308 (Munich Lager). Substitute 3 lbs. Briess pale dry (gold) malt extract for the Laaglander.

ST. VALENTINE'S DAY CHOCOLATE PORTER

OG: 1.060 FG: 1.020 IBU: 34

Why give your sweety a sappy card when you can offer this potent festive brew instead?

Ingredients
1.5 lbs. British crystal malt (60° Lovibond)
0.25 lbs. chocolate malt
0.25 lbs. black patent malt
3.3 lbs. Muntons dark malt extract syrup
2 lbs. Briess dark dry malt extract
1 lb. Briess pale (gold) DME



1 cup clover honey
6 oz. unsweetened cocoa powder
7 AAU Cluster hops (1 oz. of 7% alpha acid)
2.5 AAU Cascade hops (0.5 oz. of 5% alpha acid)
0.5 oz. Willamette hops
1 packet Whitbread ale yeast
2/3 cup corn sugar for priming

Step by Step

Add grains to 1.5 gallons water at 160° F. Hold at 150° F for 30 minutes. Strain out grains and sparge with 0.5 gallon 180° F water. Add extracts, honey and cacao powder and bring to a boil. Add Cluster and Cascade, boil 45 minutes. Turn off heat, add Willamette, steep 5 minutes. Strain out hops. Cool wort, pour into fermenter and top up to 5 gallons. Pitch yeast. Ferment at ale temperature (60° to 70° F). Bottle when fermentation is complete.

Alternatives: Substitute Coopers or Briess dark malt extract syrup for the Muntons syrup. Use Wyeast 1099 (Whitbread Ale) or White Labs WLP007 (Dry English Ale).

ST. PATTY'S CLOVER HONEY IRISH RED ALE

OG: 1.055 FG: 1.015 IBU: 47

Here's a red ale — not green — to help you celebrate in Celtic style.

Ingredients
2 oz. roasted barley
0.5 lb. British crystal malt (60° Lovibond)
0.5 lb. Victory malt
3.3 lbs. Muntons light malt extract syrup
2 lbs. Muntons amber DME
1 pound clover honey
6 AAU Willamette hops (1 oz. of 6% alpha acid)
3 AAU East Kent Goldings hops (0.5 oz. of 6% alpha acid)
3 AAU East Kent Goldings hops (0.5 oz. of 6% alpha acid)
1 oz. Fuggles hops
Whitbread ale yeast or Yeastlab A05 (Irish Ale)
2/3 cup corn sugar for priming

Step by Step

Add grains to 1.5 gallons water at 160° F. Hold at 150° F for 30 minutes. Strain out grains and sparge with 0.5 gallon 180° F water. Add extracts, honey and bring to a boil. Add Willamette and East Kent Goldings, boil 45 minutes. Add East Kent Goldings, boil 15 minutes. Turn off heat, add Fuggles, steep 5 minutes. Strain out hops. Cool wort, pour into fermenter and top up to 5 gallons. Pitch yeast when cool. Ferment at ale temperature (60° to 70° F). Bottle when fermentation is complete.

Alternatives: Substitute Coopers light syrup for the Muntons. Use Wyeast 1084 (Irish Ale) or White Labs WLP004 (Irish Ale).

SPRING CLEANING ESB

OG: 1.047 FG: 1.014 IBU: 31

Every brewer's cupboard has a few leftovers in it — the odd pound of diastatic malt extract or a few ounces of Cascade that missed the brewpot. But when the odds and ends take over the brewhouse, it's time for a round of spring cleaning!

Ingredients
2 oz. roasted barley
0.3 lbs. mild ale malt
0.5 lbs. British crystal malt (60° Lovibond)
2 lbs. Briess amber dry malt extract
1 lb. Briess light dry malt extract
1 lb. Morgan's dark crystal malt extract syrup
0.5 lbs. Briess dark dry malt extract
1/4 stick brewer's licorice
2 AAU Northern Brewer hops (0.25 oz. of 8% alpha acid)
2.5 AAU Cascade hops (0.5 oz. of 5% alpha acid)

3 AAU Styrian Goldings hops
(0.5 oz. of 6% alpha acid)
4 AAU Fuggles hops
(1 oz. of 4% alpha acid)
0.5 oz. East Kent Goldings hops
1 packet Edme ale yeast
2/3 cup corn sugar for priming

Step by Step

Add grains to 1.5 gallons water at 160° F. Hold at 150° F for 30 minutes. Strain out grains and sparge with 0.5 gallon 180° F water. Add extracts and bring to a boil. Add Northern Brewer and Cascade, boil 60 minutes. Add Styrian Goldings and Fuggles, boil 15 minutes. Turn off heat, add East Kent Goldings, steep 5 minutes. Strain out hops. Cool wort, pour into fermenter, top up to 5 gallons. Pitch yeast when cool. Ferment at ale temperature (60° to 70° F). Bottle when fermentation is complete.

Alternatives: Substitute Coopers amber syrup for the Morgan's dark crystal. Use Wyeast 1968 (London ESB Ale Yeast), Wyeast 1318 (London Ale III) or White Labs WLP001 (California Ale).

SPRING FORWARD SWEET DATE STOUT

OG: 1.080 FG: 1.025 IBU: 53

The candy sweetness of dates marries perfectly with the dark majesty of stout.

Ingredients

0.25 lbs. black patent malt
0.5 lbs. roasted barley
0.5 lbs. British crystal malt
(80° Lovibond)
0.75 lbs. British crystal malt
(60° Lovibond)
6.6 lbs. Glen Brew Irish Stout kit
(hopped liquid extract)
2 lbs. Muntons light hopped DME
1 pound chopped dates
12 AAU Northern Brewer hops
(1.5 oz. of 8% alpha acid)
Whitbread ale yeast
2/3 cup corn sugar for priming

Step by Step

Add grains to 1.5 gallons water

at 160° F. Hold at 150° F for 30 minutes. Strain out grains and sparge with 0.5 gallon 180° F water. Add extracts and dates and bring to a boil. Add Northern Brewer hops in hop bag, boil 60 minutes. Remove hop bag. Cool wort and pour, with dates, into fermenter. Top up to five gallons. Pitch yeast when cool. Ferment at ale temperature (60° to 70° F). When primary fermentation slows, rack off date to secondary fermenter. Bottle when fermentation is complete.

Alternatives: Substitute hopped stout kit from Coopers or Mountmellick for the Glen Brew kit. Use Wyeast 1099 (Whitbread Ale) or White Labs WLP004 (Irish Ale).

TAX DAY IPA

OG: 1.060 FG: 1.012 IBU: 55

Take the sting out of doing your taxes with this hoppy India Pale.

Ingredients

0.25 lb. toasted pale malt
0.5 lb. mild ale malt
0.5 lb. carapils malt
6.6 lbs. Northwestern Gold malt
extract syrup
1 lb. Briess light dry malt extract
6 AAU Magnum hops
(0.5 oz. of 12% alpha acid)
5 AAU Columbus hops
(0.5 oz. of 10% alpha acid)
3 AAU Willamette hops
(0.5 oz. of 6% alpha acid)
3 AAU East Kent Goldings hops
(0.5 oz. of 6% alpha acid)
0.5 oz. Chinook hops
1 oz. Willamette hops
Whitbread Ale yeast, Wyeast
1968 (London ESB Ale) or White
Labs WLP007 (Dry English Ale)
2/3 cup corn sugar for priming

Step by Step

Toast pale malt for 10 min. at 350° F. Add grains to 1.5 gallons water at 160° F. Hold at 150° F for 30 minutes. Strain out grains and sparge with 0.5 gallon 180° F water. Add extracts and bring to a boil. Add Magnum and Columbus, boil 45 minutes. Add Willamette and East Kent Goldings, boil 15 minutes. Turn off heat, add Chinook, steep 15 minutes. Strain out hops. Cool wort, pour into fermenter and top up to 5 gallons. Pitch yeast when cool. Ferment at ale temperature (60° to 70° F). When primary fermentation slows, add Willamette. Dry hop 5 to 10 days. Bottle when fermentation is complete.

EQUINOTICAL BOCK

OG: 1.088 FG: 1.025 IBU: 35

The rumor that bock is siphoned off the trub of old brews is hard to live down — I had a friend tell me this with a very straight face back when I was too young to know better. This is a strong, dark, Munich bock with a smooth maltiness.

Ingredients

0.75 lb. cara-Munich malt
0.25 lb. black patent malt
1 lb. German crystal malt
(80° Lovibond)
0.3 lb. chocolate malt
4 lbs. Laaglander Dutch Bock Lager
malt extract kit (hopped syrup)
3 lbs. Muntons dark dry malt
extract
2 lbs. Coopers light unhopped malt
extract syrup
0.5 lb. malto-dextrin powder
4 AAU Perle hops
(0.5 oz. of 8% alpha acid)
4 AAU Tettnang hops
(1 oz. of 4% alpha acid)
Yeastlab L32 Bavarian lager
3/4 cup corn sugar for priming

Step by Step

Add grains to 1.5 gallons water at 160° F. Hold at 150° F for 30 minutes. Strain out grains and sparge with 0.5 gallon 180° F water. Add extracts and bring to a boil. Add Perle and Tettnang, boil 45

minutes. Strain out hops. Cool wort, pour into fermenter and top up to 5 gallons. Pitch yeast. Ferment at 40° to 50° F. Lager 6 to 8 weeks before bottling. Add malto-dextrin with priming sugar at bottling time.

Alternatives: Substitute 1.6 lbs. Coopers light dry malt extract for 2 lbs. Coopers syrup. Substitute Muntons bock kit for Laaglander. Use Wyeast 2206 (Bavarian Lager) or White Labs WLP838 (Southern German Lager).

NOTTINGHAM PALE MAPLE ALE

OG: 1.060 FG: 1.012 IBU: 46

For years our friend Brad Hunter of Appleton, Maine has been tapping his sugar maples every spring and freezing the slightly sweet, watery sap until it's time to make this exceptional beer. Non-tapping brewers could try adding a half pint of maple syrup to the boil.

Ingredients (5.5 gallons)
8 lbs. Alexander's pale malt syrup
2 lbs. British crystal malt (60° Lovibond)
2 oz. chocolate malt
8 AAU Centennial leaf hops (1 oz. of 8% alpha acid)
6 AAU Cascade leaf hops (1 oz. of 6% alpha acid)
1 tsp. Irish moss
1 oz. Cascade leaf hops
Nottingham Ale yeast starter
3/4 cup corn sugar for priming

Step by Step:
Collect 7 to 8 gallons maple sap. Boil to reduce to 5 to 6 gallons (which sterilizes the sap and concentrates the sugars). Check pH and adjust. The sap will almost always require 1 to 2 tablespoons of gypsum. Steep crushed grains in 2 gallons maple sap at 160° F for 30 minutes. Strain and lightly sparge with 0.5 gallon sap. Add malt extract and Irish moss. Top off with sap to make up 6 gallons. Bring to boil and add Centennial. Boil 60 min. Add Cascade, boil 20 min. Turn off heat, add Cascade hops. Steep 5 min. Final volume should be 5.5 gallons. Cool to pitching temperature. Add yeast. Aerate well Ferment at 60° to 70° F. Bottle when fermentation is complete.

Alternatives: Use Wyeast 1028 (London Ale) or White Labs WLP005 (British Ale). ■

The Fishers are authors of "Great Beer From Kits" (Storey, 1996).

DIVE INTO Dry Hopping!

By Mark Garetz

ILLUSTRATION BY SHAWN TURNER

I admit it. I'm a hophead. For me, there's nothing better than taking a whiff of beer and getting a blast of fresh hop aroma. But that effect eludes many brewers. There's really only one way to get that fresh hop nose in your beer — and that's with a process known as dry hopping.

What is Dry Hopping?

When I first wrote about dry hopping back in 1993, the state of the literature about dry hopping was pretty sorry. It prompted me to write the following:

"Dry Hopping. Ask two brewing experts what that phrase means and you'll get three opinions. Try looking it up in the available literature and you'll get a wide variety of definitions and very little consensus amongst authors. A good many recipes call for a certain amount of hops to be 'dry hopped' with no explanation of the method."

"If we examine the homebrewing literature and try to put together a definition of dry hopping that accommodates all of the individual definitions, we come up with a definition that would read like this: 'Dry hopping is the process of adding hops to the beer at a point anywhere from after the kettle boil up to and including the bottling process.' Now that is a very long period of time, consisting of many brewing stages. Obviously, adding the hops just after turning off the heat will have a completely different effect than adding the hops during the secondary fermentation."

I'm glad to report that most writers now accept that dry hopping is the process of adding hops at the very end of fermentation or later. Dry hopping is done with one main objective: to get the aroma of fresh hops to come through in the beer.

Hops contain two main sets of compounds that interest us as brewers: the hop alpha acids and the hop oils. Both are contained in the resin produced by the lupulin gland in the female hop cone or flower. The lupulin glands are tiny, yellow to orange in color and resemble pollen

A handy guide to getting a big hop blast!

(but it's not pollen). If you've ever used or seen whole hops, you've seen the lupulin.

The alpha acids are what cause beer to be bitter. The hop oils are what give hops their aroma and give beer its hop flavor and aroma. In dry hopping we are not concerned with the alpha acids. It is the oils that we care about.

Alpha acids must be boiled in order for them to have any significant impact on the bitterness of our beer. During dry hopping, the hops are introduced to the beer days or weeks after the boil, so the hops used to dry hop the beer have no impact on the beer's bitterness. That's worth repeating: The hops used to dry hop the beer have no impact on the beer's bitterness. The hop oils are what we want to get into the beer. Hop oils are very complex and delicate and are almost completely lost during the boil. The longer the boil, the more oils are lost. That's why we add hops at the end of the boil — to retain a portion of the oils and give a beer some hoppiness. But the oils also undergo a chemical change when heated that affects their aroma. So the hoppiness imparted to a beer with a late hop addition, even if it is in the wort for just a few minutes, will not have the same aroma as a fresh hop. This is why we dry hop the beer when it is cool.

Traditional Dry Hopping

Dry hopping has been practiced for centuries in England, and was sometimes called raw hopping. No one is quite sure where the term dry hopping came from, but my theory follows: In olden times it was quite common to reuse the kettle hops a few times in successive boils before discarding them. These hops would have been "wet" (even though some fresh, dry hops would have been added as well). In contrast, the hops added in the later conditioning stages were always fresh and dry.

In England, cask-conditioned ales will typically get fresh "dry" hops added along with finings and priming sugar (or kraeusen) when the beer is racked from the primary fermenter into the cask. This is the true, traditional dry hopping method. The cask is then left to "condition" for 7 to 14 days at around 55° F. The oil from the hops is slowly extracted and disseminated throughout the beer.

If you use a kegging system instead of bottle conditioning your beer, you can follow essentially the same procedure as they do in England. Add your fresh aroma hops to the keg along with the priming sugar and — optionally — finings. If you force-carbonate the beer, you'll still have to let the beer sit with the hops for one to two weeks to allow the hop oil to be extracted into the beer. You should tie them in a hop bag to make clean-up easier and remove any potential for clogging your beer lines. You can tie the bag to the bottom of the dip tube to keep the hops immersed in the beer (they tend to float to the top) or you can try wedging the hop bag in between the dip tube and the wall of the keg. A common method is to add some weights to the bag. Use glass marbles, a piece of stainless steel or some other easily cleaned and sanitized weight. When devising your own weight system, test it first in a bucket. You will be surprised at the amount of weight it takes. Whatever you use, just be sure not to use lead fishing weights!

Almost any bag will work with whole hops, but pellets are another matter. The holes in the bag must be small enough to contain the particles. The advantage of pellets is that the hop oils have already been liberated from the lupulin glands and will get into the beer faster than whole hops, and probably with more efficiency. This means you can use slightly less and the beer will be hoppier sooner. That said, I like to use whole hops in a weighted bag in the serving keg because the hop aroma seems to keep coming out of them. It takes me a few months to finish a five-gallon keg of beer. With pellets you get a big rush of hops, and then it mellows out. One thing to remember is that pellets will expand significantly when they get wet — so make sure to leave plenty of room in the bag. Otherwise the bag could become too tight for the beer to permeate.

The advantage of traditional dry hopping is that there is no place for the hop aroma to go but into the beer. The only disadvantage is the time you have to wait before you can drink the beer. The time will vary with the temperature, but one to two weeks is a good average. The lower the temperature, the longer it will take to extract the hop aroma. The only problem is that if you don't have a kegging system, you need to do something else to get hop aroma into your beer.

Fortunately, there are alternatives to traditional dry hopping during the conditioning stage. The most widely practiced alternative is dry hopping by adding fresh hops to the fermenter. There are many points at which you could add the hops during fermentation, each with its own pros and cons. Let's examine each possibility.

Adding Hops to the Primary Fermenter

Some books say that in order to dry hop, you should add your hops to the primary fermenter as soon as the wort is cooled to about 75° F, or about the same time as you pitch the yeast. This can work, but there are some good reasons to wait.

Hops are not a sterile product. They contain bacteria and wild yeast. In a study done at the University of California at Davis, it was determined that the microbiological risks from dry hopping were essentially non-existent. The fermentation process squelched any attempt of the yeast or bacteria on the hops to get established.

However, this assumes a well maintained and vigorous yeast starter as would be used by a commercial brewery or microbrewery. Not all homebrewers can be guaranteed a good, fast start to fermentation, especially if you don't make a yeast starter. Therefore, there is some risk of contamination by the hops if they are added at pitching time. But there is no point in taking an unnecessary risk since much of the hop aroma will be scrubbed out of the wort by the vigorous action of the primary fermentation. Great volumes of carbon dioxide are given off and it will carry the hop aroma along with it. The hops will only be in contact with the beer for a short amount of time if you rack into a secondary. To compensate for these losses, you'll have to add a lot of hops, which is costly and wasteful. I can't think of any advantages to adding hops along with the yeast. Given all of the disadvantages, there's no good reason to do it.

Adding Hops During the Secondary

Dry hopping by adding fresh hops to the secondary fermentation stage is the next best alternative to traditional dry hopping in the keg. There is virtually no risk of contamination since the established yeast growth, alcohol and lower pH will inhibit any yeast or bacteria introduced with the hops. Since much less CO_2 is being given off, less hop aroma will be lost to the atmosphere, so you'll need less hops.

To dry hop your beer in the secondary, add the hops to the secondary container before racking the beer into it. The beer should be left on the hops for around two weeks, depending on the temperature (colder = longer). You can add loose whole hops, the hops in a weighted hop bag as described earlier, or you can use hop pellets.

Note that even if you use only one fermentation vessel (as is common with ales and those using plastic bucket fermenters) and don't rack the beer into a "secondary" vessel, you need to make sure you add the hops at the right time. The initial fermentation is characterized by heavy activity, lots of bubbling and (usually) a lot of foam on the top of the beer. When fermentation slows down (the foam head drops back and bubbling of the airlock slows), that's the time to dry hop.

If you are using a plastic bucket-type fermenter, open the top and add your hops. If you are adding loose whole hops or pellets, stir them in as best you can with a sanitized spoon, being careful not to oxidize your beer. Then replace the top and the airlock. If you are using the weighted hop bag approach, just drop the bag in (gently) and replace the top. If you are using a carboy, pellets are easily fed in through the top. Whole, loose hops are a bit more of a problem. Make yourself a wide funnel out of a clean sheet of paper. You'll still probably need to push the hops in with a sanitized pusher of some sort (your racking tube would be a handy candidate).

When adding hops in a weighted hop bag to an empty carboy (before racking over the beer), I advise to lay the carboy on its side, insert the hop bag and weight and let them slide down the shoulder. Then slowly stand the carboy upright. If you just drop the weight in, you risk breaking the carboy. If the carboy is full of beer (as in the single vessel example above), then the beer will cushion the blow, so don't bother trying to tilt the carboy.

How Much and What Kind of Hops to Use

This is a matter of personal taste. It is my opinion that most recipes call for far too little aroma-finishing hops and even less dry hops. My suggestion is to use more hops than you think you need (it's better to err on the high side). A lot will depend on the freshness of the hops and the method you use, but between 1 and 2 ounces is a good place to start. Also important is the style of beer. *(The chart on page 37 lists those beer styles for which dry hopping is appropriate.)* In general, the lighter the beer flavor, the less aroma hops you need. And conversely, the heavier the beer, the more hops you need. The oil content of the hops is also very important (see the next section of this article for more information).

As for what kind of hops to use, obviously you're going to use an aroma variety. You might start by buying a few ounces of many different aroma varieties and sniffing them. (If you don't like the aroma of a particular variety, you can still use it for bittering since the aroma will be boiled off.) Get them as fresh as you can and make sure your hop supplier uses oxygen barrier bags. The test is to see if you can smell the hops through the sealed bag. If you can, then it's not an oxygen barrier bag and you should use another supplier.

Popular hops used for dry hopping are Cascade, Centennial, Columbus, East Kent Goldings, Fuggle and Czech Saaz. Cascade, Centennial and Columbus will give you a distinctly American character with a heavy slant to the West Coast. Goldings and Fuggle will obviously be English and Czech Saaz would be good for extra hoppy pilsners (but be advised that pilsners, including Pilsner Urquell, are not traditionally dry-hopped.)

I can't emphasize enough that for dry hopping you need to have extremely fresh hops. Freshness is everything. If you can smell any off-aromas, don't use those hops unless you want that aroma in your beer.

Oil Content Rating

If you know the oil content of your hops, this will also help you adjust the amount of the addition. Hops like Cascade have typical oil contents above 1 percent, with Centennial and Columbus approaching 2 percent some years. Compare that with East Kent Goldings, which is usually around 0.5 percent when we get it. So if you wanted a strong hop aroma with Goldings you need a lot compared to Columbus.

Dry Hopping Problems

Sometimes homebrewers will report a great increase in bitterness after dry hopping. This is not to be confused with the slight enhancement of the beer's perceived bitterness due to the hop oils. We're speaking of really undrinkable levels of bitterness. I have not ever tasted one of these beers myself, nor have I ever met an experienced brewer who had this happen.

Dry hopping will sometimes cause an increase in a beer's astringency, which can often be mistaken for bitterness. This hasn't happened to any of my beers but I have tasted beers where this has been the case. In every case, however, this astringency vanished in a few weeks. No one knows for sure why this happens, but my theory is that it is caused by the hop tannins. Eventually these tannins drop out or combine with other compounds in the beer and lose their astringency.

It is possible that some of these brewers used "pre-isomerized" or "stabilized" hop pellets, in which a good portion of the alpha acids have been converted into iso-alpha acids. If this were the case, then these pellets would indeed bitter the beer without boiling. Normal hops just can't accomplish this feat.

If you keg the beer and dry hop in the serving keg, and, like me, can't wait a week or two for the hop aroma to get into the beer, you may notice that your beer is very "grassy" tasting. This too will pass with time.

Lastly, homebrewers may notice that dry hopping in the secondary can cause fermentation to become visibly more active again, or it may simply appear that way. Stirring in the hops may have the effect of rousing the yeast, and that may cause fermentation to kick into a higher gear for a little while. Usually, however, this is simply a result of more CO_2 being released from the beer and the hops becoming bubbly nucleation sites. In either case, it is nothing to be concerned about and, in fact, it has the advan-

BEER STYLE	DRY HOP?
Barleywine	Yes
Belgian Brown Ale	No
Belgian White (Wit)	No
Belgian Trappist House and Dubbels	No
Belgian Trappist Tripels	No
Saison	No
Lambics	No
English Mild	No
English Brown Ale	No
American Brown Ale	Sometimes
English Pale Ale	Yes
India Pale Ale (IPA)	Yes
American Pale Ale	Yes
English Ordinary Bitter	No
English Extra Special Bitter (ESB)	Optional
Scottish Light Ale	No
Scottish Heavy	No
Scottish Export	No
Robust Porter	No
Brown Porter	No
English Old/Strong Ale	No
Scotch Strong Ale	No
Dry Stout	No
Sweet (Cream) Stout	No
Imperial Stout	No
German Bock	No
Helles (Pale) Bock	No
Dopplebock	No
Dunkel	No
American Dark Lager	No
Dortmund/Export	No
Munich Helles	No
Classic Pilsner	No
German Pilsner	No
American "Lite" Lager	No
American Lager	No
American Premium Lager	No
American Microbrewed Lager	Sometimes
American "Dry" Lager	No
American Wheat Beer	No
Vienna	No
Märzen/Oktoberfest	No
Alt Beer	No
Kölsch	No
Cream Ale	No
Fruit Ale	No
Herbed and Spiced Beer	Sometimes
Smoked Beer	No
Anchor Steam Style	No
Berliner Weisse	No
German Weizen and Hefe-weizen	No
American Red Ale	Yes

tage of purging any oxygen you may have introduced to the beer when you added the hops.

Microbiological Risks of Dry Hopping

We covered this already, but it bears repeating. If you dry hop in the secondary or later, there is virtually no risk of contaminating your beer by dry hopping. The alcohol content and low pH of the beer after the primary fermentation prevents anything from surviving. Now, many brewers will not agree with this. But I have never seen a documented case of contamination that was proved to be caused by dry hopping. I once talked to a brewer who had made a contaminated batch, and was convinced it came from the dry hopping. He claimed not to have done anything different than in previous batches, except for dry hopping. After about 20 minutes of going through all of his procedures, he finally admitted that his prior three batches (which weren't dry hopped) were contaminated as well!

In my commercial brewery (which I no longer own), almost every beer we made was (and still is) dry hopped. They add pellets directly to the fermenter after fermentation has slowed down. We never had a batch of beer that was contaminated from the hops. So don't worry about contamination from hops.

Which Beer Styles Should be Dry Hopped?

Not every classic beer style has a fresh hop or dry hop aroma. Until a very few years ago, dry hopping was limited to cask-conditioned ales from England. And even dry hopping in those ales had diminished to the point where you really couldn't tell that the beer had been dry hopped at all. Fritz Maytag at Anchor Brewing is single-handedly responsible for the revival of dry hopping in this country and just might be responsible for an increase of the levels used in England.

It started when Fritz decided to

make a traditional English pale ale. He journeyed to England and visited the major brewers. Most were still practicing dry hopping, but they were using such small amounts in each cask that it hardly mattered. He thought they were mainly doing it out of a sense of tradition rather than for any aroma effect.

It wasn't always that way! In the late 1800s, India Pale Ale was heavily dry hopped. To relate the amount they used to our common five-gallon batches, they used around 2.5 ounces of hops in five gallons. Fritz Maytag observed the English brewers using about a tenth of that amount.

Needless to say, Anchor's first Liberty Ale was heavily dry hopped, and remains so today. The exact amount remains a secret, but it is around 2 ounces in five gallons. Cascade is used exclusively. If you get a fresh bottle of Anchor Liberty Ale, it's a fine example of a dry-hopped ale. Also: HopTown's IPA and Paint the Town Red, Anderson Valley's Hop Ottin' IPA, and Sierra Nevada's Celebration Ale (contrary to popular opinion, their pale ale is not dry hopped).

Today, many brewers are experimenting with adding fresh hop aroma to beer styles that never had it before. I invite you to do the same. There are some styles where dry hopping would obviously be appropriate, and others where it would not *(see page 37)*. The two flavors must complement each other. So while it's not unusual to have a beer that is finish hopped and not dry hopped, it would be highly unusual for a beer to be dry hopped but not finish hopped.

The Final Word

The rules of dry hopping are pretty basic. Always dry hop in the secondary or later and never dry hop in the primary. (If you use just one fermentation vessel, wait until the initial stages of fermentation are over.) If you keg your beer, dry hopping in the serving keg is the best place to do it. I recommend the use of a hop bag and weight. This helps to keep the hops suspended in the beer, and in turn promotes better extraction of the hop oils. If you dry hop, don't forget to finish hop as well. It is okay to finish hop without dry hopping, but generally not the other way around. Remember to use the freshest hops you can.

Lastly, you should remember that dry hopping will not impart any bitterness to your beer. Most flavor problems with dry hopping stem from the fact that you're drinking the beer too early. Have patience. Time will cure them! ■

Mark Garetz is the author of "Using Hops: The Complete Guide to Hops for the Craft Brewer" (HopTech, 1994).

DIVIDE AND CONQUER

by Roy Maddox

THE ABILITY TO CREATE a new kind of beer is one of the most appealing aspects of homebrewing. After a while, many brewers get tired of the same old styles and recipes. They want to brew something different!

One approach is to dream up a set of target parameters (OG, SRM and IBU), use your beer calculating program, and go for it. Many excellent results are obtained this way. But there's another way to go.

Try applying this simple experimental method: Brew a base beer of known quality and then split the batch at some point into a "control split" and any number of "experimental splits." The control split allows you to assess whether any negative results are caused by a flaw in the base recipe. Plus, it's always nice to have some of the base beer around. It adds another beer to your fridge, and it provides a reference for judging the splits.

One advantage to this method is the small volume allotted to each split. You don't lose much beer if you need to flush a bad split. And an accident or error that ruins one split doesn't mean that all the other splits will be bad. In a way, it's a shotgun approach; it allows you to create a number of new recipes with reduced risk and expense.

I recently used this method with great results. First, I brewed a five-gallon batch of golden ale with extract and specialty grains. (The original recipe ran in the Summer 2000 issue of *Brew Your Own*. I adapted the recipe to fit my techniques and ingredients.) After primary fermentation was complete, I divided the batch into three splits. I wanted to experiment with fruit: pineapple and Bing cherries.

The control split went through a normal secondary fermentation. The two experimental splits were subjected to another "primary" fermentation with the fruit.

By splitting a five-gallon batch of beer into smaller batches, you can easily test new recipes.

BASE BREW: GOLDEN ALE

(five gallons, extract with grains)
OG = 1.052 FG = 1.008 IBUs = 30

Ingredients:

6.5 gallons bottled water
0.5 tsp. Burton salts
0.5 tsp. table salt
7.0 lbs. Alexander's Extra Light Malt Syrup
1.0 lb. crystal malt (10° Lovibond)
0.5 lbs. carapils
0.5 lbs. wheat malt
3 tbs. malto-dextrin powder
5.5 AAU of Mount Hood pellet hops (1.25 oz. of 4.4% alpha acid)
6.5 AAU of Cascade leaf hops (1.0 oz. at 6.5% alpha acid)
12.5 AAU of Chinook leaf hops (1 oz. of 12.5% alpha acid)
3.25 AAU Cascade leaf hops (0.5 oz. of 6.5% alpha acid)
1 tsp. Irish moss
1 tbs. yeast nutrient
Starter of White Labs WLP001 (California Ale) or Wyeast 1056 (American Ale) yeast

Brewing the batch:

Two to three days before brew day, sterilize enough clean "butter tubs" to hold one gallon of bottled water. Put the butter tubs in the freezer to make one gallon of ice.

On brew day, bring 5.5 gallons of bottled water to 160° F. Add Burton salts and table salt. Crush the specialty grains (crystal, carapils and wheat malt) and put them in a muslin grain bag. Steep for 30 minutes. Drain and squeeze bag.

Dissolve 7 lbs. Alexander's Extra Light Malt Syrup into the brew kettle. Be careful to avoid scorching! Add malto-dextrin powder and bring to a rolling boil. Total boil time is 65 minutes.

As soon as the boil begins, add

5.5 AAU Mount Hood pellet hops. After 30 minutes, add 6.5 AAU Cascade leaf hops (in a hop bag). After 60 minutes, remove the Cascade hops and add 12.5 AAU Chinook leaf hops. At this time, also add Irish moss and yeast nutrient.

After five minutes, turn off heat and add 3.25 AAU Cascade leaf hops. Put lid on kettle and let stand for 30 minutes. Immerse kettle in cold-water bath. Repeat when cold water gets warm, then add the one gallon of ice cubes that you made before brew day. When the ice cubes are melted, the temperature of the wort should be in the mid-70° range. Volume should now be about 5.5 gallons.

Take a long, sanitized spoon and whirlpool the wort. Put the lid on and let it stop spinning. Carefully siphon the clear wort off the trub (the inverted cone of stuff at the bottom of the kettle) and rack into primary fermenter. Save the trub in a sanitized one-gallon jug, topped with an airlock, in the refrigerator.

Use your hydrometer to measure the original gravity. It should be about 1.052. Aerate the wort thoroughly (I used an aquarium pump and stainless-steel aeration stone for ten minutes.) Pitch the yeast starter.

Managing Fermentation:

Let the beer ferment for two to four days, or until the activity subsides and foam drops back. Skim it twice a day for the first two days.

Note: After primary fermentation is complete, you'll be dividing your 5.5-gallon batch into splits. I'll walk you through this procedure in a minute, but first we'll follow our golden ale "control beer" through secondary.

Siphon two gallons of golden ale into secondary fermenter. Decant the clear wort from the trub that you saved in the refrigerator and add some of this wort to the secondary (save some wort for the other splits). Let the beer ferment at ale temperatures (68° F) until absolutely flat. This should take about seven days. When the secondary is complete, the final gravity should be about 1.008.

Kegging or Bottling:

Siphon the beer off the settled yeast. Reintroduce a small amount of yeast (about two tablespoons from the stash you saved in the fridge) to the clear beer to make sure there's enough yeast for bottle conditioning. Save some of this "fridge yeast" for the test splits!

Boil one cup corn sugar in 0.25 gallons of water. Dissolve one packet of Knox gelatin in a little cold water, then add it to the hot liquid. The gelatin will act as a fining agent to help clear the beer. Cool in water bath briefly. Add the warm priming liquid to the beer. Bottle or keg the batch — I used a two-gallon Corny — then condition at room temperature (60° to 75° F) for two weeks.

Now move the beer into a refrigerator for cold conditioning. It will continue to mellow during the first two weeks in the fridge. Keep it there until the batch is gone! The result is a clean, crisp, bright golden ale with moderate bitterness and an excellent head.

The pineapple split

Follow the base recipe through primary fermentation. You should have about 5.5 gallons. Now separate 1.75 gallons into each of two sanitized containers. (The total set aside is 3.5 gallons, which leaves two gallons for the control split.)

To the first test batch, add 2 six-ounce cans of pineapple juice and

YEAST TEST

You can use the same golden ale base to experiment with yeast strains. In some cases, the differences between the splits will be subtle. Different tasters will record different results.

These beers would be best tasted at about 40° to 45° F. Make sure you have "clear" tastebuds and clean glassware.

Each split in this experiment will be one gallon (you will have a little left over). Be sure to ferment all splits in the same temperature range.

For the control split, use a neutral yeast like the California Ale. This yeast imparts essentially no flavor and the beer should be clean and crisp. For split two, try an English Ale or Irish Red Ale yeast. You'll look for a fruity, estery character in the finished ale. Split three could use a Saison Ale yeast. The finished flavor should be smooth and well-rounded, but a bit different from the control batch (the differences will be subjective, since everyone's palate is different). Try a German Lager yeast for split four. The result will be similar to a steam beer. Split five could be fermented with hefeweizen yeast. Our brew has a small amount of wheat malt and a higher hopping rate, and would not be true to style. Still, you should be able to detect the banana or clove aromas.

You could also experiment with dry hopping. Using the same dry hop dose (amount and alpha acid), split at primary, secondary and in the keg. Also, one could split between pellet and leaf hops. Have fun; that's what counts! — *Roy Maddox*

two 15.25-ounce cans of sliced or crushed pineapple (including the juice). This brings the volume of the split to almost two gallons.

Ferment on the fruit for 3 days, then strain into two one-gallon glass carboys for secondary fermentation and ferment to completion. During the fruit "primary" you will easily be able to smell the pineapple. By the time the secondary is complete, most of this smell is gone and you may detect a slight buttery aroma (like pineapple-upside down cake, but not like diacetyl). You may need to strain the secondary before kegging the beer, to catch any floating fruit remnants. To prime, boil one-third cup corn sugar in 0.25 gallons water. Add a packet of gelatin and stir priming mixture into beer. Add about 2 tablespoons saved yeast from the fridge and follow the conditioning schedule for the control split.

The result was a bright golden ale with a faint pineapple aroma and taste, which played well with the bitterness of the base ale. I found a few fruit particles in suspension, despite the gelatin finings, but no off-flavors. The ale became very clear after six weeks of cold conditioning. The head retention is excellent. There is no "wine" or "cider" taste from the fruit juice or canned fruit. There is no buttery aroma in the finished product. This is a great summer beer.

The cherry split

The base ale for this split could benefit from added fermentables, besides the cherries, in order to offset the bitterness a little.

Dissolve one pound rice powder in about 2 pints of boiled water. Destone about 0.5 gallons of fresh Bing cherries (not pie cherries). Add the cherries to the hot rice water, then add 0.5 tsp. yeast nutrient. Add the other 1.75 gallons of raw golden ale to the warm cherry-rice mix and ferment for 3 days. Strain the fruit and transfer to two one-gallon glass carboys for secondary fermentation. When secondary is done, prime with 0.25 cup corn sugar and 0.25 cup dried malt extract in 2 pints boiled water (plus 1 packet gelatin). This batch was bottled and conditioned for two weeks at room temperature and then cold-conditioned until the batch has been consumed.

The result was a creamy, burgundy-colored ale with an excellent head and a rich cherry flavor that blended well with the subdued bitterness of the base ale. The clarity is good and the carbonation is slightly low. All in all, I'm pleased with my trio of beers! ■

Roy Maddox lives in Oregon and has been a homebrewer and brewerianа collector since 1972. This is his first article for BYO.

The pH pHiles

How to measure and adjust pH in your wort, mash and beer

by Chris Colby

A handheld pH meter. When used properly, a pH meter is easy to use and more accurate than pH test papers.

After graduating from college, I worked as a chemist. Part of my job was taking the pH of giant vats of a sugar-and-acid solution. One day, a line worker was assigned to take the pH of the vats. After he told us the pH values, we commented that they were too low. "Well," he said, "you'd better add some more pHs then."

For all-grain brewers, a pH meter is almost as useful as a thermometer or a hydrometer. A pH meter is also useful to advanced extract brewers. Hand-held pH meters can be found at homebrew shops at prices starting around $40. Scientific supply houses sell more advanced meters, at prices up to several thousand dollars.

Used properly, a pH meter is easier to use and more accurate than pH test papers. Unfortunately, the instructions that come with pH meters aren't sufficient enough to teach homebrewers how to use them correctly. Improper use leads to incorrect pH readings. It's also easy to burn out a meter if you don't know how to use it properly.

The acidity or alkalinity of a substance can be measured using the pH scale. A pH of 7 is considered neutral (at 77° F). Acidic solutions have a pH lower than 7. Alkaline, or basic, solutions have a pH greater than 7.

Measuring pH in brewing

Values of pH are measured by immersing a pH electrode in the sample solution. The pH is read when power is applied to the electrode. The pH electrode is not taking a pH reading of the entire sample, it's reading the pH of the solution in contact with the electrode.

Before measuring the pH of any solution, turn off the power to the electrode and rinse the glass part with water. Many pH meters have only one power switch; it controls both the power to the electrode and the power to the meter itself. To rinse the electrode, swirl it in a glass of water or use a squirt bottle and direct a stream of water at the electrode. Then gently dab at the glass electrode with a tissue to dry. Wiping the surface can scratch it. Lastly, wipe away any remaining water on the parts surrounding the glass electrode.

Your electrode should now be clean so it can directly contact your next pH sample. Without cleaning, the previous liquid would cling to the electrode. Your pH reading would be inaccurate. In brewing, when we're often measuring the pH of thick, sugary solutions, rinsing the electrode is important.

Immerse the electrode in your sample and swirl the sample around for 5 to 10 seconds, then turn it on. The meter should now display the pH reading. Often, the pH readings will change at first. Allow the readings to settle down before recording your pH. Many newer meters have an indicator that tells you when the pH readings have stopped changing. A continually drifting pH reading indicates a worn-out or improperly cleaned electrode. Once you have taken the reading, turn off the power to the electrode before you remove it from the solution. To extend the life of your electrode, you should never "take the pH of air." Only turn the power on when it is immersed in a liquid.

Calibrating the pH meter

Before using your pH meter, you need to calibrate it. To calibrate the meter, you need two solutions of known pH. In brewing, the known solutions are a solution with a pH of 7 and a solution with a pH of 4. The pH 7 solution is often colored green; the pH 4 solution is often colored red. If your homebrew shop carries pH meters, it will also carry these solutions and electrode storage solution (discussed later).

To calibrate, you measure the pH of the pH 7 standard first. Your meter should read some number close to 7. Adjust the meter so it is reading a 7 in the pH 7 solution.

Refer to your meter's instructions for how to do this. Repeat this process so that the meter is reading 4 in the pH 4 solution. (Remember to rinse and dry the electrode to avoid dragging pH 7 solution into your pH 4 solution.) Now your meter is reading correctly at a pH of 7 and a pH of 4. This also means it should be reading the correct pH at all values in between 4 and 7, where values for mash, wort and beer pH should fall.

With most modern meters, you only need to calibrate your pH meter once each brew day. The meter will "remember" the calibration, even when turned off (as long as you don't remove the batteries). As a check, take a pH reading of the pH 7 and 4 standards at the end of brewing to see if the meter has drifted. If your meter reads differently at the end of your brewing day, you may need to calibrate more often. If the pH readings change by more than 0.2 pH units during your brewing day, you probably need to replace your electrode.

Don't let your pH electrode dry out. It should be stored in a silver chloride (AgCl) solution or in your pH 7 solution. This includes "long term" storage between brewing days and "short term" storage between uses on brewing day. Allowing the electrode to dry out will shorten its life and cause the meter to read erratically. If the storage solution has dried up around your electrode, re-wet the electrode and soak overnight.

When you take a sample of mash or wort, use a clean sample glass. Swirl the sample around a couple times, and then dump it back into the mash or wort. This washes away any residue on the glass that might affect the reading. After rinsing the sample glass, take the final sample and take the pH. To be safe, discard any sample that has contacted the pH electrode.

When to Measure pH

There are a few key times when it's beneficial to measure pH. All-grain brewers should measure the pH of their mash and the pH of the last bit of wort collected while sparging (the final runnings). All brewers can measure the pH of the wort before and after fermentation. Many brewers also measure the pH of their mash water or sparge water. This is okay, but be aware that it won't tell you much. Once the water is added to the grain (or mash), chemical reactions take place that change the pH.

Mash pH

The most important time to measure pH is during the mash. The pH of the mash should be between 5.2 and 5.6, with the lower end of that range being preferable for the enzymes to convert starches

to simpler sugars. If you are outside of this range, you may get a low extraction efficiency or end up with starch in your wort. Since mash temperatures are usually between 150° and 158° F, it's important to know that temperature has a direct effect on pH and a separate effect on pH metering. The actual values of pH drop as the temperature increases. In addition, higher temperatures cause pH electrodes to give lower than actual readings.

Many pH meters have a temperature compensation function. The meter senses the temperature of the solution and compensates for the change in pH. This compensation is for the change in pH due to the effect of temperature on the electrode. Temperature compensation (usually) does not compensate for the actual change in pH of the substance at different temperatures. Even with a temperature compensated pH meter, you should cool your samples to room temperature before taking a pH reading because higher temperatures are hard on pH electrodes. If you consistently take the pH of your mash directly, without cooling, you will reduce the useful life of your pH electrode.

When sampling from the mash, you don't need to avoid getting grains in your sample, but make sure that grain husks don't lodge near the electrode. If your mash pH is not between 5.2 and 5.6, you should adjust it before proceeding *(see page 46)*. Often, if the pH is out of range, it's too high.

The last bit of wort you collect while sparging is called the final runnings. Towards the end of sparging, the pH begins to rise quickly. If the pH is allowed to become greater than 5.6, tannins are extracted from the grains at an elevated rate. Too many tannins can cause astringency. Near the end of sparging, check the pH of the run-off occasionally to insure that it does not exceed 5.6.

Wort

Yeast work best at certain pH values. For a healthy fermentation, your initial wort pH should be lower than 5.2. If your mash pH was in the right range, and you have soft to moderately hard water, your wort pH is probably fine. If you have very hard water, your wort pH may be high even if your mash pH was fine.

Beer

As the wort ferments, the pH drops. The pH of most finished beers falls between 4.0 and 4.4. Since lambics are fermented with a mix of microorganisms, including lactic acid producing bacteria, their pH values may be as low as 3.4. Beers with pH values less than 4 taste "sharper" than normal beers. Beers with a pH over 4.6 don't taste as "lively" as beers with normal pH

values. Beers with pH values over 4.6 may be cloudier, with less foam stability, than normal beers.

When sampling finished beer, pour it back and forth between two clean glasses to decarbonate before taking the pH. Few brewers directly adjust the pH of finished beer. If beer pH is out of whack, a brewer will adjust his brewing procedures the next time he brews. Adjusting the pH of the wort prior to fermentation will usually correct any problems in final beer pH.

Adjusting pH

In some cases, you may find that the pH is not in the correct range and you want to change it. You generally have two options when you want to lower the pH and one option if you want to raise the pH.

The two most common types of acids used in homebrewing are lactic acid and phosphoric acid. These acids should be fairly dilute. A 10 to 30% solution of phosphoric acid is a good working strength. For lactic acid, a 40 to 60% solution works well. Using higher concentrations of these acids can "burn" the small area of mash or wort where it's added. It can also burn your skin. If you get acid on your skin, rinse it with water quickly. If you want to add either of these acids to lower the pH of a mash or wort, add a small amount (less than 1/2 tsp.) and stir it. Let it sit for about 3 to 4 minutes and take the pH again to see if further acid additions are needed.

Calcium chloride and calcium sulfate (gypsum) are two chemicals that also can be used to lower mash or wort pH. Calcium ions from these molecules react with phosphates in the mash or wort. In the process, the pH of the solution is lowered. To lower the pH of mash or wort using these chemicals, add 1/4 to 1/2 tsp. of the chemical and stir in thoroughly. Let the mix sit for about 5 minutes before checking the pH again. If the pH is not in the desired range, add more calcium. Don't add over 2 teaspoons of calcium to a homebrew-sized mash. If the pH still isn't within range, you will need to add acid. To raise the pH of a mash or wort, add calcium carbonate following the same procedure.

Conclusion

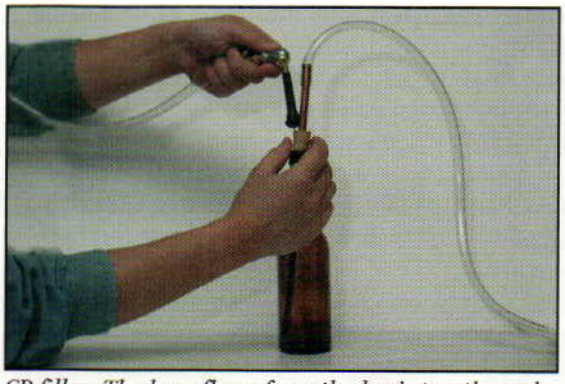
Measuring pH is essential to brewing good beer. A hand-held pH meter is a good investment for any all-grain brewer, especially if you have been getting a low extraction efficiency. It can also benefit any brewer whose beer just doesn't look or taste quite right. With care, your pH electrode should last at least a few years. You can monitor your beer and now you'll know how to "add pHs" to correct any problem. ■

Chris Colby is a regular BYO contributor. He lives in Texas.

Under Pressure

Bottle from your keg using this simple counter-pressure filler

by Thom Cannell



CP filler: The beer flows from the keg's tap through the copper tube; the CO2 comes from the keg's tank through a tire chuck, valve and sport-ball needle.

BOTTLING CAN BE A HASSLE, which is why so many homebrewers invest in kegging equipment. Rack to a keg, prime or pressurize. What could be easier? Nothing ... until you want to take a six-pack of homebrew to a party, or you decide to enter some bottles in a competition, and every precious drop is in the keg.

You can't simply fill a few bottles and head out the door. When you transfer your beer from a keg to a bottle, the dissolved carbon dioxide comes out of solution and the beer loses its carbonation. It also exposes the beer to oxygen. A bottle of flat, oxidized beer is no way to make friends or win competitions! So what's a brewer to do?

There are two answers. You could fill some bottles with beer from the keg, add priming sugar and wait a few weeks. Or you could fill your bottles with a counter-pressure filler. They'll be carbonated the minute you crimp the cap.

So what are counter-pressure fillers and how do they work? The main objective of counter-pressure filling is this: to deliver beer into a bottle with minimal oxygen exposure while keeping the carbonation intact. In other words, moving beer from keg to bottle without losing that precious CO_2 fizz.

If you've ever cleaned your bottles in a large bucket, you've stumbled across the basic principle of counter-pressure filling. Stick a bottle into water and what happens? If the neck is straight up, bubbles rush out and water rushes in. If the neck is down, water rushes in, then stops. What made it stop? Pressure that built up inside the bottle. Water entered until the pressure of the compressed gas (air) inside the bottle equaled the pressure of the liquid.

Imagine a bottling bucket high above your work counter, ready to dispense beer. On the counter is an empty bottle, and beside the bottle is a tank of carbon dioxide.

Cap the bottle with a stopper that has two tubes in it. Hook up one tube to a tank of CO_2 and flush the bottle with CO_2, a gas that is heavier than air. This will purge the air from the bottle. Now turn off the flow of gas. Start to add beer from your bottling bucket. As the beer flows in, it will attempt to displace the carbon dioxide in the bottle. Since the CO_2 tube is still attached, the gas cannot escape and it is compressed as the liquid enters. Eventually an equilibrium is reached. The liquid has compressed the gas until the pressure of the gas equals the pressure of the liquid.

If you lowered the bucket of beer, gas pressure would push some beer back into the bucket. If you raised the bucket, more beer would flow in until a new equilibrium had been reached.

This is the principle of counter-pressure bottle filling. You add beer until it stops, then you release some of the pressure and more beer flows in. When the bottle is filled, you cap it immediately.

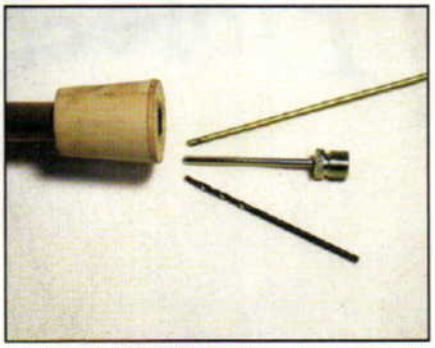
For homebrewers, there are two general kinds of commercial CP fillers available. One is made by Listermann Manufacturing and relies on gravity. The other designs require extra pressure.

The Listermann product operates pretty much as we described, using the siphon method of operation and maintaining the same pressure between the keg and the bottle. The keg must be above the bottle to be filled. The other fillers are a bit more complex. Instead of gravity pushing the beer down through a siphon hose, the beer is pushed by CO_2 out of the keg into the bottle, wherever the keg may be.

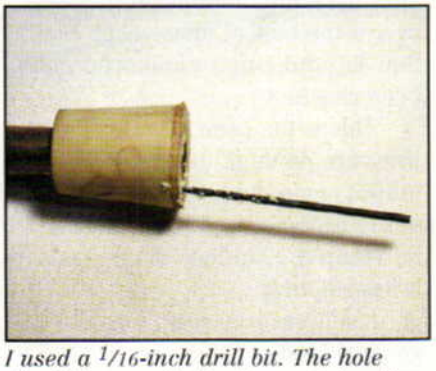
Basic Materials

Stopper #2 or #3	$0.60
sports ball needle	$0.99
tire valve	$3.99
tire chuck	$3.00
copper tube	$0.30
stainless tube	$2.75
vinyl tube	$0.80

Standard kegging equipment also required: keg, CO_2 tank and regulators, gas connection to keg, hoses, picnic tap.



Make a hole in the rubber stopper with a drill bit or a large sewing needle.



I used a 1/16-inch drill bit. The hole should be parallel to the angled wall.

Ready-made CP fillers work very well and can be purchased through many homebrew retail shops or mail-order outlets. They cost about $50. If you'd rather make your own counter-pressure filler for a test flight before investing in a commercial model, the parts will cost about $10. By doing this, you will save money and get to test the concept.

The starting point for this counter-pressure filler design comes from the December 1995 issue of *Brew Your Own*. It included a brief description of a super-simple, $3 do-it-yourself counter-pressure bottle filler. We modified the design and added some parts to make it work better. Here are step-by-step instructions.

Step by Step

1. Cut enough copper or stainless-steel tubing to reach within 1/2-inch of the bottom of your regular-sized bottle. To fill larger bottles, simply attach enough 3/8-inch vinyl tubing to the bottom end.

Note: I used copper tubing for my homemade CP filler. If the copper is clean and not oxidized, it should not impart a metallic taste to the beer. Still, you may want to go with stainless steel. This will cost a bit more.

2. Gently push copper or stainless tube through a #2 or #3 rubber stopper, just far enough to protrude above the wider end. This supplies support during the next operation.

3. Make a hole in the wall of the stopper, parallel to the angled wall. I recommend that you buy two or three stoppers, because this isn't easy. Two common methods of making the hole are:

3a. Fit a 1/16-inch drill into a drill motor and drill the hole or:

3b. Heat a large sewing needle or turkey trussing needle until it is

red hot and push it through the stopper to make the hole.

4. Push the metal tube a bit farther through the stopper, exposing enough of the tube to attach a length of 3/8-inch OD vinyl tube. The vinyl tube should be long enough reach your keg's beer tap (approximately three feet if your beer tap has a short leash).

5. Take an ordinary tire valve (they come in short and tall; I chose the tall model) and wash it thoroughly to remove the silicone release agent. Be especially thorough at the large open end away from the valve.

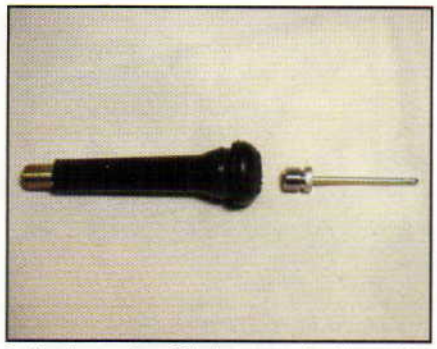
6. Push a sport ball needle (the kind you use to pump up a basketball) into the large end of the tire valve. You may wish to use a tiny bit of RTV silicone seal at the bottom threads only. This is insurance; leaks are not a worry.

7. Push this assembled valve-needle combo through your stopper hole, just until the hole in the needle is exposed. If your tire valve is as thick as mine, you'll have to angle the stainless-steel tube or remove part of the valve body by cutting or sanding. (I used my trusty Dremel tool with a carving bit to nibble away part of the thickness.)

8. Push a length of sanitized 3/8-inch OD vinyl tubing onto the copper tube and push the other end onto your picnic tap. Then you are ready to follow our easy instructions and let us know how much you enjoyed taking a sixer to your next party instead of a keg, tanks, regulators and ice bath.

Tips and Techniques

1. Your CP filler must be sanitized, preferably by immersion in liquid sanitizer (not bleach) or very hot water (165° F for 10 minutes) before and after every use. Allow the sanitized parts to air dry between uses.



Left: tire valve. Right: sport ball needle. You push the needle into the tire valve.

You also push the needle through the hole you drilled in the stopper.

You might have to carve away part of the valve so it fits next to the copper.

The completed counterpressure filler, ready for bottling.

2. The beer being dispensed should be as cold as possible, preferably no more than 35° F. Keep the beer in ice or dispense it through a jockey box if possible.

3. The bottles should also be cold. This will help to keep your carbonation level as high as possible and will also reduce unwanted foaming during the filling process.

4. To fill the bottles, replace your regular gas-in keg connection with a common tire chuck. Now set your keg pressure to approximately 3 pounds per square inch (psi). This should be just enough pressure to push the beer into the bottle.

5. Position the counter-pressure filler 12 inches to 36 inches below the bottom of your keg.

6. Push the stopper into the bottle loosely; push the chuck onto the tire valve and flush each bottle with CO_2 for 10 to 15 seconds. This pushes out the air, which could oxidize your beer.

7. With the chuck still attached, push the stopper in tightly and leave it there for a few seconds to pressurize the bottle.

8. Open the beer valve (the tap that came with your keg) and add beer. When it stops, release pressure by pushing on the center of the tire valve. It may help to slightly unscrew the valve for better access, releasing pressure in little burps.

9. When the bottle is filled to within 1/2-inch from the top, close the beer tap, release any remaining pressure in the bottle by pushing on the center of the tire valve, and slowly remove the counter-pressure filler from the bottle.

10. Cap the bottle immediately. Note: It is difficult to achieve proper-for-style carbonation. Small errors in technique can result in "gushers" or flat beer when bottling. The closer you can get to having everything at 32° F, the more successful you will be. ■

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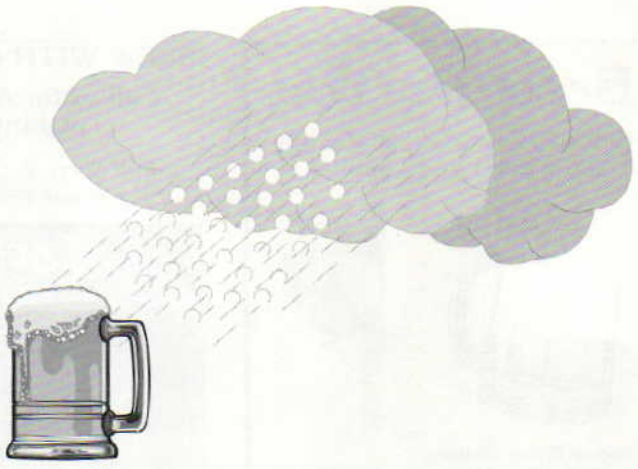

IT WAS A DARK AND STORMY night. Well, actually, it was a bright, icy Saturday afternoon. But a storm was moving in. I was at the homebrew shop, waiting on the locals who were preparing for a nice warm evening of snowbound brewing at home. No bar-hopping for these guys tonight.

As the wind and snow increased and the customer traffic petered out, my friend and co-worker Tony got bored and antsy. "Man, we gotta brew something," he said, stalking around like a tiger in a cage. "Can we start now? Where's the stuff? What'll we make?" I showed him my trusty propane cooker and table, and he dragged it onto the covered walkway out front. While he picked out malt, extracts and hops, I connected the propane, fitted my homemade stainless-steel windscreen (made of roof flashing) around the cooker and fired up. Tony took the grains to the rear of the store to run them through the mill, and I warmed up the water and collected all of the other accessories we would need.

The wind blew hard, but the windscreen worked well; the flame barely flickered. Snow blew all around us, piling up on the window boxes attached to the storefront as we dropped a muslin bag full of grains into the brew pot. Some customers came by to get their last-minute supplies before the weather socked them in. They were quite amused by the sight of us standing over the steaming brew, blasts of frigid air whipping around us.

The store sink was tiny, so we had to use an outdoor spigot to fill the fermenter and sanitizing tray. I had to keep them outside, since the store is carpeted. Needless to say, the water was a bit chilly to work in. Maintaining constant temperature was tricky, since my cooker reacts slowly to low-level adjustments. I had to adjust and view the flame while on my knees, since the windscreen blocked my view. While I was down in this position, a truck came by to plow the parking lot. The driver must have thought I was praying to a pot of boiling water.

Snow blew all around us, piling up on the window boxes as we dropped a muslin bag full of grains in the brewpot.

After the cooker steadied, we were able to stay inside, popping outside now and then to dip a thermometer into the brewpot. We removed the grains after a half-hour, then added malt extracts, rice syrup solids and some Perle hops. I turned up the heat and once again genuflected to the Brew God until the fire stabilized.

By this time, the wind was blasting snow out of the gathering dark. I had trouble sanitizing the fermenter and equipment; as you might imagine, my fingers kept getting numb.

Tony hovered over the brew, peering through the vapor to see if the heat was high enough and kicking away the built-up snow around (and on) the cooking table. With the boil at a proper level, we retreated inside again, venturing outside only to stir the wort.

Well after dark, we dropped our finishing hops (Fuggles) into the brew, allowed another few minutes and it was finally finished. We shut off the heat, poured off a little wort for a yeast starter, pushed the brew pot into a snowbank and cleaned up. After ten minutes, we pulled the pot out of the big hole it had melted in the snow and poured the remaining wort into the fermenter. The wort temperature was perfect, so we pitched the yeast (a lager strain) and stuck the fermenter in the back room of the shop.

The next day, New Year's Eve, the airlock was perking. A week later I racked the brew off into a carboy and put it into the chilly back hallway behind the store. Two weeks later I racked again.

As I write this, it's Mardi Gras and it's snowing again. We'll bottle the beer soon and enter it into a couple of competitions. Too bad they don't have a "brewed under difficult conditions" category. ■

Bruce Lucier co-owns the West Boylston Homebrew Emporium in West Boylston, Massachusetts.

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