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MARCH-APRIL 2005, VOL.11, NO.2

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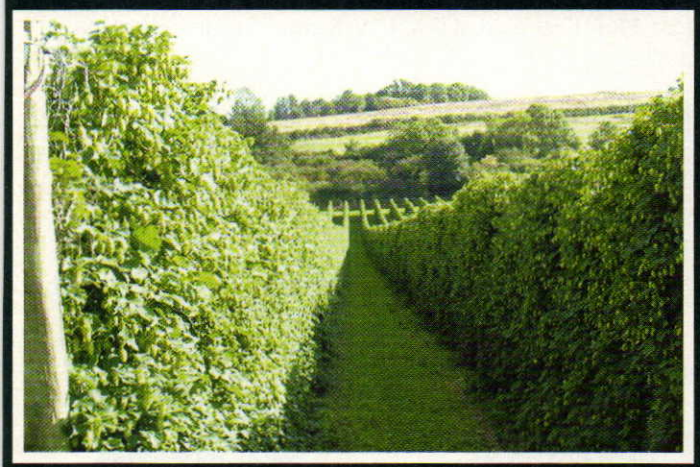

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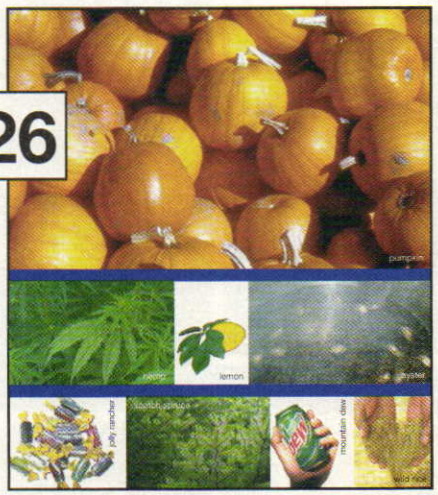
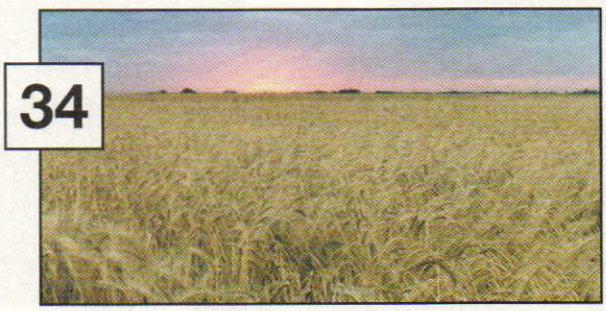
Brew Your Own

Departments

Features

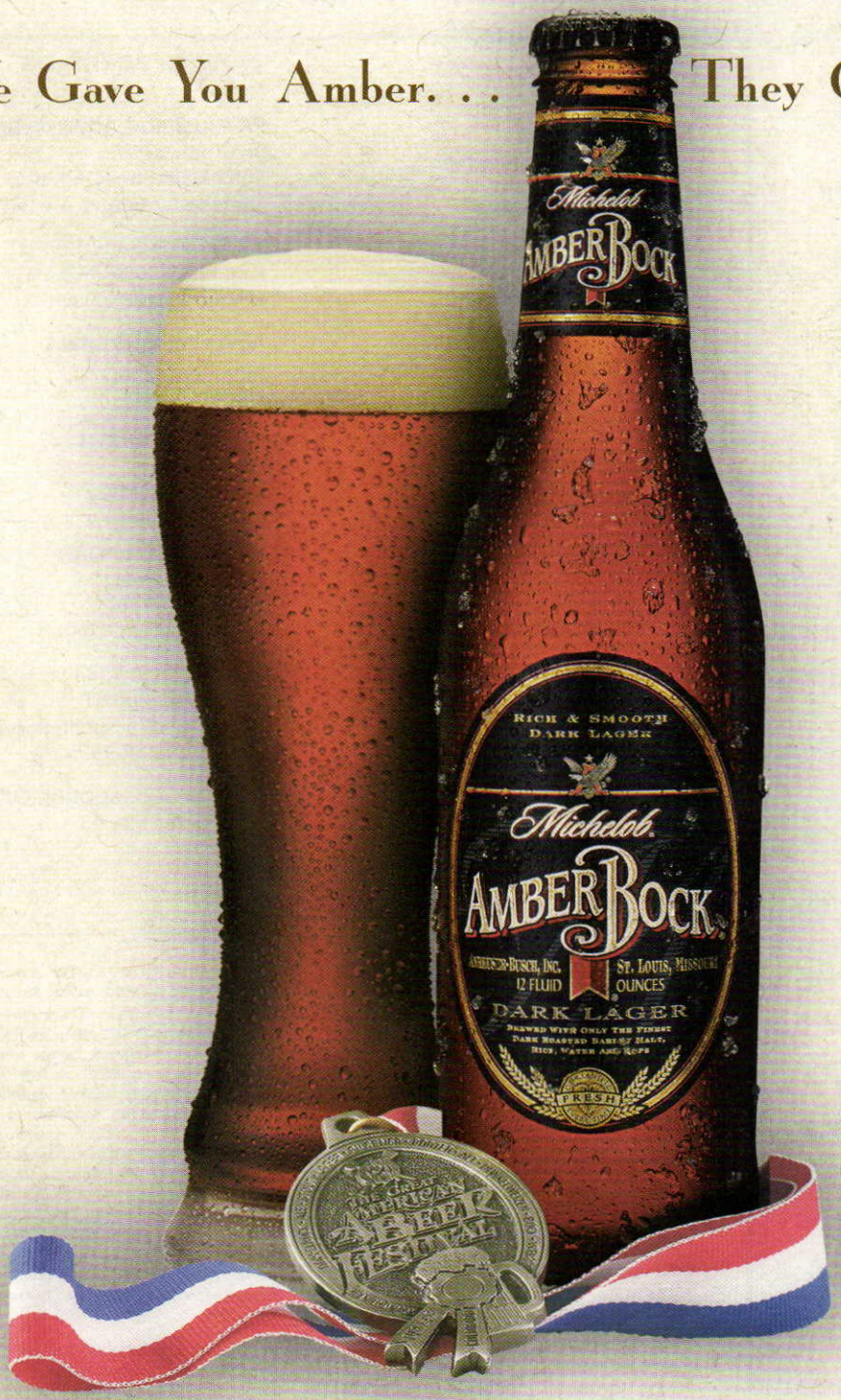




Where to find it

COVER PHOTOGRAPHY: Charles A. Parker/ Model: ZZ Hop

We Gave You Amber. . .



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 Volume 11, Number 2: March-April 2005.

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RALPH OLSON, is the General Manager and part owner of Craft Brewing Sales for Hopunion CBS L.L.C. Recently Hopunion CBS L.L.C. (formerly Hopunion, U.S.A.) entered into an agreement for the sale of the Craft Brewing Department with six hop growing families. The growers involved operate farms in both Oregon and Washington. Ralph has acquired an ownership interest as well and will serve as general manager of the new company.

Ralph has recently retired from the Board of Governors for Master Brewers of America, District Northwest where he held the office of President for the past 2 years. Ralph is on the Transition Board for the "Brewer's Association," previously the "Association of Brewers" and "Brewer's Association of America." He is also active on the American Hop Museum Board of Directors and is on *Brew Your Own*'s review board.

Ralph's career started in the hop industry 25 years ago. At that time his duties included working in traffic and overseeing plant operations. Since that time he has also worked in both sales and purchasing. Check out Ralph's story "New Hop Varieties and How They Come About" on page 47 of this issue.

HORST D. DORNBUSH was born and raised in Düsseldorf, Germany, where he grew up on a wonderfully sustaining diet of traditional altbier, rye bread, sausages and spicy mustard. In 1969 he boarded a boat for a voyage across the Atlantic Ocean to North America. He started homebrewing as much out of nostalgia as out of necessity. "If you wanted a decent beer in North America in those days, you had to make it yourself," he says. In 1995, after a 20-year career in broadcasting and publishing, Horst founded a small microbrewery in Massachusetts. In 2000, he won a bronze medal for his altbier at the Great American Beer Festival in Denver, Colorado.

Horst is the author of two books: "Altbier" (1998) and "Bavarian Helles" (2000) (both of Brewer's Publications) and our regular "Style Profile" columnist. Check out his story on American Cream Ale on page 19.

GARRETT HEANEY has been the associate editor of *BYO* and *WineMaker* magazines for nearly two years. He earned his bachelor's degree in English and Communications at Southern Vermont College in Bennington. There, he served as editor and sports editor of *The Mountain Press*, SVC's student newspaper and covered college basketball as a stringer to the *Bennington Banner* sports department. Garrett is a native Vermonter who grew up in the Northeast Kingdom and graduated from St. Johnsbury Academy in 1997. When not reading and writing, he enjoys playing basketball, snowboarding, hiking and a good pint.

In January, Garrett expanded our Homebrew Nation department with the debut of "Beginner's Block," his new column. He writes a similar column (also titled "Beginner's Block") in *WineMaker* magazine. Find his latest, "Intro To Hop Utilization" on page 12 of this issue.

RECIPE INDEX

BYO RECIPE STANDARDIZATION

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

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

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

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

New Hybrid Ingredient?

I am giving your Mud Bock Spring Ale recipe in January-February's Replicator column a try and have a question about the "wheat barley" ingredient. Is this a typo or am I missing something?

Charlie Onasch
via email

The ingredient called wheat barley should be wheat malt. That is indeed a typo. Sorry for any inconvenience.

Got Grain (Info)?

Since I read that great article on Stouts and what grains to use ("The Dark Secrets of Stout," by Ashton Lewis, Jan-Feb 2005), I thought that maybe you could do a type of grain page in every issue. For example, you could discuss Victory malt or any (or all) toasted grains, how to use them, in what percent for each beer style and what color to expect. I believe this would help get the extract brewers into brewing with specialty grains and it could even help get an all-grain brewer to try something new. I've been brewing for 6 years now and I keep hearing about different grains online, but don't know how to use them or even find them. From Carafa® this to debittered that, it gets confusing.

David Woods
via email

New homebrewers are faced with a barrage of information. To help welcome new faces to the hobby, we recently debuted a new mini-column in BYO. "Beginners Block" — written by associate editor Garrett Heaney and found in our Homebrew Nation section — will dispense basic homebrewing information regarding various techniques, ingredients and equipment with the aim of getting new brewers up to speed quickly. There are a lot of specialty grains out there these days and, in fact, one of our planned installments, covers dark grains.

Contaminated Cornies

I've been a homebrewer for a few years now. Now, as I attempt to stock the new bar with my carefully homebrewed creations, I am discovering that my Cornelius kegs do not respond to any type of sanitation measures that I've used so far! In addition to a initial complete disassembly and cleaning when I first received the kegs, I used a iodophor solution to sanitize all parts. Then I reassembled each for storage and later use. I also go through a mild cleaning and sanitation soak in iodophor prior to each use. Even the use of my special vocabulary proved useless. I reviewed the latest article in BYO pertaining to the same ("Cleaning the Big Bottle," by Mike Heniff, Jan-Feb 2005) and suspect another disassembly and "stronger" sanitation measures are needed. I am somewhat new to this kegging thing but I've had to dump two kegs due to this problem. Hopefully with your help I can purge my bar and equipment of the recurring problem without the use of any special vocabulary.

Steve Gambrell
via email

From our personal experiences, we can tell you conclusively that brewery contaminants are not deterred by specialized vocabulary terms . . . the $@&-ers. If your corny kegs seem chronically contaminated, you should clean your entire brewery and look for steps in your process where they might be picking up contaminants.

Disassembling the kegs and cleaning them, as you did, is the first step. The cleaners and sanitizers available to homebrewers are sufficient for the job, but you can try professional-strength cleaners as well if you are careful. Many of these chemicals are very strong and you may want to wear gloves (and perhaps even goggles) and work in a well-ventilated area if you try them.

Next, you should disassemble and clean anything that comes in contact with your kegs, especially the taps.

Contaminating organisms can live in your beer lines and migrate to the keg. Likewise, review your cleaning and sanitation "upstream" — your beer may be getting contaminated in the fermenter, but only showing the effects of contamination in the kegs. Clean your wort chiller and fermenter well and consider replacing your racking canes and rubber stoppers.

Finally, clean your brewing area and keep wort and beer away from grain dust. Microorganisms from the air can settle into your beer during racking. If you rack your beers in the same area you mill your grains, your chance of contamination is greatly increased.

You may also want to use a bit of lysozyme in your beers until the problem is fixed.

Well Kiss My Grits

In your July-August '04 issue there is a recipe for "Flatonia" Bock which calls for 2.66 lbs. of corn grits. I have consulted with several of my friends, including Chuck (Papazian), Davie (Miller) and Raymond (Daniels) and can't find a good description of what exactly corn grits are.

Christian Kelso
Dallas, Texas

You should consult your friend Denny, the guy who serves all those Grand Slam breakfasts across the US. Grits are degerminated corn that is ground into chunks. They are often served as a breakfast food in the South. Homebrew stores don't usually carry grits, but your supermarket probably does. Look for corn grits or polenta. Check the label and don't buy any that have preservatives or other flavors added.

brewer PROFILE

Jay Wince • Zanesville, Ohio

photo courtesy of Jay Wince

When I started brewing nearly 10 years ago, little did I know what I was in for. I started brewing for no other reason than to try it. It was mysterious and held some basic secret to the universe. I wanted to see what it was all about. I also wanted to drink beer. A friend gave me a small homebrewing catalog and after careful consideration, I bought the basic equipment kit and an American wheat ale kit. I must admit that even my first beer was not too bad. I continued to brew extract with specialty grain beers for the next six years, averaging about two batches a year. I was not what you would call a serious brewer.

Then for Christmas one year, my wife bought me a plastic bucket all-grain set-up and I finally did my first all-grain batch in March of 2002. I ended up doing 12 more batches by the following Christmas, topping 60 gallons (228 L) for the year. I was hooked. I had surpassed my previous six-year total in just nine months!

Step ahead to 2005 — I now brew about twice a month and have stepped up to an all-stainless brewery with the exception of a few glass carboys. My rack system was patterned after some commercially available systems with a few alterations to fit my particular brewing style. A co-worker did all of the welding for the price of a couple of ingredient kits (he was a new extract brewer). Converted kegs make up all of the kettles while a 12.2-gallon (46.4-L) stainless conical fermenter from Beer, Beer & More Beer is the workhorse of the fermentation process. A polysulfone pump handles the transfer of liquids and is armed with polysulfone quick disconnects for maximum flexibility.

Even after 10 years I still bottle about a third of my homebrew. I enjoy passing much of it along to friends and also entering competitions. These days however, I do keg a great deal and keep it all cold in an externally temperature controlled chest freezer. It has a capacity of seven five-gallon (19-L) kegs with room for bottles or two more 3-gallon (11.4-L) kegs on the shelf. I also utilize this freezer for lager fermentation and conditioning.

One of the greatest accolades for my homebrewing was winning the homebrew competition held at Barley's Brewing Company in Columbus, Ohio twice in a row (in 2003 and 2004) with my imperial stout and smoked porter. The prize for winning the Barley's competition is brewing a 10-barrel batch of my recipe on their system and having it offered for sale. It was a homebrewer's dream to brew on a pro system and offer it to the public.

Big Winning RECIPE:

Edward Bielaus • 2004 Happy Holiday Homebrew Competition Best of Show, St. Louis Missouri

GWB Dim-nit-half-Wit
(5 gallons/19 L, all-grain)

Ingredients

5.0 lbs. (2.3 kg) Pils malt
2.7 lbs. (1.2 kg) white wheat malt
2.3 lbs. (1.0 kg) unmalted wheat flakes
0.3 lbs. (0.1 kg) rice hulls
3.1 AAU Perle hops (90 minutes) (0.4 oz./11 g of 7.8% alpha acids)
½ vial White Labs WLP400 (Belgian Wit Ale) yeast
½ vial White Labs WLP550 (Belgian Ale)

Step-by-Step

Mash at 139 °F (59 °C) for 30 minutes, then step up to 156 °F (69 °C) for 30 minutes. Sparge with 168 °F (76 °C) water treated with food-grade phosphoric acid to a pH of 5.7. Sparge until the runoff reaches 4 °Brix. Do not over sparge. The mash water is treated with CaCl and phosphoric acid to a pH of 6.7. Boil sweet wort for 10 minutes skimming break material thereafter. Then add 0.4 oz. Perle hops (7.8% alpha acid) and boil for 90 minutes after the hot break material was skimmed. Yeast is then pitched at 70 °F (21 °C). Ferment at 68 °F (20 °C) for two weeks, then rack into two secondary fermenting containers (about 2.5 gallons in each). White Labs WLP400 and White Labs WLP550 were used in separate fermenters. Watch the WLP400, it really rips at first, heaving all the yeast out of the fermenter. It will then regrow the yeast and start again. These yeasts work well together and taste great when blended. Look for a starting gravity of 1.051 and a target gravity of 1.010. I added 0.23 oz. (6.4 g) of organic coriander that I grew myself. It added a slight peppery flavor and aroma and mellowed nicely after two and a half months. I also added 0.32 oz. (9 g) sweet orange peel, as well as 0.4 oz. (11.2 g) of bitter orange peel.

homebrew DROOL

Dennis Howlett's Tripod Brewery • Soucé, France

System details

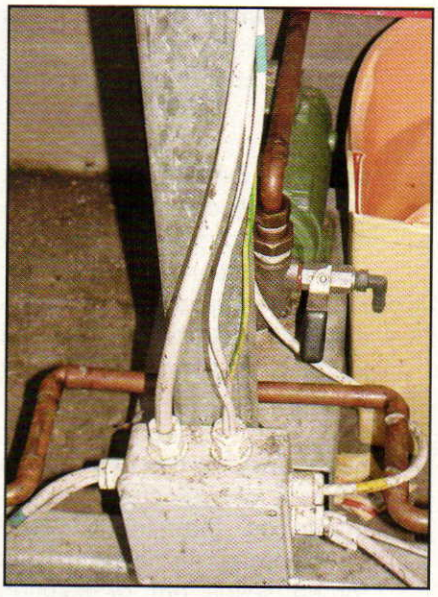
This rig is primarily intended for single step all-grain infusion mashes and is designed as a small footprint pilot brewery for commercial use. However, it makes excellent homebrews of up to 80 liters (one English barrel) a batch at a maximum of 5.8% ABV strength. Most brews are in the range 4.3–5.3%. The rig could easily be adapted for multi-step RIMS by fitting a copper coil inside the hot liquor tun (HLT) and adding an extra pump. Each vessel is crafted from re-engineered 18-UK gallon barrels.

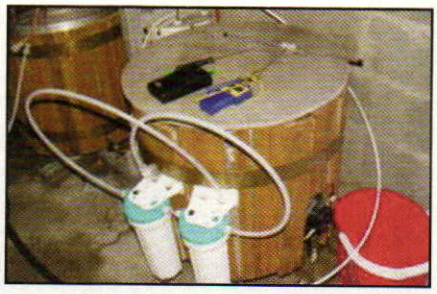
The HLT and copper tun each have a steel cross-section welded to them, in the center of which is a 'spike' that slots over a receiving spike on the frame. The capacity of the HLT and copper is 80 liters. The mash tun has a slightly different arrangement, incorporating a removable pin. The mash tun can then swivel through 90 degrees to allow spent grain dumping. Its capacity is roughly 50–60 liters and incorporates a full size, stainless steel removable false bottom. The copper tun has a small, domed hop screen, also made from stainless steel.

Each vessel is wrapped with heavy-duty bubble wrap that is secured in place with a set of wooden slats. These are held in position with brass straps that fit around the circumference of each vessel. Not only does this look pleasing, but it also provides enough insulation to ensure that the mash temperature is maintained.

Each vessel has an Aquaseal lid, about ⅜" thick that completes the insulation. Aquaseal is like fiber board but is water and stain resistant. The HLT and copper tun are both fitted with single, 13-amp, 3-kilowatt electric heating elements. To prevent potential burnout, float switches have been fixed just above the elements. The HLT has a thermostat attached that can be set at any temperature up to 80 degrees centigrade. A small stainless steel pump controls liquid flow.

Both the HLT and copper tun have valves and copper piping that is arranged around a 'T' that flows out to the vertical sparge pipe. The pipe is fitted with a threaded union onto which I can screw the sparge arm or a tube that circulates via the counter-flow chiller.





(Top): The chiller control panel regulates the chilling of green beer from 0–15 °centigrade.
(Right): This electrical junction box protects the live wires and is water tight.
(Bottom Left): here the pump can draw from either the HLT or the copper tun.
(Bottom Right): Two inline cartridge filters clean up beer from the conditioning tank.

we want you

Do you have a system or some unique brewing gadgets that will make our readers drool? Email a description and some photos to **edit@byo.com** and you too may have a claim to fame in your brewing circle!

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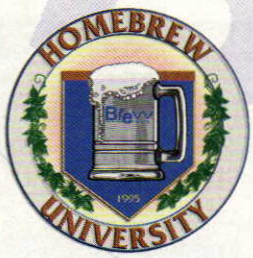
homebrew DICTIONARY



S is for . . .

saccharification: the process of converting starches contained in malt into fermentable sugars

saison: a Belgian beer typically amber in color and top-fermented. At least 90 days of bottle conditioning is called for in this beer, that has a noticeable fruity flavor and alcohol percentage of about 5% by volume.

secondary fermentation: the second, slower stage of fermentation that takes place after primary fermentation has forced solids out of solution and the brew is racked to a closed bin (the "secondary fermenter").

sediment: the solid material that falls out of solution during fermentation (more so in the primary fermentation, but also in the secondary for certain brews.)

six-row barley: a variety of barley that grows six rows of grains and has more husk material by proportion than the more pristine two-row variety. The result is a less developed grain that yields less in the way of extract.

skimming: the process of removing the top layer of yeast that forms on the head of the brew during primary fermentation (with a tool known as a *skimming oar*). Brewers can utilize this process to save the yeast for later use.

smoked malt: a smoky flavored malt that gains its flavor through drying over open fire.

soft water: water that is free of calcium, magnesium, cholorine, iron and other elements that otherwise contribute to "hard water."

sparge: a process that brewers conduct during mashing in which spent grains are sprayed with hot water in order to extract the remaining sugars from the husks.

specific gravity (SG): a measurement that represents the density of a liquid at a specified temperature. Pure water is given a value of 1.000 SG at 39 °C (4 °C). This measurement is highly used in brewing in order to monitor various processes from boiling throughout fermentation.

homebrew CALENDAR

7th Annual Drunk Monk Challenge

March 12, 2005
Aurora, Illinois

The Urban Knaves of Grain are proud to present the 7th Annual Drunk Monk Challenge — a qualifying event for the Masters Championship of Amateur Brewing (MCAB) and the first leg of the Midwest Homebrewer of the Year. All styles from the 2004 BJCP guidelines will be accepted along with the special "Menace of the Monastery" category. The fee for this event is $5 per entry online, $7 per entry via mail and Menace of the Monastery entries are only $3 (online). The entry deadline is March 5 and the awards ceremony will take place on March 12. Contact Rodney Kibzey via telephone at 630-889-9610 or email at rjkchicago@aol.com. Visit the Knaves online at http://knaves.org/dmc for further information.

SODZ 2nd Annual British Beerfest Competition

April 1, 2005
Powell, Ohio

This year's SODZ British Beerfest Competition will be held on April 9 at the Leatherlips Yacht Club located at 9230 Shawnee Trail in Powell, Ohio. The competition will accept all English style entries including the following categories as defined by the 2004 BJCP Style Guidelines: 8, 9, 11, 12, 13, 14, 19, 24, 25, 26, 27 and 28 (mead included). Fees are $6 for the first entry and $4 for each additional entry. Please send two bottles per entry to: Thirsty Dog Brewing Company, C/O Eric Asebrook/SODZ Competition, 45 West Alex-Bell Road, Centerville, Ohio 45459 before April 1. For pre-registration online, visit www.sodz.com, or call Frank Barickman at (614) 354-8750 for more information.

27th annual AHA National Homebrew Competition

April 4, 2005
Multiple sites across the U.S.A.

The first round of the AHA's National Homebrew Competition is accepting entries from April 4–15 at regional sites. For full information, visit the official Website at www.beertown.org/events/hbc.

replicator

by **Steve Bader**

Dear Replicator,

A couple of years ago my husband and I took a trip to Fort Bragg, California for our anniversary. While we were there, we had dinner at the North Coast Brewing Company. We sampled all of their brews and the Blue Star American Wheat was awesome, by far our favorite! It is the best wheat beer that either of us have ever tasted; unfortunately I can't usually find it locally. I've brewed a number of wheat beers, but nothing has come close to the Blue Star flavor. Can you help us out with a recipe?

Kim Bishop
Santa Rosa, California

I talked to Head brewer Chuck Martins about the process of brewing this wonderful beer. Chuck has been a brewer at North Coast for 12 years and was a homebrewer prior to this job. Chuck said that the Blue Star American Wheat was originally made in 1995 and has been a regular beer in their lineup ever since.

Chuck described Blue Star American Wheat as a beer with a clean, neutral yeast profile, with the distinct flavor of wheat in the malt. As for hops, the beer carries a decidedly Yakima hop profile. The Yakima Valley (and city of Yakima) in Washington State is at the center of the U.S. hop producing area. The most famous hop to come out of the Yakima Valley is Cascade, which is the hop used in Blue Star American Wheat. Cascade has a signature "citrus" flavor that brings out the crisp flavor in the Wheat Beer style.

Chuck appreciates this beer as a great year-round beer, even though many people consider wheat beers as summer refreshments.

Part of the difficulty in making a beer like this is the fact that it is a simple beer to be made very clean. The malt and the hop levels are subdued in this brew, so, as is the case with the more delicate-flavored beers, flaws in the beer are more noticeable than in heavier, darker beers. I would suggest putting a little extra care in sanitation, brewing methodology and then fermenting at a stable temperature as close to 68 °F (20 °C) as possible.

For more information you can visit the North Coast Brewing Website at www.northcoastbrewing.com or call the brewery at 707-964-2739.

North Coast Brewing Blue Star American Wheat

(5 gallons/19 L, extract with grains)

OG = 1.046 FG = 1.008
IBUs = 18 SRM = 5 ABV = 4.9%

Ingredients

3.3 lbs. (1.5 kg) Briess Wheat malt extract syrup
1.0 lb. 14 oz. (0.85 kg) Briess Light dried malt extract
0.5 lbs. (227 g) wheat malt
0.5 lbs. (227 g) pale 2-row malt
0.5 lbs. (227 g) Carapils (dextrin) malt
3.3 AAU Cascade hops (60 mins)
(0.58 oz./16 g of 5.7% alpha acid)
4.8 AAU Cascade hops (15 mins)
(0.84 oz./24 g of 5.7% alpha acid)
2.8 AAU Cascade hops (0 mins)
(0.5 oz./14 g of 5.7% alpha acid)
White Labs WLP001 (California Ale) yeast or Wyeast 1056 (American Ale) yeast
0.75 cup (180 mL) corn sugar (for priming).

Step by step

Steep the 3 crushed malts in 3 gallons (13.5 L) of water at 154 °F (68 °C) for 30 minutes. Remove grains from wort, add the malt syrup and dry malt extract then bring to a boil. Add the Cascade hops and boil for 60 minutes. Then add the second addition of Cascade hops for the last 15 minutes of the boil. At the end of the boil add the last addition of Cascade hops for aroma.

Now add wort to 2 gallons (9 L) of cool water in a sanitary fermenter, and top off with cool water to 5.5 gallons (25 L). Cool the wort to 75 °F (24 °C), aerate the beer and pitch your yeast. Allow the beer to cool over the next few hours to 68 °F (20 °C) and hold at this temperature until the beer has finished fermenting. Sanitize all of your bottling equipment, it's time to bottle. Enjoy!

All grain option:

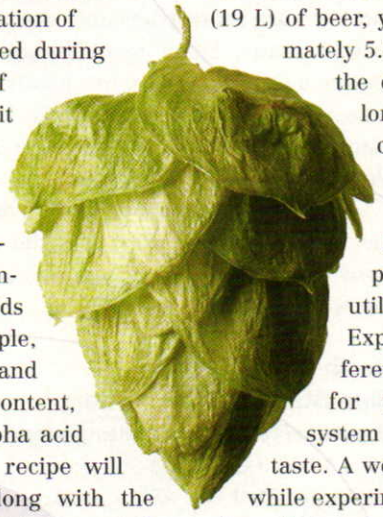
This is a single step infusion mash. The grain bill for this beer is 3.3 lbs. (1.5 kg) wheat malt, 5.5 lbs. (2.5 kg) pale 2-row malt and 0.5 lbs. (226 g) Cara-Pils (Dextrin). Mash the three grains together at 154 °F (68 °C) for 60 minutes. Collect approximately 7 gallons (32 L) wort to boil for 90 minutes and have a 5.5-gallon (25 L) yield. Lower the amount of the Cascade hops in the boil to 0.5 ounces (42 g) to account for the higher extraction ratio of a full boil. The remainder of the recipe follows the same step-by-step instructions as given in the extract version starting with the cooling of the wort to 75 °F (24 °C) for fermentation.

Intro to Hop Utilization

Adjusting your boil volume to control bitterness extraction

by Garrett Heaney

Hops are responsible for a number of flavors in brewing, above all, bitterness. The hop plant, and derivative hop pellets and extracts, contain different levels of alpha acids. While boiling, the alpha-acids within the hops go through a chemical reaction called isomerization and convert to iso-alpha acids — the resins that ultimately provide bitterness to your otherwise sweet malt. Hops, therefore, are measured for alpha acid content and assigned values to give brewers an approximation of the potential bitterness that can be extracted during the boil. The most common measurement of bitterness is the international bitterness unit or "IBU." This measurement is usually included with a recipe to describe the overall bitterness of the beer. A common measurement for hop bitterness among homebrewers is the alpha acid unit or AAU, a number that describes the amount of alpha acids contained within an ounce of hops. For example, if a recipe calls for 6 AAUs of a hop variety and a brewer is using hops with 3% alpha acid content, he will need 2 ounces.; or, if he has 2% alpha acid hops, he will need 3 ounces. Typically, a recipe will include both an AAU recommendation along with the appropriate time the hops need to be boiled to extract the required bitterness.



Recognizing the relationship between hops and alpha acids is important, because it allows the brewer to control the bitterness of the beer. Similarly, the more that a brewer understands about the relationship between boiling and extracting bitterness from hops (i.e. **hop utilization**), the better he will be able to perfect his final beer. Luckily, the biggest influence a brewer has in controlling hop utilization is as simple as adding water to the boil. Boil volume, or more specifically, wort concentration, has a direct impact on the effectiveness of extracting the bitter resins (iso-alpha acids) from hops. More concentrated worts (i.e. worts with higher gravities) are less suitable environments for isomerization to occur. Thinner worts with lower specific gravities allow for greater hop utilization and extraction of bitterness.

In general, no matter how sound a homebrewing setup, a brewer will only be able to conduct a boil with 18–30% hop utilization. This means that out of all the alpha acids in a particular hop, only 18–30% will be isomerized into the bitter iso-alphas for your beer. This percentage will fluctuate (inversely) with the concentration of the wort. Thick worts, with approximately 1.112 SG will allow for less than 20% hop utilization, while thinner worts of about 1.048 SG will be capable of 25% or greater. For a rundown of wort gravities and respective hop utilization percentages, check out the table we've provided below. If you want to shoot for the maximum level of hop utilization, your best bet is to conduct a full wort boil — containing a greater wort volume than your full batch of beer will amount to. If you're making 5 gallons (19 L) of beer, you'll want to start your boil with approximately 5.5 gallons (21 L) of wort and boil it down to the desired amount. If you find this takes too long, you can try working with a more concentrated wort. The time factor is really the biggest advantage to a concentrated wort. Concentrated worts take less time to boil, but sacrifice hop utilization. Like all processes in brewing, boiling and hop utilization become better with experience. Experiment with different wort gravities for different styles of beer and find what works best for your system and taste. A worthwhile experiment for all brewers to conduct is to clone a certain beer with a known IBU rating. When the beer is ready to drink, compare it to the commercial beer that was cloned and focus on the hop bitterness. Given the results, you'll have an idea of whether your hop utilization was better, equal to or less than commercial brewers and you can adjust your brewing practice accordingly.

Hop Utilization vs. Specific Gravity

°Plato	SG	Hop utilization (%)
12	1.048	25.0
13	1.052	24.7
14	1.056	24.4
15	1.060	24.0
16	1.064	23.8
17	1.068	23.4
18	1.072	23.0
19	1.076	22.7
20	1.080	22.3
21	1.084	21.9
22	1.088	21.6
23	1.092	21.2
24	1.096	20.9
25	1.100	20.5
26	1.104	20.2
27	1.108	19.8
28	1.112	19.5

* for pellet hops boiled for one hour

Hop Growing Tips

Two hop professionals reveal tricks of the trade

by Thomas J. Miller

Freshops

Dave Wills is the owner of Freshops, a purveyor of fine hops, hop oil, and hop rhizomes. His business is located in Philomath, Oregon.

You don't need much land to grow hops — a two-foot by two-foot (0.6-m by 0.6-m) plot will do. The plants grow vertically, so if you have a nice southern location on your house and some support (like a pole or a string) hops should grow fine. I would not recommend using pots, however. These plants grow 18 feet (5.4 m) vertically in three months so they need more root support than pots provide.

A strong support system is needed for the plant to climb. Look for space along fences, garage or property lines. Plant in early spring once the threat of frost is gone but no later than May. The soil where you plant the hops should be tilled to create a weed free area and be worked into a friable condition. In cold climates you can plant rhizomes in pots and transplant them in June. Hops prefer full sun and rich soil, preferably light textured and well-drained with a pH of 6.5–8.0.

If drainage is a problem, small mounds can be built using surrounding topsoil mixed with organic matter. Plant one rhizome per hill with the buds pointed up and cover with one inch of loose soil. Hills should be spaced at least three feet (0.9 m) apart if the hops are of the same variety and five feet (1.5 m) apart if they are not.

The first year the hop plant has a minimal root system and requires frequent, but light watering — be careful not to drown it with too much water. Mulching the soil surface with some organic matter helps conserve moisture and control weeds.

Each spring apply a hearty dose of manure as a top dressing or fertilize with a balanced chemical fertilizer that is recommended for garden vegetables. Don't expect very much in growth of flowers the first year because the hop is basically establishing its root system. Full growth and a maximum crop of flowers will be achieved during the second year.

When the young vines are about one foot (0.3 m) long, two to six vigorous vines are selected for each hill and the rest removed. One to three vines can be trained clockwise on a string that has been staked to the hill. Hops mainly grow vertically, but lateral sidearms extend from the main vine and produce flowers. The main concern is to support the vines and prevent sidearms from tangling. Most cones are produced on the upper part of the plant. In July, the lowest four feet (1.2 m) of foliage and lateral branches can be removed to aid in air circulation and reduce disease development. The removal of lower leaves (stripping) must be done carefully to avoid breaking or kinking the main stem. In August, allow additional bottom growth to remain in order to promote hardiness of the crown and plant vigor for next year.

At the end of the season you can bury healthy bottom vines for propagating new plants the next spring. Simply bury the vines in a shallow trench and mark their location. In spring dig them up and cut them into pieces about four inches (10.2 cm) long. Make sure each new cutting has an eye or bud. The following year, the harvest date will vary with variety and location. At maturity, the hop aroma is at its strongest and is measured by crushing a cone and smelling it. The yellow lupulin glands in the cone become much more evident and plump looking when magnified.

The cone will develop a drier, papery feel as it matures. Some browning of the lower bracts is a good sign of ripeness. Squeeze the cones as they develop and you will notice they become more resilient.

After picking the flower cones (without the leaves), drying can be done in a good dehydrator, custom made hop dryer, well-vented oven or you can simply air dry. If you use heat, the temperature should not exceed 140 °F (60 °C). Under dry weather conditions, I suggest taking a screen off of your house and setting it up in a wind protected area, elevated on each end. Spread the hops as shallow as possible and fluff daily so moist inner cones are brought to the outside of the pile. If weather is dry and the pile is not too thick they will dry in about three days.

A high moisture content in the cones will adversely affect storability and recipe formulation. The hops are dry when the inner stem of the cone (strig) is brittle and breaks rather than bends. The strig takes much longer to dry than the bracts, so be patient. Be sure to store the hops in an airtight container in the freezer until used.

Diana Puterbaugh, of Puterbaugh Farms in Mabton, Washington, has been selling hop rhizomes (roots) for years online and has hosted a chat room on the same topic. She also grows hops commercially.

The "best" conditions for growing hops is a south to southwest facing spot with a structure of some kind on which the hops can grow (e.g. a fence, garage, deck or trellis). Hops need lots of daylight and love the heat of summer.

Good soil comes next. I would first suggest mixing some old mulch and fertilizer into your plot with a shovel. Dig quite deep, approximately two feet (0.6 m) down and roll the soil and additives around to loosen the ground where the new roots will grow.

Give the area a good drink of water and see how well it drains. Improve the planting area if it drains poorly. Hops begin best as a root and like to be planted early in the year (March or April, depending on location). Just make sure the topsoil is not frozen.

One hill of three or four established hops roots should provide about twenty pounds of fresh hops in the fall. The first year yields are usually a lot less. Baby hops require a bit of attention, but once established, the hop will grow pretty much on its own.

Create your hop hills about five to seven feet apart (2.1 m) (if planting more than one variety or more than one hill). Keep in mind these plants will grow excessively. In the summer, many of our hops will grow a foot in one day. That's no exaggeration!

Also, remember hops need something to climb on. We frequently sell hop twine (jute) to our customers because the hop requires a coarse string. Basic string or wire is too slick and the plant just will not make it.

Do keep in mind that when the plant reaches about two feet (0.6 m) in height, it will need a little help going in the right direction. They need to be trained around the string in a clockwise direction. Like a sunflower, the head of the hop will follow the sun each day. Just gently wind the young plant shoots (once long enough) around the string to get it well established.

Later in the fall, as the hops reach maturity the flowers will bloom like a rose bud. The cone petals will have a "give" to them when squeezed. Sort of a springy feel and, of course, the aroma will be evident, too.

Not Digging Diacetyl

"Help Me, Mr. Wizard"

Targeting strike temperatures and a clove-laden homebrew

I have just started brewing lager beers, but have had problems with my first batches. The problem is the production of diacetyl. I just can't seem to get rid of it. I believe that I am following good lagering technique, but my beer tastes like a butterscotch sundae. Here is what I am doing: After wort production, 5 gallons (19 L) total, I am chilling the wort to 52 °F (11 °C) overnight. I then pitch a 2-quart (~2-L) slurry of yeast, the strain is Wyeast 2007 Pilsen Lager Yeast. I ferment for two weeks at 52 °F (11 °C), then raise the temperature to 60 °F (16 °C) for three to four days to finish the fermentation. I chill the beer down to 32 °F (0 °C) at a rate of 4 °F (~2 °C) per day. I rack the beer to a keg for final lagering and lager at 32 °F (0 °C) for four weeks. The problem is that I cannot taste the diacetyl in the green beer, I can only detect it after the lagering period. I am trying to salvage this batch by depressurizing the keg, pitching a fresh slurry with a little extra corn sugar to feed the yeast as a makeshift kraüsening method, then refermenting at 60 °F (16 °C) for a couple of weeks and relagering. I am fairly experienced with sanitation, but I cannot completely rule out contamination without a microscope. I have produced many good ales with no contamination in the past. Is there any hope or am I an ale drinker for the rest of my days?

Darrin Burchell
Paris, Kentucky

The first thing that comes to mind when contemplating diacetyl problems is yeast strain. I have not personally used Wyeast 2007 Pilsen Lager Yeast, but after reading its description and learning that it is not highly flocculent, I don't believe this yeast is prone to diacetyl-laden beers. Highly flocculent yeast strains are often associated with diacetyl problems because the yeast drops out of solution before the diacetyl in the beer is reduced.

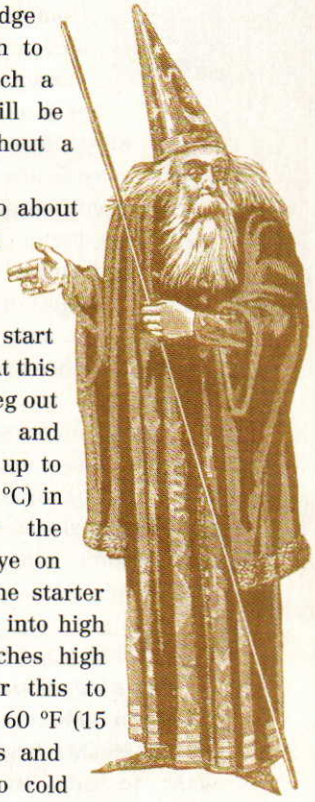
The observation you make about detecting no diacetyl in the green beer before racking but picking it up after is important. You indicate that you ferment the beer to completion, raise the temperature for a diacetyl rest, chill to 32 °F (0 °C) then rack it to lagering. I think what is happening is that you are picking up some oxygen during your racking step and the oxygen converts diacetyl precursor (i.e. alpha acetolactate) in the green beer into diacetyl during lagering. You have already cooled the beer to 32 °F (0 °C) and the yeast is inactive.

Another possible cause is bacterial growth that occurs slowly and shows up later in the process. If you maintain effective sanitation practices and ferment with healthy yeast, this is probably not the problem. Yet another possibility is that you only detect the diacetyl late in the process when some of the "funky" flavors associated with fermenting and young beer have mellowed; the diacetyl was present before you racked to lagering, but you were unable to taste it.

Let's get back to the "late blooming" diacetyl. This is actually quite common and is caused by prematurely chilling the beer. What happens is that diacetyl precursor remains in the beer after the yeast has been effectively knocked out by chilling. Any oxygen or oxidizing ions like iron or copper can later convert the precursor to diacetyl and there will not be any yeast left to mop it up. Kraüsening is definitely an effective technique to correct diacetyl problems associated with rushed fermentation . . . bacterial problems however cannot be mended by this technique.

Most brewers who kraüsen add about one part kraüsen beer to nine parts finished beer. The key to the method is having an actively fermenting population of yeast. The high kraüsen stage of fermentation is the peak of excitement — for ales this occurs about 24 hours after pitching and for lagers about 48–72 hours after pitching (both durations are heavily influenced by yeast health and pitching rate). You are on the right track with your proposed remedy, but adding corn sugar and yeast to finished beer will not rapidly kick-start the uptake of diacetyl.

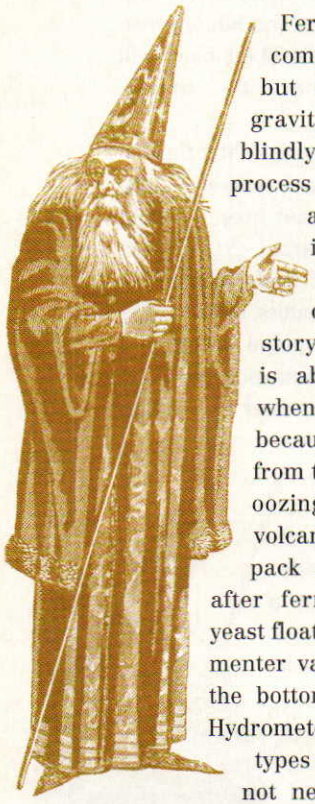
If you are going to take the time to save your buttery brew, spend a little time making a kraüsen beer. I would suggest making 2 quarts (~2 L) of wort using dry malt extract and a sprinkle of hops to get the bitterness in the same ballpark as your troubled batch. If I were doing this I would boil the wort for 30-60 minutes, transfer to a gallon jug, screw on the lid and throw it in the fridge or in an ice bath to cool it down. Such a small volume will be easy to cool without a wort chiller.



Once cooled to about 68 °F (20°C), add a pack of Wyeast 2007 Pilsen Lager Yeast and start the propagation. At this time, move your keg out of cold storage and allow it to warm up to around 60 °F (15 °C) in preparation for the yeast. Keep an eye on the progress of the starter and when it kicks into high gear (i.e. approaches high kraüsen), transfer this to your keg. Hold at 60 °F (15 °C) for 1–2 weeks and move it back into cold storage. You may want to rack before transferring back to the cold to remove the yeast added with the kraüsen beer.

I do not think lager fermentations are difficult once you get the hang of them. My personal experience with lagers has taught me to stay on guard and never make assumptions. The key things that I stay focused on with lager

brewing is pitching rate, wort aeration, fermentation temperature and tracking the fermentation with a hydrometer. I used to base my decisions largely on time and by nose — but was burned several times by poor decisions. Your process description is solid except you omit the key confirmatory piece of data — specific gravity. Fermentation should be complete in two weeks, but without taking a gravity sample you will blindly go to the next process step only to be disappointed to find out it's too late.



Ales are often a different story. Frequently there is absolutely no doubt when fermentation begins because yeast is flowing from the blow-off like lava oozing from an active volcano. Most ale strains pack up and head south after fermentation and the yeast floating on top of the fermenter vanishes and sinks to the bottom of the fermenter. Hydrometer checks with these types of fermentations are not nearly as critical but the diligent brewer will check just to confirm.

There is an old saying in carpentry, measure twice, cut once. The same idea can be applied to stepping through the stages of lager fermentation. Don't be discouraged in the future!

Tightening your temperature

I have talked to some friends about building a RIMS unit into my newly purchased MiniMash system. The reason I want to add this component is because I'm not able to hit my strike temperature consistently (as I don't know the mash tun thermal mass, even after contacting the manufacturer). They say to just pre-heat the tun with hot water and the thermal mass will be zero. They are discouraging me from adding this equipment for the following reasons: extra expense, more equipment to clean and maintain, more time required to mash and more complications hitting mash temperatures when compared to infusion mashing. When they talk of commercial breweries, however, they say that everyone vorlaufs in order to hit mash temperatures and clarify wort. Isn't that the same thing as incorporating a RIMS? I'm just looking to have better control over the mash temperatures and RIMS has to be easier than step mashing with additions of hot water, right?

JC Converse
Aliso Viejo, California

I must confess that I am one of those particular brewers who likes nailing my target temperature and appreciate the gadgets of modern brewing. I have a mash mixer where I work that is externally heated with steam and we have a computer system that automatically controls the mashing sequence. We even have some programming code to calculate how hot the mash water needs to be in order to hit our strike temperature depending on the malt temperature and our chosen ratio of water to grist. I do not believe, however, that this type of precision and accuracy is required for brewing great beer. It simply makes consistency easier when consistency is important.

In our brewery we do not use the recirculating infusion mash system (RIMS) for mash heating, but we do vorlauf. These two terms do not mean the same thing. Vorlauf is the first step of wort collection (one translation of vorlauf into English is "forerun") and serves two purposes — hitting mash temperature is not one of them.

The vorlauf removes weak wort from the under-plate area of a lauter tun and returns this weak wort to the top of the grain bed. Strictly speaking, a lauter tun is only used for wort separation and is filled with mash after mashing has occurred. The false bottom of a lauter tun is covered with water before filling and that is why there is weak wort in the under-plate area. The vorlauf also helps clarify the wort before sending it off to the kettle. Most commercial brewers vorlauf for about 20 minutes and this time permits about 40% of the liquid in the mash to be recirculated.

The RIMS just happens to recirculate wort from the infusion mash tun (combination mash and lauter vessel) continuously during mashing to move the wort through an in-line heater. The primary objective of this recirculation is to heat the wort and wort clarification is simply an unintended bonus.

There is no doubt that a RIMS retrofit will add the features you desire. You can also do step mashing by adding known volumes of hot water provided you hone your technique, collect data and accurately measure your ingredients. I am not surprised that the manufacturer of your brewing rig does not know its thermal mass, but if you know how to deal with that variable in a calculation, you also know how to determine it empirically. Some engineers consider this to be a miscellaneous heat loss term and add a loss term into their energy balances.

In layman's terms, if you use room temperature malt and determine the water temperature needs to be 162 °F (72 °C) to hit a mash temperature of 150 °F (66 °C) and you come in at 148 °F (64 °C), use hotter water the next time around. As long as your malt and mash tun are at room temperature (or your mash tun is always pre-heated to some temperature) and you know the ratio between water and malt you can empirically determine an off-set. My rule of thumb for infusion is to add 12 °F (7 °C) to the desired mash temperature to determine water temperature. This assumes a 3:1 ratio between malt and water and that the malt is at 68 °F (20 °C).

Once you have a single infusion dialed in you can begin to develop your method of adding hot water to increase mash temperature. Again, the key is keeping good records and measuring the amount you are adding. Brewers in Europe used decoction mashing long before the advent of thermometers and many argue that consistency was one of the reasons.

A word of advice on thermometers is to have little faith in their accuracy,

especially if they are the bi-metallic type with a dial indicator. I strongly recommend periodically measuring the temperature of an ice bath and the temperature of boiling water. Your thermometer should read 32 °F (0 °C) and 212 °F (100 °C) respectively. If it does not, adjust the calibration screw on the dial or rotate the dial face by using the nut on the stem to make the thermometer read properly in the ice bath (an ice bath temperature is not subject to changes in atmospheric pressure like the temperature of boiling water). It's your choice, but if I had just bought some new brewing equipment I would try to fine-tune my method before modifying the design.

My beer tastes clovey

I have just racked 10 gallons (38 L) of an American pale ale into its secondary fermenter. I have brewed this all-grain recipe many times. It is a favorite amongst my family around the holidays so I am a bit concerned. You see, it smelled and tasted different than it ever has before, and I suspect that it has some kind of infection. It had a very distinct clove taste to me, very similar to a Celis White. I'm from Texas and I used to drink Celis quite a bit when it was brewed in Austin, so I do not necessarily consider it a bad taste. I have a two part question: Is it possible that the flavor is from wild yeast rather than bacteria, and assuming that it tastes good, is it all right to drink? The second part of my question has to do with the fact that I did not get my yeast starter going in time — I used Wyeast 1056 American Ale Yeast and did not get around to pitching it until two days after I brewed. The wort was sitting at fermentation temperature (68 °F/20 °C) for two days and I am meticulous about sanitation. I have never waited this long to pitch. Assuming that one uses good sanitation, is it still likely that the yeast will get contaminated if it's not pitched immediately?

Kyle Newman
Dallas, Texas

The clove-like flavor you describe is a relatively common flaw in beer and usually comes from one of two places. Some brewing strains are termed phenolic off-flavor positive (POF+) and are capable of converting ferrulic acid in malt to 4-vinyl guaiacol, a compound that smells like cloves. Ale strains used in German weizens are POF+ as are many Belgian ale strains. Lager strains, on the other hand, are always POF- and some ale strains are slightly POF+ and produce just enough 4-vinyl guaiacol to be detected. Wyeast 1056 American Ale Yeast is POF-, so the flavor is not associated with the pitching yeast unless the yeast was contaminated at the lab or mislabeled, two possibilities that can never be ruled out.

Many "wild" or non-brewing yeast strains produce this clovey flavor and many brewers associate this problem with wild yeast. Most brewers these days use closed wort coolers (as opposed to the cool ships of yesteryear)

and really do not operate in an environment at risk for yeast drifting in from the environment. If you told me you used an open fermenter, this possibility would certainly be a prime candidate. I am assuming that you did not leave your wort in an open container for two days prior to pitching (and hope this is a safe assumption!).

The other common cause of phenolic off-flavors comes from wort spoilage bacteria. One commonly implicated bug is Obesumbacterium proteus. This critter can be picked up from wort coolers or any contact of boiled and cooled wort with non-boiled wort. I have brewed beers that I was convinced were contaminated with this bug because the intensity of the off-flavor was extremely high — this is a trait of the bacteria as is a healthy dose of DMS. Beers spoiled by Obesumbacterium proteus taste extremely foul and in my opinion are totally undrinkable — prime candidates for the sewer.

If your beer is similar to Celis White with respect to the cleanliness and intensity of the clove aroma I would really doubt that Obesumbacterium proteus is the culprit. If your palate is biased and tends to be a bit forgiving, you may be understating the aroma. Wort spoilage bacteria require time to do their dirty work and this brew certainly had the time available.

The assumption that a homebrewer can produce sterile wort that can sit unpitched in a fermenter is not one I readily accept. In the food industry this type of processing is called aseptic processing. The mechanics of sterilizing a food product with heat and then transferring the sterile product into a container for storage are held in high regard. Furthermore, the container must be protected in such a way that contamination from the environment is nearly impossible. Wort cooling, aeration and transferring to the fermenter are far from perfect and most brewers want to get fermentation rolling as soon as possible to minimize the risk of spoilage. With that being said, the most likely problem is the two-day wait before pitching. If the clovey beer is not objectionable to your palate I would suggest drinking it and renaming it something like pseudo-Celis! In the future however, you can always do yourself a favor and adjust your brewing schedule to pitch earlier.

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!

American Cream Ale

An American "retro" brew

by Horst D. Dornbusch

The universe of beer is neatly divided into two camps, ales and lagers. However there are exceptions — cream ale being one of them. Oddly, in spite of its name, this beer style can be brewed authentically with either ale or lager yeasts, or even with a combination of the two. There is a consensus that cream ale is an indigenous American pre-Prohibition style. It is traditionally (but not always) made from six-row malt and a certain portion of adjuncts such as corn grits, which make for a highly attenuated brew with a dry finish.

Commercial cream ales nowadays are rare. They are invariably light-bodied and usually well carbonated. In appearance, they are usually a very pale, golden color — paler with the addition of more adjuncts. They taste relatively low in diacetyl and estery fermentation byproducts — though estery notes are often detectable in the nose. Cream ales also tend to be low in hop bitterness and in maltiness. Instead, their middle flavor is usually characterized by a grainy sweetness from the adjuncts. In the finish, cream ales can be slightly fruity and end on a note of pronounced dryness.

american cream ale by the numbers

OG	1.044–1.052
FG	1.007–1.010
SRM	2–5
IBU	10–22
ABV	usually 4.2–5.6%

Subjectively, this beer is best when chilled and served as a thirst-quencher. The above description is admittedly vague. Yet, for those in search of a more precise brew-technical definition of cream ale there is next to no definitive documentation available that would tell us how cream ale ought to be brewed. Even a glance at the medalists in the cream ale category at the Great American Beer Festival does not advance our understanding: In 2004, for instance, the cream ale gold went to Red Dog, a pure lager with an ABV of 5%, brewed by the SAB/Miller subsidiary Plank Road Brewing Company. Special Export from the Pabst Brewing Company, a brew that is usually considered an American adaptation of a Dortmund Export, took the silver, while the bronze medal went to what many people consider *the* classic, hallowed cream ale, Genesee Cream Ale from the High Falls Brewing Company in Rochester, New York. Introduced in 1960 and often falsely identified as a malt liquor, good old "Genny" has a certain nostalgia value for the baby-boom generation. It is a pure ale with an ABV of 5.1%. It is well aged and then kräusened before packaging for natural carbonation. In deference to "Genny," our Cream-of-the-Crop Ale also finishes at an ABV of approximately 5.1%.

Cream ale's roller-coaster history

Cream ale came into being sometime in the 1880s. It was an invention

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RECIPE

Cream-of-the-Crop Ale

(5 gallons/19 L, all-grain)

OG = 1.048 FG = 1.008
IBU = 18 SRM = 3–3.5
ABV = 5.1 %

Ingredients

5.1 lbs. (2.3 kg) American six-row pale ale malt (1.7–2.0 °L)
3.1 lbs. (1.4 kg) American pale ale malt (3.2–3.6 °L)
1 lb. (0.45 kg) corn sugar
4.75 AAU Cluster hops (bittering, 60 mins) (0.79 oz./22 g of 6% alpha acid)
1 oz. (28 g) Cluster hops (aroma)
1 tablespoon Irish Moss
1 package each of White Labs WLP810 (San Francisco Lager) yeast and/or Fermentis Safale US-56 dry "Chico" ale yeast
1 cup corn sugar (for priming)

Step by Step

Using 3 gallons (11 L) of hot brewing liquor, mash in at 148–150 °F (64–66 °C) for a one-hour amylase rest. At this temperature, the enzymes produce mostly fermentable sugars. This helps create a dry finish. Then increase the temperature, using a combination of hot-water infusion and direct heat, to 168 °F (76 °C) for the mash-out.

Recirculate the run-off for 15–20 minutes, until it runs very clear. Then start lautering and sparging, until the wort in the kettle reaches a gravity of roughly 1.048 (12 °P).

Add the corn sugar and boil for 75 minutes. Add the bittering hops after 15 minutes and

continued on page 20

continued from page 19

the aroma hops and Irish Moss after 70 minutes. After shutdown, check the gravity and add cold water to adjust for evaporation losses until the original gravity measures 1.048 (12 °P). Then let the brew rest for at least 15 minutes to let the trub settle. Siphon the wort off the trub and heat exchange it to the pitching temperature of 70 °F (21 °C) or slightly below.

Pitch the ale or lager yeast of your choice, or pitch both yeasts simultaneously. Primary fermentation at this temperature should be rapid, probably lasting no more than three or four days. Check the final gravity. Once it has reached about 1.008 (2 °P), let the brew rest for another two days to allow the lees (yeast sediment) to settle. Rack into a clean fermenter for conditioning at a temperature as low as your equipment allows, but at least down to approximately 40 °F (5 °C). Let the brew mature for about 10 days and rack again. Finally, prime the brew with corn sugar for packaging. The cream ale is ready for drinking after another two weeks.

Flaked maize option:

Replace corn sugar added in kettle (not the priming sugar) with 2.0 lbs. (0.91 kg) flaked maize. Add another 0.5 gallons (1.9 L) of water to mash to hit proper mash consistency. Flaked maize will add more corn flavor to the beer. Corn sugar is flavorless.

Corn grits option:

Replace the corn sugar with 2.0 lbs. (0.91 kg) of corn grits. With grits you will need to perform a cereal mash. See the techniques artcile on page 51 for details. (There is also another cream ale recipe there.) Making a cream ale with corn grits adds the most corn flavor of the options presented here.

Cream-of-the-Crop Ale

(5 gallons/19 L, extract with grain)

OG = 1.048 FG = 1.008
SRM = 3–3.5 IBU = 18 ABV = 5.2%

Ingredients

4.0 lbs. (1.8 kg) American pale liquid malt extract
2.75 lbs. (1.3 kg) American six-row pale malt (1.7–2.0 °L)
1.0 lb. (0.45 kg) corn sugar
4.75 AAU Cluster hops (bittering, 60 mins) (0.79 oz./22 g of 6% alpha acid)
1 oz. (28 g) Cluster hops (aroma)
1 tablespoon Irish Moss
1 package each of White Labs WLP810 (San Francisco Lager) yeast and/or Fermentis Safale US-56 dry "Chico" ale yeast
1 cup corn sugar (for priming)

Step by Step

Coarsely mill the American six-row pale ale malt and place in a muslin bag. Immerse the bag in about 2 gallons (~8 L) of cold water and heat slowly, for about 30 minutes to 170–190 °F (77–88 °F). The steeping liquid must never boil! Lift and dunk the grain bag several times in the liquid like a tea bag to extract the maximum flavor. Then discard the bag without squeezing it. Mix the liquid with about 5 gallons (19 L) of brewing liquor. Heat the liquor and stir in the liquid malt extract. Add the corn sugar. Bring the wort to a boil. For hopping, transferring, fermenting, and packaging, follow all-grain instructions.

Cream-of-the-Crop Ale

(5 gallons/19 L, extract only)

OG=1.048 FG=1.008
SRM=3–3.5 IBU=18
ABV=5.1–5.2%

Ingredients

6 lbs. (2.7 kg) American pale liquid malt extract
1.0 lb. (0.45 kg) corn sugar
4.75 AAU Cluster hops (bittering, 60 mins) (0.79 oz./22 g of 6% alpha acid)
1 oz. (28 g) Cluster hops (aroma)
1 tablespoon Irish Moss
1 package each of White Labs WLP810 (San Francisco Lager) yeast and/or Fermentis Safale US-56 dry "Chico" ale yeast
1 cup corn sugar (for priming)

Step by Step

Mix the American pale liquid malt extract and the corn sugar with your hot brewing liquor in the kettle. Bring the wort to a boil. For hopping, transferring, fermenting and packaging, follow the instructions for the all-grain version.

Add the bittering hops after 15 minutes and the aroma hops and Irish Moss after 70 minutes. After shutdown, check the gravity and add cold water to adjust for evaporation losses until the original gravity measures 1.048 (12 °P). Then let the brew rest for at least 15 minutes to let the trub settle. Siphon the wort off the trub and heat exchange it to the pitching temperature of 70 °F (21 °C) or slightly below.

Pitch the ale or lager yeast of your choice, or pitch both yeasts simultaneously. For the remainder of the fermentation process, see all-grain recipe.

continued from page 19

by American ale breweries who wanted to compete with the lagers that began to spread from the eastern seaboard throughout the New World after the American Civil War. However, there was no single model that set the new anti-lager style. Rather, like much in American culture in those days, the new brew was a "make-do" beer. As such, cream ale was defined by very broad and general concepts of what it was and what it was not: The brew had to be suitable for an ale brewery, but in terms of appearance and drinkability, it had to be more German "lager-ish" than British "ale-ish."

Because cream ale was made by ale breweries which tended not be set up for cold fermentation, it was probably brewed warm regardless of yeast type, at least until Prohibition. Like many beers in the latter part of the 19th century, it was probably more assertively hopped and contained more alcohol than is common today, but we cannot be sure. Because we have no clear evidence one way or the other, we can speculate that the mash composition was fairly flexible, probably involving a combination of two and six-row barleys as well as various adjuncts. The likely result was a good quaffing ale, but one that was probably more effervescent than a British ale.

What then is cream ale?

What we do know about cream ale's past and present makes it sound like a brew of quite indeterminate specifications, a vagueness of definition that constitutes both the style's strength and its weakness. Its strength lies in the brew's sheer infinite adaptability, its weakness in the fact that you never quite know if you hit the mark or if you missed it. This may be a dilemma for a commercial brewer, but it is also the reason why homebrewing a cream ale can be fun. With so few prescriptions to follow, formulating a cream ale recipe is a creative challenge with more improvisation and experimentation than reconstruction of a recipe. Because cream ale can apparently be fermented with lager or ale yeast, our Cream-of-the-Crop Ale uses both types to recreate that hybrid character of a brew that cannot decide if it is an ale or a lager. The resulting brew tastes cleaner and crisper than might be expected from its list of ingredients.

Because of its topsy-turvy history and meandering fortunes, this "retro" ale with lager overtones is clearly much misunderstood and perhaps not as well appreciated as it should be. But, if made with care, cream ale has the potential to be made well at home. To turn a cream ale into a beverage for a contemplative moment, try blending half a pint of it with two shots of plain scotch or rye and a good dash of hot sauce (such as Tabasco). This cream ale shooter is a slammer.

Regardless of its stature in the

annals of beer styles, incidentally, cream ale can lay claim to a much ignored yet very consequential "first" in global brew history: Almost exactly seven decades ago, the very first beer in a can hit the market, and the beer inside that can was...Krueger Cream Ale! It went on sale in Richmond, Virginia, on January 24, 1935 —exactly 13 months and 19 days after the ratification of the 21st Amendment to the U.S. Constitution, which ended Prohibition and made the (legal) sale of beer, including that of cream ale, possible again.

Brewing ingredients and process

With that kind of a genesis and with the large variation of brews currently marching under the cream ale flag, no clear recipe prescription presents itself for this brew. Obviously, there are so many different ways of brewing this style that composing a cream ale recipe is like giving structure to an amoeba. Any choice of recipe leaves much room for debate and none can claim exclusive authenticity. Thus, you should feel free to experiment with this brew. Depart from the recommendations given here with a clean conscience. Just remember these few prescriptions:

•The ingredients for this classic American beer style should be all-American.

•The brew should be warm-fermented and then cool-conditioned (lagered).

•The brew should obtain its uniqueness from a combination of both ale and lager characteristics.

•The brew should be effervescent, sparkling and dry.

The recipe suggested here takes a simple, pragmatic approach. It relies on a grain bill of about 60% enzyme-rich six-row brewers malt (such as Briess) and 40% two-row pale ale malt. The recipe also calls for an addition of corn sugar as an adjunct in the kettle to bump up the alcohol content and to create a dry finish. Feel free to alter, even reverse, these grain ratios or to drop the corn sugar in favor of other adjuncts or more malt. In our recipe, the mash is composed from the two malts to yield a wort with an OG of 1.048 (12 °P).

Extract brewers need approximately 6 pounds (2.7 kg) of liquid malt extract (LME) to create 5 gallons (19 L) of wort at a gravity of 1.048 (12 °P). Note that this quantity varies somewhat in either direction depending on your choice of malt extract brand. Unfortunately there is no LME on the market that is known for certain to contain a significant portion of malt from six-row barley. In fact, with very few exceptions, extract manufacturers tend to be very secretive about the grain composition of their liquid malts.

Extract-only brewers, therefore, cannot replicate the all-grain recipe precisely. Instead, they should make the entire brew with regular American pale ale extract. The result will still be a cream ale!

Extract-plus-grain brewers, too, have a problem, because it would be difficult to achieve the required gravity of 1.048 (12 °P) by merely steeping (instead of mashing) the large amount of six-row malt. As a compromise, therefore, extract-plus-grain brewers should rely entirely on their LME for fermentables and just steep about 2.75 lbs. (1.3 kg) of American six-row pale ale malt — an amount of steeping grain that is still reasonable to handle — for that slightly tannic six-row flavor. These variations in the cream ale malt department for extract-only and extract-plus-grain brewers make the beers no less authentic than the all-grain recipe, principally, because no single, uniformly accepted model for cream ale has come down to us through the decades. Considering that even modern commercial cream ale brewing practices are so varied, dogmatism in the formulation of a homebrew cream ale recipe would be completely out of place.

To follow the all-American theme for ingredients, the recommendation for hops in our recipe is Cluster, for both bittering and aroma, but again, you can use just about any hops you wish. In the 19th century, Cluster was a common hops cultivated in New York and New England, before hop growing moved west. Cluster is a classic American type, which is reputedly a cross between a British cultivated and an American wild variety. Nowadays Cluster comes from the Pacific Northwest and usually has about 6% alpha-acids.

In the beginning, cream ale was obviously brewed with ale yeast and submitted to a cellar regimen that made it more lager-like, but nowadays it can be brewed with either yeast. This gives the homebrewer a complete range of choices. You can pick any one of the yeasts listed below or follow my idiosyncratic practice of using a combination of both American ale and lager yeasts simultaneously. Take your pick among the following American strains: White Labs WLP 001 liquid California Ale yeast, Wyeast 1056 liquid American Ale yeast, Fermentis Safale US-56 dry "Chico" ale yeast and White Labs San Francisco liquid lager yeast WLP 810. Using both an ale and a lager yeast creates some of the ale fruitiness and some of the lager crispness in the finish. Use a fermentation temperature of 65–70 °F (18–21 °C) and a conditioning temperature of approximately 40 °F (5 °C).

Horst Dornbusch has written three books on beer, "Prost! The Story of German Beer," "Altbier" (Classic Beer Style Series #12) and Bavarian Helles (Classic Beer Style Series #17) and writes the "Style Profile" column in every issue of BYO.

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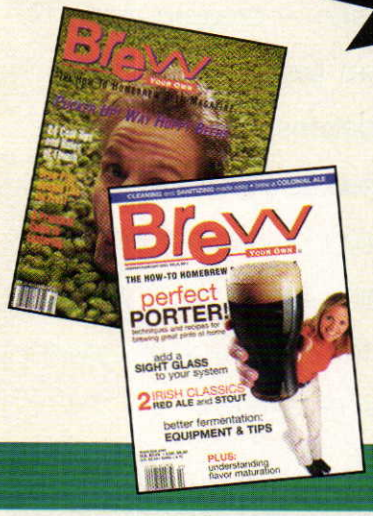

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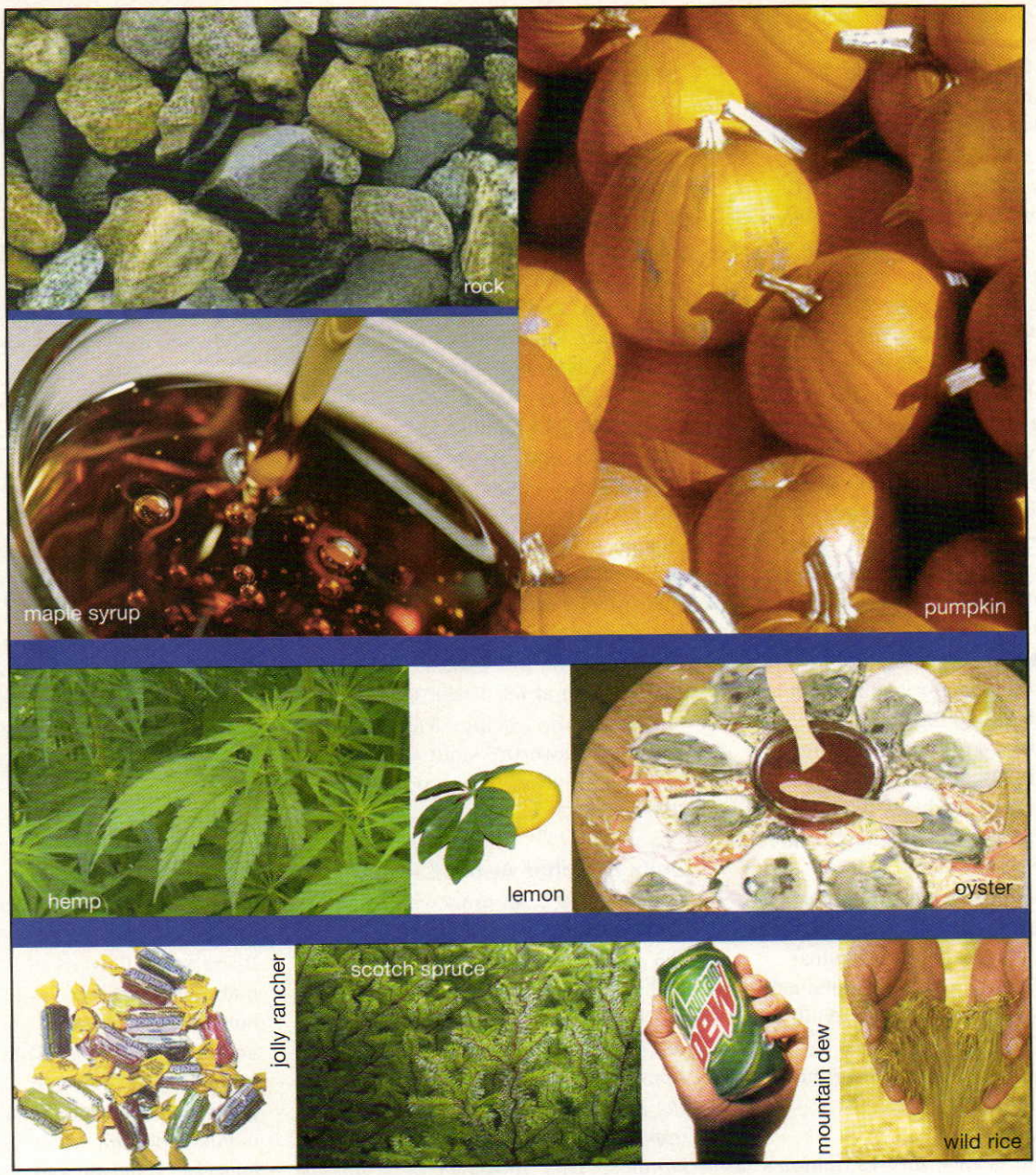
10 wildEST

CONTINUING IN OUR SERIES

of articles celebrating *BYO*'s 10th anniversary, here are 10 recipes "from the wild side." At *BYO*, we devote a lot of space to classic beer styles. (Our Style Profile column, for example, covers a classic beer style every issue.) However, we've also been known to push the envelope a bit, trying new and interesting ingredients, techniques and even — as you will see — brewing aids.

For this collection of recipes, we've chosen one interesting recipe from each year of *BYO*'s existence. Some have been tweaked based on the author's recommendations, feedback from readers or our own experience brewing the beer. (All have been updated, where needed, to conform to *BYO*'s recipe assumptions and modern standards of brewing quality homebrew. References are given in case you want to check out the recipe in its original form.) So, if you're looking to brew something new, give one of these beers a try. Or, let the recipes spark your imagination to create you own wild and wacky — but wonderful — experimental brew.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maple syrup
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wild rice

recipes

Black Pearl Oyster Stout

(5 gallons/19 L, all-grain with bivalve mollusks)

OG = 1.052 FG = 1.013

IBU = 37 SRM = 60 ABV = 5.0%

Despite names like Fat Spider Ale, Turkey Stout and Black Kitty Brown, only one BYO recipe has ever featured animals as an ingredient — Black Pearl Oyster Stout. We've been lucky enough to taste this beer, brewed by Joe Walton and Jim Michalk, and it's delicious. The beer has a complex dark grain character and a slightly silky mouthfeel. There's no strong oyster flavor, but you may detect a slight salty/briney character. For best results, use hard water with a moderate to high level of carbonates.

Ingredients

9.0 lbs. (4.1 kg) 2-row pale malt
0.5 lb. (0.22 kg) flaked oats
1.0 lb. (0.45 kg) roasted barley
0.5 lb. (0.22 kg) chocolate malt
0.25 lb. (0.11 kg) black patent malt
10 oz. can raw oysters (and brine)
1 tsp. Irish moss
8.6 AAU Fuggles hops (60 mins) (1.5 oz./43 g of 5.7% alpha acids)
4.3 AAU Fuggles hops (20 mins) (0.75 oz./21 g of 5.7% alpha acids)
Wyeast 1084 (Irish Ale) or White Labs WLP004 (Irish Ale) yeast
0.75 cups corn sugar (for priming)

Step by Step

Mash grains for 45 minutes at 152 °F (67 °C). Boil wort for 120 minutes. Add hops at times indicated. Add oysters and Irish moss with 15 minutes left. Cool wort. Transfer to fermenter, leaving oyster bits behind. (Don't eat the oysters, Joe and Jim say they taste terrible.) Aerate, pitch yeast and ferment at 68 °F (20 °C).

Extract with grains option:

Replace 2-row pale malt with 14 oz. (0.40 kg) Briess Light dried malt extract, 3 lbs. 14 oz. (1.8 kg) Muntons Light liquid malt extract and 2.0 lbs. (0.91 kg) 2-row pale malt. In a 3 gallon (11 L) or larger stock pot, heat 1.6 gallons (6 L) of water to 163 °F (73 °C). Placed crushed grains and flaked oats in a large steeping bag and submerge bag in this hot water. Maintain temperature at 148–153 °F (64–67 °C) for 45 minutes. While grains mash, heat one gallon (3.8 L) of water to 170 °F (77 °C). Remove grain bag from steeping pot and place in colander over stock pot. Rinse grains with 0.75 gallons (2.8 L) of water from brewpot. Combine "grain tea" and dried malt extract with remaining hot water in brewpot and heat to a boil. Boil 60 minutes, adding hops at times remaining indicated in recipe. With 15 minutes left in the boil, add liquid malt extract, oysters and Irish moss. Stir thoroughly to dissolve extract. (Keep the clock running even though it will take a few minutes for the wort to resume boiling.) Cool wort and transfer to fermenter, leaving oyster bits behind. Add water to make 5 gallons (19 L). Aerate, pitch yeast and ferment at 68 °F (20 °C).

(All-grain recipe from "Oyster Stout: A seaworthy stout experiment" by Joe Walton, January-February 2004, p. 64.)

Jolly Rancher Apple Lambic

(5 gallons/19 L, all-grain with hard candy)

OG = 1.065 FG = 1.006

IBU = 11 SRM = 4 (green) ABV = 6.3%

We couldn't resist throwing in one of Chris Colby's recipes. Jolly Rancher Apple lambic is a dry, sour beer with the flavor and aroma of Granny Smith apples coming from Jolly Rancher hard candies. This latest version of the recipe is based on the results of three brewings. For best results, let the beer age warm for at least three months.

Ingredients

5.0 lbs. (2.3 kg) 2-row pale malt
3.0 lbs. (1.4 kg) wheat malt
4.0 lbs. (1.8 kg) Jolly Rancher Apple hard candies
3 AAU Saaz hops (aged) (60 mins) (3.0 oz./85 g of 1% alpha acids)
¼ tsp yeast nutrients
Wyeast 3278 (Lambic Blend) yeast and bacteria
1.25 cups corn sugar (for priming)

Step by step

Mash grains at 150 °F (66 °C) for 60 minutes. Collect 4 gallons (15 L) of wort, add 1.5 gallons (5.7 L) of water and boil for 90 minutes. Boil hops for 60 minutes. (If you don't have aged hops, just add 3 AAU of any noble German hop.) At the end of the boil, you should have 4 gallons (15 L) of wort at SG 1.049. Cool wort, transfer to fermenter, aerate and pitch yeast/bacteria blend. Ferment at 70 °F (21 °C). After one week, boil yeast nutrients in 1 gallon (3.8 L) of water and dissolve candies into this liquid. (It takes at least 20 minutes for the candies to fully dissolve.) Cool "candy water" to 70 °F (21 °C) and rack to secondary fermenter. Rack beer from primary into candy water, making 5 gallons (19 L). (Don't splash or otherwise aerate wort at this stage.) Condition beer in secondary, at 70–75 °F (21–24 °C), for at least 3 months before bottling. You may want to add a small amount (~1 tsp) of dried ale yeast to the bottling bucket when bottling.

Extract option:

Replace 2-row and wheat malt with 2.0 lbs. (0.91 kg) Briess dried wheat malt extract and 3.0 lbs. (1.4 kg) Coopers liquid wheat malt extract. Bring 2.5 gallons (9.4 L) of water to a boil. Dissolve dried malt extract and boil for 60 minutes, adding hops at beginning of boil. With 15 minutes remaining in boil, stir in liquid malt extract. Cool wort, transfer to fermenter and add water to make 4 gallons (15 L). Aerate and pitch yeast/bacteria blend. Follow all-grain instructions for details of fermentation and how to add candies.

(Adapted from Reader Recipe by Chris Colby, found in Homebrew Nation, May-June 2003, p. 7.)

Mountain Brew

(5 gallons/19 L, extract with soda pop)

OG = 1.046 FG = 1.006

IBU = 19 SRM = 4 ABV = 5.2%

Jason Pavento wanted to combine his two favorite beverages, homebrew and Mountain Dew. His creation — Mountain Brew — does just that. We've fiddled with his procedures a bit, based on our own experimentation, but the ingredients are the same as his original recipe. The beer turns out light and

crisp, with some aroma, but not much flavor from the Mountain Dew. And, in case you're wondering, neither the preservatives or the caffeine seem to bother the yeast. Mountain Brew is also a very easy to make. So, to mangle a phrase from their ads — just brew it!

Ingredients

4.0 lbs. (1.8 kg) Muntons Extra Light dried malt extract
2.3 gallons (8.7 L) Mountain Dew (24 12-oz. cans of the soda)
4.5 AAU Northern Brewer hops (45 mins) (0.5 oz./14 g of 9% alpha acids)
2.25 AAU Northern Brewer hops (15 mins) (0.25 oz./7 g of 9% alpha acids)
½ tsp Irish moss
¼ tsp yeast nutrients
Danstar Manchester yeast
1.0 cup corn sugar (for priming)

Step by step

Pour Mountain Dew into a clean, sanitized brew bucket. (The soda should not have anything growing in it, so there's no need to boil. You may want to wipe the lips of the cans with a paper towel soaked in sanitizing solution, though. Let it sit in the bucket (covered) as you boil the wort so the level of carbonation will decrease.) Bring 2.5 gallons (9.5 L) of water to a boil and stir in malt extract. Boil for 60 minutes, adding hops at the times indicated in the recipe. Add Irish moss with 15 minutes left in the boil. Cool wort and pour into Mountain Brew. (Watch for excessive foaming.) Top up to 5 gallons (19 L) with water. Aerate (again, watching for excessive foaming) and pitch yeast. Ferment at 68 °F (20 °C) for 1 week. Rack to secondary and age for 2 weeks, Bottle with corn sugar.

All-grain option:

Next time you make a light all-grain beer, such as a Kölsch, cream ale or light pale ale, make an extra 2.5 gallons (9.5 L) of wort. Combine 2.5 gallons (9.5 L) cooled wort with Mt. Dew and water to make 5 gallons (19 L).

(Adapted from Reader Recipe by Jason Pavento, found in Homebrew Nation, March-April 2002, p. 8.)

Stonehenge Stein Beer

(5 gallons/19 L, all-grain with metamorphic rocks)

OG = 1.051 FG = 1.013

IBU = 22 SRM = 15 ABV = 5.0%

When you wish for new brewing gear, do you ever wish for metamorphic rocks? You might after seeing this recipe. Here's a recipe for steinbier — a beer whose wort is heated by hot stones. Heat from the rocks boils the wort and caramelizes sugars they directly contact. To brew this beer, you will need at least a 10 gallon pot, a stainless steel basket and heat resistant tongs to handle the rocks. For safety purposes, it would be best to get a friend to help you. When moving the rock-filled basket into the wort, suspend it by the basket handle from the middle of a pole, held on each end by one brewer. So here's the recipe — do you have the stones to try it?

Ingredients

5.0 lbs. (2.3 kg) 2-row pale malt
5.5 lbs. (2.5 kg) Munich malt
0.5 lbs. (0.23 kg) crystal malt (40 °L)
6 AAU Hallertau hops (60 mins)
(1.5 oz./43 g of 4% alpha acids)
10-15 fist-sized chunks of granite
1 tsp. Irish moss
White Labs WLP002 (English Ale) yeast (1 qt/1 L starter)
0.75 cups corn sugar (for priming)

Step by Step

Start a hardwood fire in a large grill. Let fire burn down to coals and place rocks in coals. Mash grains in 2.5 gallons (9.5 L) of water. Hold mash temperature at 150 °F (66 °C) for 60 minutes. Run off wort, then sparge with 170 °F (77 °C) water to yield 6 gallons (23 L) of wort. With heat-resistant tongs, remove 3 to 5 rocks from coals and place in a stainless steel basket. Whisk away any ash or embers from rocks with barbecue brush. Submerge basket with stones in wort. Boil for 90 minutes. Rotate rocks in kettle with those on the coals during entire boil period to maintain boil. Add hops with 60 minutes left in boil, Irish moss with 15 minutes left in boil. Cool wort, siphon to fermenter, aerate and pitch yeast. Place stones on a clean surface and allow them to cool. Store stones — wrapped in plastic wrap or in clean Tupperware-type containers — in refrigerator. After one week of primary fermentation, add rocks to sanitized bucket and rack beer on top of stones (which will be surrounded in a layer of caramelized sugar). Let condition for 2 weeks. Bottle or keg.

Extract with grains option:

Replace 2-row and Munich malt with 3.5 lbs. (1.6 kg) Weyermann Bavarian Pils liquid malt extract and 4.0 lbs. (1.8 kg) Weyermann Munich amber liquid malt extract. Heat 6 gallons (23 L) of water to 160 °F (71 °C) and stir in malt extracts until they are completely dissolved. Place crushed crystal malt in a steeping bag and steep in wort for 45 minutes. Keep temperature between 148–162 °F (64–72 °C) while steeping. Remove bag and begin heating with heating with rocks as described in the all-grain instructions.

(All-grain recipe from "Hot Rocks!" by Thomas J. Miller, Feb. 2001, p. 38.)

Eye in the Pyramid Wild Rice Helles Bock

(5 gallons/19 L, extract with rice adjunct)

OG = 1.059 FG = 1.015

IBU = 29 SRM = 10 ABV = 5.7%

A light-colored beer made with rice? How is that wild? Well, for starters, this recipe uses wild rice, which adds its characteristic flavor to the beer rather than just contributing fermentable sugars. And, although golden in color, this is a fairly strong beer. Brewing this beer requires a cereal mash, but it's well worth it for the interesting — but not overpowering — flavor notes from the wild rice. Wild rice can be found at many organic food stores. For best results, stir the rice constantly as you cook it to prevent scorching.

Ingredients

4.0 lbs. (1.8 kg) Laaglander Dutch Light lager kit
2.7 lbs. (1.1 kg) Northwestern Gold malt extract
1.0 lbs. (0.45 kg) 2-row pale malt
0.75 lbs. (0.34 kg) Munich malt
0.66 lbs. (0.30 kg) crystal malt (20 °L)
0.5 lbs. (0.23 kg) CaraPils malt
1.0 lb. (0.45 kg) wild rice
8 AAU Hallertau Hersbrücker hops (60 mins)
(2.0 oz./57 g of 4% alpha acids)
1 tsp. Irish moss
Wyeast 2206 (Bavarian) or White Labs WLP820 (Octoberfest) yeast
0.75 cups corn sugar (for priming)

Step by Step

Boil wild rice and a handful of crushed pale malt for 30 minutes. Stir constantly. Heat 1 gallon (3.8 L) of water to 142 °F (61 °C). When 15 minutes are left in rice boil, place crushed grains in steeping bag and submerge in this water. Hold temperature at 126–131 °F (52–55 °C) for duration of rice boil. Open steeping bag, dump in rice and stir into grains. Add heat, if needed, to bring temperature to 155 °F (68 °C) and hold for 45 minutes. Remove grain bag, place in colander and rinse with 0.5 gallons (1.9 L) of water at 170 °F (77 °C). Combine "grain tea," 2.0 lbs. (0.91 kg) of malt extract and water to make 2.5 gallons (9.5 L) of wort. Bring this to a boil, adding hops once boil begins. Boil for 60 minutes. Add Irish moss and remaining malt extract with 15 minutes left in the boil. Cool wort to at least 65 °F (18 °C) and transfer to fermenter. Aerate and pitch yeast. Ferment at 55 °F (13 °C) for two weeks, then let temperature raise to 60 °F (16 °C) for two days. Rack to secondary and lager for 4 weeks at 32–40 °F (0–4.4 °C).

All-grain option:

Replace first four ingredients with 9.75 lbs. (4.4 kg) 2-row Pilsner malt and 0.75 lbs. (0.34 kg) Munich malt. Boil wild rice and a handful of crushed pale malt for 30 minutes. Stir constantly. In your kettle, heat 3.6 gallons (14 L) of water to 142 °F (61 °C). When 15 minutes are left in rice boil, mash in grains and hold at 131 °F (55 °C) for duration of rice boil. Stir rice into grains and add heat to bring temperature to 158 °F (70 °C) and hold for 45 minutes. Add boiling water to mash

out to 168 °F (76 °C). Boil wort for 90 minutes, adding hops for final 60 minutes. Add Irish moss with 15 minutes left in the boil. Cool wort to at least 65 °F (18 °C) and transfer to fermenter. Aerate and pitch yeast. Ferment at 55 °F (13 °C) for two weeks, then let temperature raise to 60 °F (16 °C) for two days. Rack to secondary and lager for 4 weeks at 32–40 °F (0–4.4 °C).

(Adapted from "Wild Wild Rice" by Joe and Dennis Fisher, Oct. 2000, p. 24.)

Original Hempen Ale

(5 gallons/19 L, all-grain with hemp seeds)

OG = 1.054 FG = 1.014

IBU = 36 SRM = over 30 ABV = 5.2%

Steve Nordahl, former head brewer at Frederick Brewing Company and the originator of (commercial) Hempen Ale told the story of how his hemp beer came to be in a 1999 story in BYO. Hempen Ale was originally meant to be a dark beer, with the flavor of roasted hemp seeds playing a large role in the flavor profile of the beer. However, roasting hemp seeds wasn't viable on a commercial scale. (Coffee roasters had the wrong equipment and malting companies feared cross-contamination.) So, the commercial beer was pale in color. Here, however, is the original recipe for Hempen Ale. [Note: In the US, it is legal to possess (and brew with) sterilized hemp seeds. (An internet search will reveal multiple sources for the seeds.) These seeds contain only a trace of THC (the active ingredient in marijuana) and have no psychoactive effects. However, it is possible that consuming hemp beer may cause you to test positive on some modern drug tests. Use your best judgement of your situation when brewing this beer.]

Ingredients

10 lbs. (4.5 kg) 2-row pale malt
1.0 lb. (0.45 kg) Munich malt
1.0 oz. (28 g) black patent malt
1.5 lbs. (0.68 kg) mild hemp seed (roasted)
4.5 AAU Cascade hops (90 mins) (0.75 oz./21 g of 6% alpha acids)
4.5 AAU Cascade hops (45 mins) (0.75 oz./21 g of 6% alpha acids)

3 AAU Cascade hops (10 mins)
(0.5 oz./14 g of 6% alpha acids)
4.5 AAU Cascade hops (0 mins)
(0.75 oz./21 g of 6% alpha acids)
1 tsp. Irish moss
Wyeast 1056 (American Ale) or White Labs WLP001 (California Ale) yeast
0.66 cups corn sugar (for priming)

Step by Step

Place hemp seeds on a cookie sheet and roast in a 450 °F (232 °C) oven for 30 minutes. Mash grains and hemp seeds with 3.5 gallons (13 L) of water; hold mash at 156 °F (69 °C) for 60 minutes. Sparge with 170 °F (77 °C) water to collect 5.75 gallons (22 L) of wort. Boil for 90 minutes, adding hops at times indicated. Add Irish moss with 15 minutes left. Cool wort, transfer to fermenter, aerate and pitch yeast. Ferment at 68 °F (20 °C) for 10 days. Bottle or keg.

Extract with grains option:

Replace 2-row and Munich malt with 2.25 lbs. (1.0 kg) Muntons Light dried malt extract, 4.0 lbs. (1.8 kg) Alexanders Pale liquid malt extract, 0.5 lbs. (0.23 kg) 2-row pale malt and 1.0 lb. (0.45 kg) Munich malt. Place hemp seeds on a cookie sheet and roast in a 450 °F (232 °C) oven for 30 minutes. Heat 1 ⅛ gallons (4.3 L) of water to 167 °F (75 °C). Place crushed grains and hemp seeds in a steeping bag and submerge bag in this water. Steep for 45 minutes, holding temperature around 156 °F (69 °C). Remove bag and let drip dry. Combine "grain tea," dried malt extract and water in brewpot to make 2.5 gallons (9.5 L) of wort. Boil wort for 90 minutes, adding hops at times indicated. Add Irish moss and liquid malt extract with 15 minutes left. Cool wort, transfer to fermenter. Top up with water to 5 gallons (19 L). Aerate wort and pitch yeast. Ferment at 68 °F (20 °C).

(From "Brewing Hempen Ale" by Steve Nordahl, July 1999, p. 34.)

Smoked Maple Amber Ale

(5 gallons/19 L, extract with tree sap)

OG = 1.077 FG = 1.015
IBU = 21 SRM = over 25 ABV = 7.9%

Maple sap is the clear liquid that maple syrup is made from. In this recipe, maple sap replaces your brewing liquor. Maple sap contains 2.5% sugar on average. (In contrast, maple syrup contains around 66% sugar.) If you don't have access to maple sap, use water and add an extra 1.66 pints of maple syrup during the boil. The amount of German smoked malt called for will only yield the faintest whiff of smoke. For a stronger smoked flavor, try replacing it with some home-smoked malt (we'd try hickory smoke).

Ingredients

8 gallons (30 L) of maple sap
6 lbs. (2.7 kg) Muntons Amber dried malt extract
1.0 lb. (0.45 kg) crystal malt (60 °L)
0.25 lb (0.11 kg) German rauchmalz (smoked malt)
1 pint Vermont maple syrup
4 AAU Cascade hops (60 mins)
(0.8 oz./23 g of 5% alpha acids)
8 AAU Northern Brewer hops (0 mins)
(0.88 oz./25 g of 9% alpha acids)
dried ale yeast
0.33 cup corn sugar (for priming)
0.66 cup maple syrup (for priming)

Step by Step

Boil maple sap down to 6 gallons. Place crushed specialty malts in a steeping bag. In a large saucepan, combine 1 qt. (~1 L) of hot maple sap from kettle with enough tap water to bring temperature down to 160 °F (71 °C). Steep grains in this liquid for 45 minutes, holding temperature between 150–155 °F (66–68 °C). Add malt extract and "grain tea" to kettle and boil for 60 minutes, adding hops at times indicated. Add maple syrup with 15 minutes left in boil. After the boil, let wort stand (covered) for 30 minutes before cooling. Cool wort, siphon to fermenter, aerate and pitch yeast. Ferment at 68 °F (20 °C) for two weeks. Rack to secondary and let condition for 3 to 4 weeks. Bottle with corn sugar and maple syrup. Let bottle condition for 4 weeks before you try it.

All-grain option:

Replace amber malt extract with 8.0 lbs. (3.6 kg) 2-row pale malt and 3.33 lbs. (1.5 kg) Munich malt. Heat maple sap to 163 °F (73 °C). Use 4 gallons of sap water to mash grains. Mash at 152 °F (67 °C) for 60 minutes. Sparge with 170 °F (77 °C) sap water. Boil wort for 60 minutes, adding hops at times indicated. Add maple syrup with 15 minutes left in boil. After the boil, let wort stand (covered) for 30 minutes before cooling. Cool wort, siphon to fermenter, aerate and pitch yeast. Ferment at 68 °F (20 °C) for two weeks. Rack to secondary and let condition for 3 to 4 weeks. Bottle with corn sugar and maple syrup. Let bottle condition for 4 weeks.

(Adapted from "Brewing with Sugar" by Scott R. Russell, February 1998, p. 44.)

Spruce Bock

(5 gallons/19 L, extract with grains and spruce tips)

OG = 1.081 FG = 1.020
IBU = 19 SRM = 46 ABV = 7.9%

Here's a hearty holiday beer with an unusual spice — evergreen needles. Spruce tips, the new-growth of spruce trees, give a unique, characteristic flavor to beer. This flavor is not "piney," as many people suppose. Spruce tips can be found through an internet search. For best results, age your beer several months before sampling it.

Ingredients

1.5 lbs. (0.68 kg) Muntons Amber dried malt extract
2.0 lbs. (0.91 kg) Muntons Dark dried malt extract
6 lbs. 2 oz. (2.8 kg) Muntons Amber liquid malt extract (late addition)
1.0 lb. crystal malt (40 °L)
8.0 oz. (0.23 kg) wheat malt
4.0 oz. (0.11 g) chocolate malt
4.0 oz. (0.11 g) lager malt (toasted)
1 cup (loosely packed) spruce tips
5.25 AAU Hallertauer hops (75 mins)
(1.5 oz./43 g of 3.5% alpha acids)
3 AAU Spalt hops (15 mins)
(1.0 oz./28 g of 3% alpha acid)
lager yeast
0.75 cups corn sugar (for priming)

Step by Step

Steep crushed malts in 0.75 gallons (2.8 L) of water at 152–157 °F (67–

69 °C) for 45 minutes. Combine "grain tea," dried malt extracts and water to make 2.5 gallons (9.5 L) of wort. Boil for 75 minutes, adding hops at times specified in the recipe. Add spruce tips and liquid malt extract with 15 minutes remaining in the boil. Cool wort and transfer to fermenter. Top up to 5 gallons (19 L) with water. Aerate and pitch yeast. Ferment at 55 °F (13 °C).

All-grain option:

Replace malt bill with 9.75 lbs. (4.4 kg) 2-row pale malt, 5.0 lbs. (2.3 kg) Munich malt, 1.0 lb. crystal malt (40 °L), 8.0 oz. (0.23 kg) wheat malt, 8.0 oz. (0.23 kg) chocolate malt, 4.0 oz. (0.11 kg) lager malt (toasted) and 4.0 oz. (0.11 kg) Carafa III malt (dehusked). Mash at 154 °F (68 °C). Boil 90 minutes. Add spruce tips with 15 minutes left in boil. Ferment at 54 °F (12 °C).

(From "Homebrew Holidays" by Scott R. Russell, December 1997, p. 42.)

Lemonweizen

(5 gallons/19 L, extract with grains, citrus peel and acid)

OG = 1.044 FG = 1.011
IBU = 9 SRM = 5 ABV = 4.3%

Berlinner Weisse is a light, tart wheat beer fermented with brewers yeast and lactic acid bacteria. Lemonweizen is similar to a Berlinner Weisse, but without the bacteria. The lightly-tart twang comes from an addition of lactic acid. A bit of lemon zest accentuates this flavor.

Ingredients

2.5 lbs. (1.1 kg) Coopers wheat liquid malt extract
2.0 lbs. (0.91 kg) Briess wheat dried malt extract
0.5 lb. (0.23 kg) lager malt
0.5 lb. (0.23 kg) malted wheat
0.5 lb. (0.23 kg) CaraPils malt
0.5 lb. (0.23 kg) raw wheat
1 oz. (30 mL) lactic acid (88%)
1 oz. (28 g) lemon zest
2 AAU Tettnanger hops (60 mins) (0.5 oz/14 g of 4% alpha acids)
1.5 AAU Saaz hops (15 mins) (0.5 oz/14 g of 3% alpha acids)
Wyeast 1007 (German Ale) yeast
⅞ cups corn sugar (for priming)

Step by Step

Steep crushed malts in 0.75 gallons (2.8 L) of water at 148–153 °F (64–67 °C) for 45 minutes. Combine "grain tea," dried malt extract and water to make 2.5 gallons (9.5 L) of wort. Boil for 60 minutes, adding hops at times indicated. At 15 minutes left in the boil, stir in liquid malt extract and lactic acid. Add lemon zest when the boil is over and let steep for 15 minutes before cooling the wort. Cool wort, transfer to fermenter and top up with water to 5 gallons (19 L). Pitch yeast and ferment at 70 °F (21 °C).

All-grain option:

Replace first four ingredients with 4.0 lbs. (1.8 kg) 2-row Pilsner malt and 4.0 lbs. (1.8 kg) malted wheat. Mash at 148 °F (64 °C). Boil for 90 minutes. Add lactic acid for final 15 minutes of boil. Steep lemon zest 15 minutes post boil. Ferment at 70 °F (21 °C).

(Adapted from "Lawnmower Bier" by Scott R. Russell, June 1996, p. 11.)

Pumpkin Beer

(5 gallons/19 L, extract with grains and pumpkin)

OG = 1.048 FG = 1.012
IBU = 19 SRM = 6 ABV = 4.6%

By modern standards, a pumpkin ale would hardly be considered that wild. But, it was the wildest recipe of 1995 (BYO's first year). The biggest key to brewing this beer is getting the spice blend right. If you use "supermarket spices," these amounts should yield a subtly spicy beer. Decrease the amount if you grind your own whole spices.

Ingredients

1.25 lbs. (0.57 kg) Muntons Extra Light dried malt extract
3.5 lbs. (1.6 kg) Northwestern Gold liquid malt extract
1.0 lb. (0.45 kg) 2-row pale malt
1.0 lb. (0.45 kg) CaraPils malt
5–6 lbs. (2.3–2.7 kg) pumpkin (cubed)
5 AAU Cascade hops (60 mins) (1.0 oz./28 g of 5% alpha acids)
¾ tsp. ground cinnamon
¼ tsp. ground cloves
¼ tsp. ground ginger
¼ tsp. ground nutmeg
Dried ale yeast
0.75 cup corn sugar (for priming)

Step by Step

Boil pumpkin cubes in water for 15 minutes. Heat 0.75 gallons (2.8 L) of water to 163 °F (73 °C). Place crushed grains in steeping bag and steep grains at 152 °F (67 °C) for 45 minutes. When pumpkin is ready, add chunks to grain bag and add cool water (to maintain 152 °F (67 °C) temperature). Combine grain and pumpkin "tea," dried malt extract and water to make 2.5 gallons (9.5 L) of wort. Boil for 60 minutes, adding hops at the start of the boil. Add liquid malt extract and spices with 15 minutes left in the boil. Cool wort and transfer to fermenter. Top up to 5 gallons (19 L) with water. Aerate and pitch yeast. Ferment at 69 °F (21 °C).

All-grain option:

Replace malt extract and 1 lb. (0.45 kg) 2-row malt with 8.0 lbs. (3.6 kg) 2-row pale malt. Boil pumpkin cubes in water for 15 minutes. Mash grains and pumpkin chunks at 153 °F (67 °C) for 60 minutes, stirring occasionally. Boil for 90 minutes, adding hops with 60 minutes left. Add spices with 15 minutes left in boil. Ferment at 69 °F (21 °C).

(Adapted from "In Search of the Great Pumpkin" by John Naleszkiewicz, November 1995, p. 32.)

10 More Wild Recipes

Come-Back Gose, a salty German brew (Jan-Feb 2005)
Wee Little Hottie, a Scottish ale with hot peppers (October 2004)
Alder Smoked Porter, a salmon smoked porter (May-June 2004)
Tubers for Victory, a potato American Pilsner (March-April 2004)
Ice Block Eisbock, freeze-concentrated beer (December 2003)
Sweetgrass Ale, an ale with sweetgrass (May-June 2003)
Sahti, a juniper-spiced beer (December 2001)
Masaai Cucumber Beer, an African specialty beer (January 2001)
Don't Whine Cooler, a light beer with Kool-Aid (June 1998)
Choco-mint Brown Ale, (Feb 1996)

PHOTO COURTESY OF NWGA

WHEAT

WHEAT BEERS — whether German hefeweizens, Belgian wits or any of the other classic styles of wheat beers — are great beers. But wheat beer is not only a great beer, it also has a great story behind it. Deciding where to start is a problem, though. It could start in your homebrewery, when you're deciding how to mill the grain. It could start at your local homebrew shop, where wheat malt and wheat malt extract sit on the shelves, waiting to be made in to beer. It could start in the first century in Germany, where the modern style of wheat beer began to emerge. Or, it could start where I'm going to start the story — in 8,500 BC in the Fertile Crescent. (If you'd like to start out earlier, check out my May 2000 Last Call essay in which I trace the evolution of beer from the Hot Big Bang to cold frosty mug. If you'd like to skip the long, James Michener-esque windup in this article, skip to the section on wheat malting.)

The Evolution of Wheat

A modern supermarket holds thousands of food products from domesticated plants. There are foods derived from roots, tubers, stems, stalks, leaves, flowers, fruits and seeds (including nuts, legumes and — of course — grains).

story by chris colby

the OLDest grain

PHOTO COURTESY OF USDA

WHEAT IS THE OLDEST domesticated plant species, first grown in the Fertile Crescent over 10,000 years ago. Modern bread wheat carries the chromosomes of einkorn and two species of goat grass, the result of two natural hybridizations. Wheat kernels thresh free (have no husk when harvested) and contain enough of the protein gluten to allow rising breads to be made. These two characters can cause problems in the brewhouse.

Each one of the plants that supply the food product was once wild, but was domesticated at a certain time and place. As it turns out, the first plant to be domesticated was wheat.

Einkorn One of the ancestors of modern wheat is a species called einkorn (*Triticum monococcum*). Einkorn is a species of grass, like modern wheat. Unlike modern wheat, however, einkorn has a hull (like barley) and is diploid. (Diploid species are those that contain two sets of chromosomes. Most modern wheat is hexaploid, having six sets of chromosomes.)

Around 8,500 BC in the Fertile Crescent (a region — centered around the Tigris and Euphrates rivers — that occupies part of modern day Turkey, Syria and Iraq), wild einkorn (*T. monococcum boeticum*) was domesticated when a series of mutations were selected for by humans in the area.

The first mutation selected for was one that kept the wheat "head" — where the kernels are — from shattering. In wild einkorn, the head shatters to disperse its seeds. However, in einkorn (and many grass species) a single mutation leads to a plant in which the head stays intact. In the wild, this is

PHOTOs COURTESY OF USDA

[...] a wild wheat (*T. urartu*) and a species of goat grass (*Aegilops speltoides*) naturally hybridized.

detrimental as the seeds do not get dispersed. However, humans in the Fertile Crescent collected these easy-to-harvest mutants. Seeds from these mutants were then planted, at first perhaps accidentally when stray kernels fell onto the ground, and people began growing them preferentially. Further domestication involved selecting for faster-maturing strains, larger kernels and many other features. This lead to domesticated einkorn (*T. monococcum monococcum*). Einkorn was rediscovered in the 1970's in France, where it was still being grown to be made into porridge.

Emmer and Durum

Here the wheat story backtracks a bit. About a million years before humans domesticated einkorn wheat, a wild wheat (*T. urartu*) and a species of goat grass (*Aegilops speltoides*) naturally hybridized. The result was a wild species of tetraploid grass (*T. turgidum*). (Tetraploid means four sets of chromosomes). This tetraploid species later became the second species of wheat domesticated and is called emmer wheat (*T. turgidum dicoccum*). Emmer wheat was originally a hulled wheat like einkorn, but unhulled (also called free-threshing or naked) forms appeared later. Emmer is still available in parts of Europe under its Italian name *faro*.

Emmer was the most widely planted type of wheat until early Roman times, when it was largely supplanted by durum wheat and modern bread wheats. Durum wheat (*T. turgidum durum*) is another domesticated subspecies of *T. turgidum*, the tetraploid species that gave rise to emmer. Durum is a huskless wheat with a high protein content that is still widely available today as it is regarded as the best wheat for pasta making. (In 1875, plant breeders hybridized durum wheat and rye to make triticale, a grain that combined the productivity and disease-resistance of wheat with the vigor of rye.)

Spelt and Bread Wheat

The final big step leading to modern wheat happened just 8,000 years ago, around 6,000 BC, when our tetraploid wheat species (*T. turgidum*) hybridized with another species of goatweed (*Aegilops tauschii*) to make a hexaploid wheat (*T. aestivum*). This

species gave rise to spelt (*T. aestivum spelta*, husked), modern bread wheat (*T. aestivum aestivum*, unhusked) and club wheat (*T. aestivum compactum*, unhusked). Scientists hypothesize that modern bread wheat evolved, through artificial selection, from a variety of spelt.

Scientists have crossed *T. turgidum* and *A. tauschii* in the laboratory and recreated the historic hybridization. The result is a hulled wheat, much like spelt, which meshes well with the previous hypothesis. Evidence for the "big picture" of the evolution of wheat, presented in brief here, comes from the analysis of wheat kernels found associated with human archaeological remains and the genetic analysis of the modern genomes of wheat and goat grass species.

The success of modern bread wheat is largely due to its gluten content. Gluten is a protein found concentrated in the outer layers of the wheat kernel. Gluten is cohesive (it sticks to itself) and insoluble in water. In bread wheats, the sticky gluten is also elastic — allowing it to capture gas bubbles rising in wheat dough to make leavened bread. Durum wheat has sticky gluten, but its elasticity is not sufficient to make rising breads. Einkorn wheat, for comparison, has a fairly non-sticky, non-elastic gluten.

Today, about 90% of all wheat grown is (hexaploid) bread wheat; the remaining 10% is mostly (tetraploid) durum wheat, for pasta making. Wheat is the third most cultivated grain in the world — behind maize and rice, but ahead of barley (in fourth place). A large amount of maize becomes food for livestock or is used in the production of ethanol for fuel use. In contrast, almost all rice harvested is for human consumption. Wheat is used for human food, livestock feed and brewing.

As homebrewers, of course, it's the brewing we're most interested in. From a brewing standpoint, a quick summary of the evolution of wheat might be that its kernels got bigger, its hull disappeared and it gained sticky gluten. The first thing is good; the other two, as we will see, can be problematic for brewers.

Wheat Malting

Both malted and unmalted wheat are used in brewing. Wheat destined to be malted is hexaploid wheat. Durum and einkorn wheat are not malted. Malted wheat is most often winter wheat, as winter wheat has less protein than spring wheat, but some malt made from spring wheat can be found. Wheat is sometimes divided into hard and soft wheats and either may be malted. Hard wheats are usually higher in protein (and gluten).

Because wheat kernels have no husk, wheat takes up water faster than barley and hence the steeping stage of malting occurs more quickly. Because wheat kernels are larger than barley kernels, it takes longer to dry them in the kilning stage. Typically, the drying

is done at a lower temperature than with barley malts. The extra time in the kiln, however, means that wheat base malts are slightly darker (~2.4–3.2 °L) than the lightest barley malts (1.2–2.0 °L). A clear beer made with mostly wheat (say, 70% wheat and 30% barley) would be golden in color, a hair darker than a Pilsner. Turbidity in wheat beer, though, makes wheat beers seem "whiter" than they are.

In 2002, 568 million metric tons of wheat were produced across the globe. Wheat grows quickly and each year there is a spring and winter crop of wheat.

Wheat Brewing Products

At your homebrew shop, you will likely find two kinds of wheat malt — red wheat malt and white wheat malt. (These may be spring or winter, hard or soft.)

Raw kernels of red wheat are darker than that of white wheat kernels as red wheat contains more phenolic compounds and browning enzymes than white wheat. However, as most of the color in wheat malt comes from kilning, both types of wheat malt add about the same color depth to beer. (Wheat beers made with red wheat don't, for example, turn out amber-colored.) White wheat kernels are a bit plumper than red wheat kernels.

Traditionally, German weissbiers and Belgian wits were made with red wheat, although many brewers use red and white wheat interchangeably. Ashton Lewis — brewmaster at Springfield Brewing, technical editor of BYO and GABF medal winner for his American wheat beer — says, "I see differences in the haze stability in beers made with red and white wheats. I prefer the red varieties because the haze stays around longer."

Raw wheat (sometimes called wheat "berries") can be found at many homebrew shops and nearly all health food stores. Any type you find except durum is likely acceptable for brewing. Whereas German wheat beers are always made from malted wheat (as the Reinheitsgebot prescribed that only malted grain be used in brewing), Belgian wheat beers often contain unmalted wheat. Traditional lambics, for instance, were made from around 65% malted barley and 35% unmalted wheat.

Most malting companies make red and white wheat malts. Weyermann (a German malting company) also makes a few types of wheat specialty malts, including a dark wheat malt (5.8–7.3 °L), a caramel wheat malt (38–49 °L) and chocolate wheat malt (300–450 °L). Brian Peters — a brewer at The Bitter End, a brewpub in Austin, Texas — says, "Homebrewers should try out some of the wheat specialty malts. Because of the difference in protein content, wheat specialty malts have a different flavor from barley malts." The Bitter End's wheat bock (Austintinus) showcases some of these darker malts and is delicious.

Wheat malt extracts are also available. Most wheat malt extracts are made from a mixture of wheat and barley malts, but some 100% wheat extracts are available. Usually, a wheat malt extract will have a minimum of 50% wheat and extracts with 65–70% wheat are common, especially when sold as extracts for German wheat beers. Frequently, the percentage of wheat is given on the package.

Wheat in the Brewhouse (or Big, Hard, Naked and Sticky)

Wheat is different from barley in several ways. Compared to barley, wheat has larger kernels, harder kernels, no husk and more gluten. Wheat also contains more protein overall than barley. These differences chart the course for how to treat wheat differently than barley when brewing.

High Protein Wheat has more protein than barley, and excess protein can cause haze in beer. In high-protein barley malts (such as six-row barley malts), protein is frequently diluted by using low protein adjuncts (such as rice or corn). However, in wheat beers, the usual response to the protein levels is to accept, or even embrace, the resulting turbidity. A German hefeweizen, for example, is supposed to be cloudy. So is a Belgian wit. A few Belgian beers combine wheat malt and refined sugars (a zero protein adjunct) added as a kettle adjunct.

Hard Kernels Wheat is hard to mill if you do it by hand. It's not impossible to do — I brew a 20-gallon (76-L) batch of lambic every year and crack the grains with my unmotorized mill — but it takes a little more effort.

Big and Naked Wheat kernels are larger than barley kernels, but don't

have a husk. It's reasonable to assume that you might want to adjust your mill to account for this. Ashton Lewis says, "I tighten up my mill a bit and grind the wheat a bit finer." Conversely, Brock Wagner of St. Arnolds Brewing (Houston, Texas) says, "We loosen our mill a little."

The finer you grind, the more extract you can get from your malt. However, you also run the risk of a stuck mash when running off the wort. A little finer or little coarser grind is not a big deal if you match your crush type to your lautering plan (see below).

Sticky Glucans The glucan content of wheat is what gives it its reputation for being difficult to lauter. However, this reputation may be overstated. None of the brewers I spoke to had any troubles with their wheat beers. If you perform a mash out — and insulate your mash tun so the temperature doesn't drop while sparging — you will likely not encounter any problems collecting your wort. To perform a mash-out, just stir boiling water into your mash and raise its temperature to 168 °F (76 °C). Let the mash sit for 5 minutes before beginning to recirculate.

Running off the wort at a reasonable speed will also help you avoid problems. Aim to collect your wort at a steady rate over 60–90 minutes.

If you wish, you can employ a step mash with a rest in the beta-glucanase range (104–122 °F/40–50 °C) for 15–30 minutes. For even more insurance, you can add rice hulls to your mash if you have over 60% wheat.

Raw wheat can also be used in the mash. Raw wheat can be used in a single infusion or step mash. Or, the raw wheat portion can be boiled with a little malt as is done in a cereal mash. (See Techniques on page 51 for more details.)

Boil

Wheat worts contain a lot of protein and most traditional styles of wheat beer employ a 90-minute or longer boil. The length of the boil ensures good hot break formation.

German hefeweizens and Belgian wits are light-colored beers. When making them, some homebrewers are

If you wish to make a turbid (cloudy) beer, don't add Irish moss during the boil.

wary of an extended boil — afraid that they will caramelize sugars in the wort and darken the wort excessively. However, a 90–120 minute full wort boil of a light-colored wheat wort will not darken to the extent that is not representative of that style.

Boiling a concentrated wort — as when making a stovetop extract beer — can lead to copious amounts of wort darkening. (Back in the day, my first hefeweizen turned out red when I boiled all my malt extract in around 1.5 gallons (5.7 L).) If you're making a wheat beer from extract, add only about one quarter to one third of the extract initially. Boil the hops in this wort, then add the remaining malt extract in the final 15 minutes.

If you wish to make a turbid (cloudy) beer, don't add Irish moss during the boil.

Wheat Flavor

In most wheat beers, the flavor of wheat is paired with other flavors. In German weissbiers, wheat mingles with the banana and clove from the yeast. In a Belgian wit, the wheat is paired with spices and in lambics, the beer is soured. And, wheat beers are a favorite base beer for fruit flavors. Here are a couple recipes that offer slight twists on common wheat styles.

Dreherweizen

(5 gallons/19 L, all-grain)

OG = 1.048 FG = 1.012
IBU = 22 SRM = 6 ABV = 4.7%

This is a standard hefeweizen with Vienna malt substituted for pale barley malt and a hint of hop flavor from Amarillo hops. The color depth is only slightly deeper than a standard hefe — a deep golden with a hint of orange.

Ingredients

7 lbs. (3.2 kg) red wheat malt
3 lbs. (1.4 kg) Vienna malt (4 °L)
5.4 AAU Hallertau hops (60 mins)
(1.4 oz./38 g of 4% alpha acids)
0.25 oz. (7.1 g) Amarillo hops (15 mins)
Wyeast 3068 (Weihenstephan Wheat)
or White Labs WLP300 (Hefeweizen)
yeast (1 qt./1 L starter)
1 cup corn sugar (for priming)

Step by Step

Heat 3.75 gallons (14 L) of water to

115 °F (46 °C) and mash in grains in your kettle. Hold at 104 °F (40 °C) for 30 minutes. While the main mash is resting, pull a thick decoction equal to about one-quarter the volume of the main mash and place it in a separate pot. Heat decoction to 162 °F (72 °C) and hold for 5 minutes, then boil decoction for the remaining time in the main mash's 30 minute rest. (Stir decoction constantly.) Stir decoction into main mash and apply direct heat, bringing the mash temperature to 156 °F (69 °C) and hold for 45 minutes. Transfer mash to lauter tun and add boiling water to raise temperature to 170 °F (77 °C). Recirculate wort for 20 minutes and collect about 5.5 gallons (21 L) of wort. Add 1 gallon (3.8 L) of water and boil wort for 90 minutes, adding hops at times indicated. Cool wort, aerate and pitch yeast. Ferment at 70 °F (21 °C). Prime with corn sugar and bottle.

Belgian Cowboy

(5 gallons/19 L, partial mash)

OG = 1.049 FG = 1.012

IBU = 19 SRM = 6 ABV = 4.7%

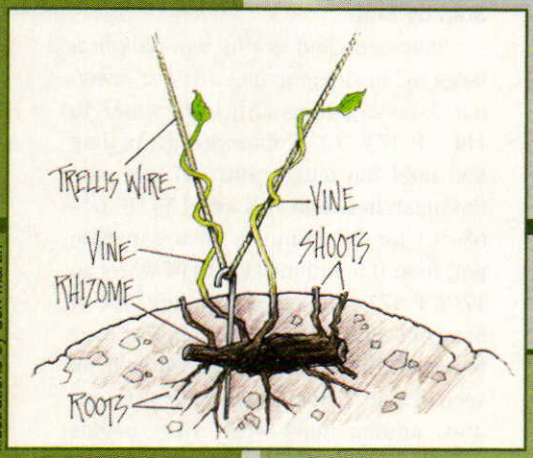
A fairly standard Belgian witbier that's perhaps a bit less spicy but a bit more tangy than most (but not by much). A good first time partial mash recipe for extract brewers.

Ingredients

3.3 lbs. (1.5 kg) Coopers liquid wheat malt extract (late addition)
2.5 lbs. (1.1 kg) 6-row pale malt
2.0 lbs. (0.91 kg) wheat malt
0.5 lbs. (0.23 kg) Weyermann sour malt
0.75 lbs. (0.34 kg) rolled or flaked oats
5 AAU Styrian Goldings (60 mins) (1 oz./28 g of 5% alpha acids)
Wyeast 3944 (Belgian Wit) or White Labs WLP410 (Belgian Wit II) yeast
0.33 oz. (9.4 g) coriander
0.33 oz. (9.4 g) Curaçao orange peel
⅞ cup corn sugar (for priming)

Step by Step

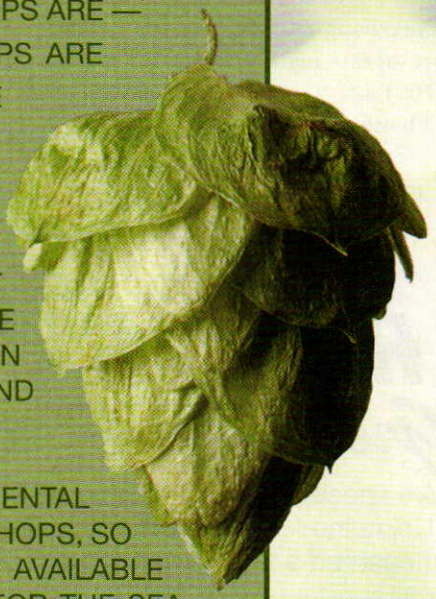
Place cracked grains and oats in a large nylon steeping bag. In your brewpot, heat 2 gallons (7.6 L) of water to 166 °F (74 °C). Submerge grain bag and hold the temperature of this partial mash between 148 and 155 °F (64–68 °C) for 60 minutes. In a separate pot, heat 0.5 gallons (1.9 L) of water to 170 °F (77 °C). Lift grain bag out of brewpot and place in colander over brewpot. Rinse grains with water from second pot. Boil this wort for 60 minutes, adding hops when wort begins boiling. In the final 15 minutes of the boil, stir in liquid malt extract and add spices (Stir extract well, but keep the clock running on the boil time.) Cool wort and transfer to fermenter. Top up to 5 gallons (19 L) with water. Aerate wort and pitch yeast. Ferment at 70 °F (21 °C) for one week. Cold condition, if practical, for two weeks. Then, prime with corn sugar and bottle.



illustrations by don martin

How to Grow HOPS at Home

at **YOUR LOCAL HOMEBREW SUPPLY STORE**, THE GRAINS ARE PROBABLY STORED IN BINS OR BARRELS AT ROOM TEMPERATURE. IN CONTRAST, THE HOPS ARE — OR SHOULD BE — REFRIGERATED. THE HOPS ARE STORED COLD FOR A REASON — BECAUSE FRESHER HOPS TASTE BETTER.



PICKING UP HOPS FROM YOUR LOCAL SUPPLIER IS EASY. HOWEVER, IT'S POSSIBLE TO GROW HOP PLANTS (*HUMULUS LUPULUS*) AT YOUR OWN HOME. BEST OF ALL, HOPS ARE PERENNIAL, SO — ONCE PLANTED — YOU CAN ENJOY A BOUNTIFUL HARVEST OF FRESH AND FLAVORFUL HOPS YEAR AFTER YEAR.

THE CLIMATE ANYWHERE IN THE CONTINENTAL UNITED STATES IS CONDUCIVE TO GROWING HOPS, SO LONG AS PLENTY OF DIRECT SUNLIGHT IS AVAILABLE AND THE CHANCE OF FROST HAS PASSED FOR THE SEASON, TYPICALLY IN EARLY SPRING. ALL OF THE COMMERCIAL HOP FIELDS ARE LOCATED IN NORTHERN STATES, AND THE CONDITIONS THERE ARE MORE TO THE HOP PLANT'S LIKING, BUT — WITH A LITTLE CARE — THEY CAN BE GROWN ANYWHERE. HOPS EVEN GROW WILD IN SOME PARTS OF NORTH AMERICA. IN OTHER WORDS, IF YOU HAVE AN OPEN, SUNNY SPACE AND A MOTIVATION TO PRODUCE THE FRESHEST BEER POSSIBLE, YOU CAN GROW YOUR OWN HOPS.

by Kristin Grant

Before you run out and purchase your first hop plants, KEEP THESE POINTS IN MIND:

Hop Bocabulary First, you need to know that hop vines are called bines, which Webster's refers to as "the winding or twining stem of a hop vine or other climbing plant."

Get in the "zome" Second, when grown for use in beer, hops are not started from seed. Instead, they are grown from rhizomes. Rhizomes are short underground stems that are planted in the soil horizontally.

Males are Useless Third, hop plants can be male or female, but only female plants produce the lupulin-laden cones used in beer-making. Retailers of hop rhizomes are aware of this trait, of course, and will only sell the female rhizomes.

Planting Window Fourth, hop plants will only flourish if cultivated from March to May. Because of the short planting season, most retailers only stock hop plants during these times. (And, they sell out fast! It's probably best to contact your local homebrew shop and reserve some, or order some on the Internet ahead of time.)

Guide Their Growth Finally, be prepared to build or buy a trellis for your hop bine, which will grow from 15 to 25 feet in a single season.

Purchasing Hops

More than 150 varieties of hop plants are available for purchase. So which are the easiest to grow? Ralph Olson, of Hop Union, says, "All hop types have an Achilles heel, but some might be better for first time hop growers. Cascade is a good choice and so is Nugget if you are looking for a high-alpha hop. Other good choices are Chinook, Willamette (if your location is not too hot) or Centennial. Aroma hops tend to be more finicky and can't take the heat." So, take your hop preferences, location and gardening skills into consideration when choosing a hop variety or varieties to plant.

If you plant more than one variety, space the rhizomes at least eight feet apart; hop plants grow rapidly and need a spacious area in which to take root.

The cost of hop rhizomes ranges from approximately $10 to $20 per pound, or start at $3 per rhizome. Hop rhizomes are sold at some homebrew supply stores and can be purchased from Internet retailers (see sidebar on page 45).

Planting and Caring for Hops

Your hop plants will thrive best in soil with a pH between 6 and 7.5. Testing the acidity of soil is easy with a soil test kit from your local gardening center. You can lower the pH (increase the acidity of the soil) by adding any type of organic matter, such as compost, or purchasing an additive, such as fertilizer containing ammonium, at your gardening center. If you need less acidity, add sand or lime.

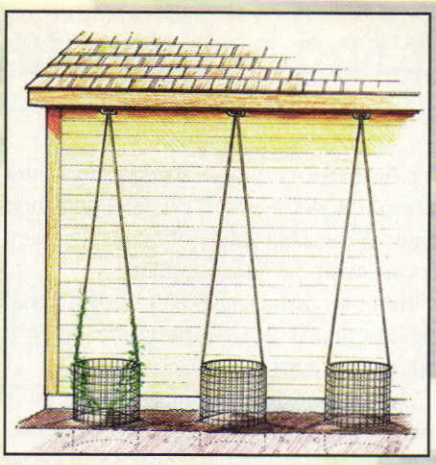
Next, loosen the soil with a hoe or other gardening tool. Plant the rhizome in a shallow hole, and cover the area with one inch of soil. If your soil does not drain well, prepare a small mound of soil and plant the rhizome in that mound.

Within a few weeks, six or seven bines will sprout from the earth. Once the tallest bine reaches 12 in. (30 cm) in height, identify the two largest and clip the others off. This allows the nutrients in the soil to be devoted to only the two strongest sprouts.

The two hardy bines will grow rapidly — up to twelve inches in a single day! This is where your trellis comes in. The bines must have a support system in place before they are two feet tall since the plants grow so fast. You can build

photo by peter glendinning

While this plot in the Herefordshire region of England is growing some fine hops, even the biggest hop head would consider this agricultural overkill for the modest homebrewer.



This simple trellis system can be constructed easily with some twine and a few nails.

one yourself or buy a trellis at a gardening store, craft store or home improvement store.

Provide plenty of water throughout the summer, as hop plants can dry out easily. However, avoid watering the plant so much that water pools at the base of the plant.

Watch for pests or diseases on your hops. The hop aphid — a tiny, light green insect that lives on the underside of leaves — is a common nuisance that can be eradicated with organic insecticides such as insecticidal soap. Insecticidal soap has no adverse residues that may affect human consumption. Hop plants are also susceptible to different types of mildew, which are easily spotted as small, powdery clusters of black or white spores on the leaves. Fungicides should be administered immediately if mildew is noticed on the plant.

The bine will be leafy and grow vertically, and the actual hop cones will emerge toward the top of the bine on short, horizontal branches. In other words, do not give up hope if you do not see any cones at eye level. The hop cones will show up a few weeks after the small, pod-like flowers appear. The cones, made up of thick, tightly wrapped "petals," form where the flowers were after they drop off.

Once the bine reaches ten or more feet, prune the leaves growing on the bottom three feet of the plant. This reserves the nutrients for the important part of the plant — the hops.

Harvesting and Drying Hops

By early August and no later than the end of September, you can harvest the hop cones from the plants. Hops produce many cones during the first season; however, subsequent seasons yield even larger crops.

There are two main ways to determine whether the hops are ready for picking. First, the bottom of the cone turns yellow and the casing turns thin and crispy, like parchment paper. You must not harvest the cones before they are ready; as the flavor will not be optimal. The cone should feel light and you should not be able to squish the cone between your fingers without the cone breaking. The yellow coloring at the base of the cone is secreted from the lupulin glands — and this is what gives the hops their unique flavor. Second,

you can monitor the coloring of the cones and when the first few cones begin to turn brown, the cones are all ready to harvest. Do not wait until the brown coloring is prevalent; otherwise the hops will not be usable. When the first cones start turning brown, you should start harvesting the hops.

So, how do you pick the cones, which hang 20 feet above the ground? The easiest way is to cut the bine a foot from the base and bring the plant to the ground. Unwinding the bine from the support may take some tugging since tiny hairs from the bine hook into the support; this is how the bine climbs. Do not worry about losing your prized plant - the root system will survive future frosts and your hops will spring up each year.

Each plant will yield 1.5 to 2 pounds of hop cones, which must be dried before use in the beer-making process. Hops can be dried in a dehydrator, or by placing the hops on a drying rack in a cool, dark place. You can store your dried hops in a sealed plastic bag or mason jar in the freezer.

You can use your hops in the same way you would use store-bought hops. Moreover, when a friend compliments your flavorful beer, simply raise a glass and say, "Why thank you — I grew the hops myself."

This is Kristin Grant's first article for Brew Your Own.

Sources for Rhizomes

Alternative Beverage
114-E Freeland Lane
Charlotte, NC 28217
Website: www.ebrew.com
Phone: 1-800-365-2739

The Beer Essentials
2624 South 112th St., #E-1
Lakewood, WA 98499
Website: http://thebeeressentials.com
Phone: 1-800-685-BREW (2739)

Beer and Wine Hobby
155 New Boston St., Unit T
Woburn, MA 01801
Website: www.beer-wine.com
Phone: 1-800-523-5423

Freshops
36180 Kings Valley Hwy.
Philomath, OR 97370
Website: www.freshops.com
Phone: 1-800-460-6925

Hopunion CBS, L.L.C.
203 Division Street
Yakima, WA 98908
Website: www.hopunion.com
Phone: (509) 453-4792

Seven Bridges Cooperative
Organic Brewer's Ingredients
325A River St.
Santa Cruz, CA 95060
Website: www.breworganic.com
Phone: 1-800-768-4409

photo courtesy of hopunion

by Ralph Olson

new hop VARIETIES and how they come about

There are new hop varieties, more properly known as hop cultivars, seemingly coming out each year. While these new cultivars are different from a genetic standpoint, many are similar to hops already grown. There are many reasons for hop growers to produce a new cultivar. The primary one is to keep trying to find the perfect hop.

Hop producers are always looking for a variety that has better production or yield. It also might contain more chemical components useful to brewers, mainly alpha-acids. It is always important to find hops that have natural disease and pest resistance so the need to spray pesticides is eliminated or at least minimized. If the hop is bred for its aroma profile, this profile must also be acceptable to the brewer. Other factors considered are maturity dates, how well the cones can be picked, storagability, etc. One must also remember that most new hops are produced in the hope that a major brewery will take an interest. That is where the true money to be made is and also the major breweries are the biggest contributors of funding to hop growing programs.

Producing New Cultivars

There are three main ways that new hop cultivars can come to the marketplace. The first is to find a mutation in an existing hop field that exhibits a different character that a grower can easily see. This can be a couple of things. The easiest thing to notice is maturity. While that might not sound important, to a grower, maturation time is one of the most important things he has to contend with. Hop harvest goes on for around 40 days, but most hops have a small window of maturity in which to pick them. This time span can be measured in a few days.

With a 40-day harvest, the crop must mature at staggered times for it to be picked properly. Finding a hop that matures earlier or later, but is still similar to the original cultivar, can be a benefit to growers. A number of years ago when Cluster was the main hop, there were sub-names like E-1, L-1, L-8, Talisman and Bates. "L" and "E" signified late and early maturing cultivars, respectively.

The sweetness of beer is balanced by the bittering properties of the cones of the hop plant (*Humulus lupulus*). New hop varieties are being developed all the time.

New hop varieties can be selected from random mutants present in the hop field, bred by crossing different cultivars or created by making triploid cultivars.

The second way to get a new cultivar is by crossing hops. Although the plants of some species have both male and female parts, individual hop plants are either male or female. Hops grown commercially for their cones are female. Males are grown for breeding purposes. This is a random way to create new cultivars and it is not unusual to produce 10,000 or more plants in this manner for testing, although if you get one or two good ones, it is considered successful.

Plants created by crossing are screened for vigor, resistance to disease, maturation rate and must have cones that can be harvested mechanically. The hops that have the right set of agricultural properties — perhaps 100 out of the 10,000 plants grown from seeds — are then examined for their suitability for brewing. Of these 100, perhaps 20–30 will be planted in small amounts for further testing.

The third way to create a new cultivar is through chemical inducement. Basically, you create a hop that has four sets of chromosomes. These plants are very weak and aren't any good for commercial purposes. However, if you cross these plants with a diploid (an organism with two sets of chromosomes), the result is that you get a triploid plant.

The advantage of a successful triploid plant is that it can have superior yield and alpha acids. Many varieties sold today are triploids. Examples would be Willamette, Liberty, Mt. Hood and Crystal. One of the newer hops that we will be discussing that comes from the triploid program is the Santiam. This hop was released in 1997 and is similar to the Hallertauer hop. Acreage for this cultivar, like most other experimental hops, is quite limited. There is starting to be a good following for this hop in many beer styles. It has a floral and slightly spicy aroma.

Private Hops

While many hops come from public breeding programs, there is an increasing amount coming from private programs. In these private programs, the people involved are looking to find good cultivars that will become accepted. They stand to make some money if successful, as they are able to keep control of how it is grown. Some of these varieties produced by private programs would be Warrior, Palisade, Simcoe, Amarillo and Millennium. Amarillo is interesting in that it is the only hop owned by a grower. The others are owned by either groups of growers or hop dealers. At any rate, these hop varieties are increasing in popularity.

The newest hop cultivar out of the shoot is **Palisade**. It is being tested this year by some major brewers and some smaller craft brewers. It is a hop that has both some decent alpha acids and good aroma. The alpha acid levels are estimated to be between 6 and 10%. It is a cross from a Swiss Tettnanger and open pollenation. It grows well and is fairly disease resistant, but is not yet available to homebrewers.

The Warrior and the Millennium are both high alpha hops being grown primarily for the hop extract market or mainly for exportation. Both are doing well and have been received well by the craft brewing industry.

Warrior is an exceptionally good storing hop and has a fairly low co-humulone content (around 24% of the total alpha acids). It's a mild, friendly hop that should mainly be used for bittering. It has 15–17% alpha acids and can be used as a substitute for Nugget or Columbus.

Millennium is another triploid hop that is somewhat similar to Nugget. In fact it has Nugget in its ancestry. Also has good storage and is a fairly mild hop, despite its 15% alpha acid rating.

Simcoe was released in 2000. It has 12–14% alpha acids and has a pine-like aroma and is primarily used in American Ales. It has very limited acreage, but we should see this almost doubled for next year as more brewers are expressing an interest in this hop.

Amarillo has been around for a while, but only in the last few years has it grown immensely in popularity. It is similar to the Cascade and Centennial, but has its own aroma that people like. It also has in part similarities to the Ahtanum, Crystal and Chinook hop. This hop will also see a large increase in its acreage for next year. Amarillo has 8–11% alpha acids. Keep in mind that most of these hops have less than 100 acres devoted to them. (Compared to about 6,000 acres for an established hop cultivar like Willamette.)

One thing to point out is that many of these varieties can become quickly unavailable in the market place because of their limited acreage. In cases of shortages of popular hops, brewers must learn to use other varieties and in some cases find that they like the new substitutions even more. An example of this is the Centennial shortage of the early 90's, which lead to people trying the Columbus hop as a substitution. Many brewers today use Columbus in their beers as a result of this shortage.

There are many other varieties that are fairly new to the scene that are receiving interest. The first of these would be **Glacier**. This hop, with around 5.5% alpha acids, was released in 2000 and has wonderful oil properties. When brewing, this hop tends to hide its bitterness, but shows off its flavor and aroma properties in a beer. One major brewery has expressed interest in this hop and as a result has seen a couple hundred acres put in. Glacier has a low co-humulone content (11–13% of the total alpha acids, compared to the 30–40% found in high co-humulone hops such as Nugget, Galena or Brewers Gold) and can be used as a substitute for Willamette.

Horizon, a half sister to Nugget, is another new hop with fairly high alpha levels (estimated to have around 11–13% alpha acids). It is quite mild in brewing and seen as a possible substitution for Magnum. The aroma is floral and spicy. It has a low co-humulone percentage of around 16–19%.

DWARF HOPS from ENGLAND

New varieties of hops are becoming available from naturally dwarfing plants that grow only 6 to 10 feet tall. The new dwarfing hops are grown in English hedgerows, and so have become known as hedgerow hops.

Hedgerow hops are harvested by a mobile harvester that removes only the cones and some of the leaves. Apart from the obvious ways in which mechanising the harvesting can benefit the grower, the most rewarding is the fact that the picking is so much more gentle for fragile hop cones. This allows growers to pick closer to ripeness to maximize the aroma for the brewer. A mobile hop harvester can cover about 5 acres a day. Mobile harvesting does not cut the bine, allowing more sap to return to the rootstock in the autumn. This strengthens the hop plant for the following season, reducing its fertilizer requirement. The hedgerows remain all year round, so quickly become a haven for wildlife, with birds and small mammals seeking shelter and feeding on the insect life and fallen seed. Also, growing hops in a hedge enables growers to work with indigenous predatory insects in their fight against damaging hop pests. They require much less in the way of assistance from man-made chemicals, and so are referred to sometimes as Eco-hops. Growing hops like this has enabled more to be produced totally organically.

First Gold was bred for the National Hop Association of England at the famous Wye College, in Kent, England by Dr. Peter Darby, and released in 1996. It was the first naturally dwarfing hop, and a true granddaughter of Kent Goldings. With it's 6.5–8.5% alpha acid content, its mother came from a cross between Kent Goldings and American male hops being grown nearby, to give us a Golding variety. Its mother was simply crossed with a dwarfing male and First Gold has proven to be golden in many ways, including its aroma.

— Peter Glendinning, National Hop Association of England

The High-Alpha Ancestor

In the hop industry, hops are normally put into two classifications — high alpha or aroma hops. This would be a good time to talk about the ancestry of today's high alpha hops. Earlier we discussed how to create new cultivars. All of today's hops came originally from wild hops. Many are so old that their parentage is unknown and are called land race varieties. Two of these hops would be Saaz and Hallertauer.

Most of the high-alpha hops of today are a result of a hop bred by Professor E.S. Salmon. In 1917, he found a wild hop growing in Manitoba. This plant was pollinated and two of the seeds produced Brewers Gold and Bullion. These hops are the background to all high-alpha hops grown today, including established hops like Nugget and Galena and newer hops like Columbus. Incidentally, the original crossed hop — the progenitor of all today's high-alpha hops — died the year after the cross was made.

New High-Alpha Hops

High-alpha hops are great for use in high IBU beers, such as double IPAs. Two of the newer high-alpha hops are Magnum and Newport.

Magnum was bred in Germany and is gaining wide acceptance as a clean bittering hop. It has an alpha acid level of 12–14%.

Newport was bred in Oregon from an open pollination. It has good resistance to disease, 13.5–17% alpha acids and has a fairly high beta acid content. (Beta acids are of interest to breweries bottling beer in clear bottles as beta acids don't yield a skunky character when exposed to light.) It was released in 2002 and is being used by the craft brewing industry.

New Aroma Hops

Three of the newer aroma hops would be Santiam, Sterling and Vanguard.

Santiam, is a triploid hop released in 1997 that is similar to Tettnanger. This was one of the late George Fix's — homebrew lecturer and writer — favorite hops. Santiam has 5–7% alpha acids and an aroma with noble hop characteristics.

Released in 1998, the **Sterling** is a hop that has recently been accepted by a larger brewer as one of their main hops. It has been called a cross between Mt. Hood and Saaz. With 6–9% alpha acids, it has an herbal, spicy aroma with a hint of floral and citrus.

The last hop to talk about is the **Vanguard**, with an alpha acid rating of 5.5–6%. It is also similar to the Hallertauer hop. It has also developed a following and should grow in acreage.

Reading about hop varieties is fine, but — of course — to really get to know a new hop variety, you really need to brew with it.

Ralph Olson is the owner and general manager of HopUnion CBS, L.L.C.

Cereal Mash

Utilize any unmalted grain or starchy adjunct

by Chris Colby

One of the advantages of all-grain brewing is the ability to use ingredients that can't be used in extract brewing. Specifically, all-grain brewing allows brewers to use starchy grains or adjuncts that would cause haze (and instability) in an extract beer. Because grain-derived enzymes in the mash (alpha and beta amylase) degrade starch into simple sugars, starchy adjuncts can be added to an all-grain mash.

In order to degrade starch in a mash, however, the starch needs to be accessible to the starch-degrading amylase enzymes. In most plants, including barley, starch is stored in granules. In these granules, starch has an organized structure. When a starchy food is soaked in cold or lukewarm water, the starch absorbs some of the water, but the granules remain essentially intact. Within a range of temperatures, however, the starch loses its structure and becomes a "net" of starch with lots of water molecules interspersed. This is called the gelation range. Above the gelation range, the starch dissolves into the water. Because the starch-degrading amylase enzymes are water soluble, they can then get to the starch and begin degrading it.

(A note: starch gelation is often referred to as starch gelatinization. Technically, gelatinization is the process that occurs to gelatin (a protein) in hot liquids. Gelation is the proper term for the process in carbohydrate gels.)

The gelation range varies among starches for different types of plants. Most, however, begin the range of 120–140 °F (50–60 °C). [Differences exist among plants starches because different plants have a different ratio of amylose (straight-chained starch) to amylopectin (branched starch).] An upshot of this is that many grains or other starchy adjuncts can simply be stirred into the mash. The temperatures in the saccharrification range are sufficient to gelate the starch and render it accessible to amylase enzymes. Unmalted barley and unmalted wheat, for example, are two grains that can be mashed. Some starches, however, have gelation temperatures starting above mash temperatures. Likewise, some starchy adjuncts have traditionally been boiled to obtain a better extract or to speed up hydration.

Corn grits and rice are two common adjuncts in American Pilseners (and American Bocks). These ingredients are boiled, along with a small amount of barley malt, in what is called a cereal mash. Also, in traditional Belgian lambic brewing, raw wheat is sometimes boiled — again, with a bit of malted barley — before stirring it into the mash. (A step mash is used in other occasions.) This is not called a cereal mash, but the process is the same. For brevity, I'll simply call the process "a cereal mash" rather than "a cereal mash or the process that's exactly the same as a cereal mash but not labeled as such because a standard beer grain or non-cereal adjunct is involved."

Learning to perform a cereal mash not only allows you to brew American Pilseners (including classic American Pilseners), American Bocks and lambics, it also allows you to experiment with many types of grain or other starchy foods that are not malted. Beers brewed with potatoes, sweet potatoes and tapioca, for example, can be made if you know how to do a "cereal mash."

What you'll need

The only equipment you'll need for a homebrew cereal mash is a pot and a spoon. I brew outside, using two "turkey fryer" set-ups — one for my hot liquor tank and another for the brewpot. When I do a cereal mash, I simply use my old 5-gallon (19 L) brewpot on my kitchen stove.

Ingredient amounts

In an American Pilsner, 30-40% of the grain bill is rice or corn. The rest is 6-row pale malt. This gives a good upper limit to the amount of adjunct you would want to use. (Use the dry weight of the ingredient when calculating this.) For 2-row malt, which has fewer enzymes, an upper bound of 30% would be prudent. If you have worries about converting all the starch in your recipe, perform an iodine test and do not mash out until it tests negative. (You can also add commercial preparations of amylase enzymes.)

Within a range of temperatures, however, the starch loses its structure and becomes a "net" of starch with lots of water molecules interspersed. This is called the gelation range.

Mash options

When you plan to utilize a grain or starchy adjunct using a cereal mash, you will need to plan whether you want to do a step mash or a single infusion mash.

A traditional cereal mash, of the type used in making American Pilseners, is part of a step mash program. In this mash program, the barley is mashed in at a temperature below the starch conversion range. The cereal mash — which is about

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30–40% the size of the main mash — is boiled, then pumped into the main mash. The heat from the cereal mash raises the temperature of the main mash. See the recipe for an example of a stepped cereal mash.

As a homebrewer, however, you can also opt for a single infusion mash along with your cereal mash. To do this, boil your cereal mash but do not mash in the rest of your grains initially. When the cereal mash is ready, combine it with the crushed grains and hot water to mash in at your preferred temperature.

A single infusion mash is conceptually simple, but it can be difficult to hit your mash-in temperature. I've done this a few times with my sweet potato ales and have found an easy way to hit the right temperature. For a "single cereal mash," heat your brewing liquor to about 11 °F (6 °C) over your target mash temperature as you usually would. But, keep some room temperature water on hand. Stir the cereal mash into your dry grains, then quickly start adding water to your mash. (Stir vigorously since you're stirring water into the grain.) When your mash is a very thick, oatmeal-like consistency, take the temperature. You should be close. Bring the mash up to your normal consistency by adding small amounts of room temperature water, hot brewing liquor or mixtures of the two, as needed. Work steadily, but don't sweat if it takes you a few minutes to go from thick mash to the proper consistency.

How to cereal mash

To do a cereal mash, combine your "cereal" — whether, it's corn or rice, an unmalted grain or other starchy food — with about 10% six-row barley malt or 15% two-row barley malt. The malt should be crushed and — if your cereal is another grain — crush that too. Slice, dice or otherwise reduce the size of other starchy foods to small enough pieces so that they will hydrate quickly. You can go higher on the barley percentage if you want, up to around 30% if you wish.

Add water and begin heating the cereal mash. Shoot for a thin gruel-like consistency. Some foods will take on water as they cook, so don't be afraid to add water as you go if the cereal mash gets too gooey.

Bring the cereal mash to the high end of the starch conversion range, around 158 °F (70 °C) and hold for 5 minutes. The barley malt in the mix will convert any stray starches at this point, but the bulk of the starches will be converted in the main mash. (Even with starchy foods with a low gelation range, there is not enough enzymatic power in the cereal mash to fully convert it.)

After the five-minute rest, bring the cereal mash to a boil. You will need to stir nearly constantly as it heats and boils to prevent scorching. Boil the mash for 30 minutes. When the cereal mash is done, stir it into your main mash. At this point, the starches in the cereal mash will be exposed to the amylase enzymes in the main mash and degraded. At this point, you simply finish brewing as you normally would.

Grains and astringency

At this point, some all-grain brewers may be wondering about astringency. If you boil an unmalted grain, won't you extract tannins from the grain and get a horribly astringent beer? After all, when sparging, you are told not to exceed 170 °F (77 °C).

In fact, the pH of the boiled mash will be fairly low and not conducive to tannin extraction. This is why decoction mashes don't yield terribly astringent beers (although a small amount of astringency can develop in a decoction mash). In a grain bed rinsed with sparge water, the pH is much higher and the temperature must be kept lower. If you use large amounts of a husky grain, astringency is a possibility. However, it is not assured.

Why should I try it?

Learning to do a cereal mash adds another tool in your bag of brewing tricks and allows you to experiment with new ingredients not found at your local homebrew store.

Chris Colby writes the Techniques column in each issue of BYO.

cereal mash recipe

The Cream Police

(5 gallons/19 L, all-grain)

OG = 1.045 FG = 1.009

IBU = 17 SRM = 4 ABV = 4.7%

For the "corniest" cream ale you can make, a cereal mash with corn grits is just the thing. This recipe will show you that cereal mashing is a useful homebrewing technique and not just a Cheap Trick.

Ingredients

8.0 lbs. (3.6 kg) 6-row pale malt
1.8 lbs. (0.82 kg) yellow corn grits
4.66 AAU Brewers Gold hops (60 minutes)
(0.58 oz./17 g of 8% alpha acids)
1 tsp. Irish moss
1/4 tsp yeast nutrients
Wyeast 1056 (Amercian Ale) or White Labs WLP001 (California Ale) yeast (1.5 qt./1.5 L starter)
1 cup corn sugar (for priming)

Step by Step

In your kettle, heat 2.5 gallons (9.5 L) of water to 144 °F (62 °C). Mash in crushed 6-row malt and hold at 133 °F (56 °C). Reserve a handful of 6-row malt. In a stock pot, mix the grits and the handful of malt with water and heat to 158 °F (70 °C). Hold for 5 minutes, then bring cereal mash to a boil, stirring constantly. Boil cereal mash for 30 minutes, then add to main mash. Apply heat to bring full mash temperature to 150 °F (66 °C) and hold for 45 minutes. Scoop mash into your lauter tun and add boiling water to raise temperature to 158 °F (70 °C). Recirculate wort for about 20 minutes, then begin running off wort. Sparge with 190 °F (88 °C) water, but do not allow grain bed to exceed 170 °F (77 °C). Collect about 5 gallons (19 L) of wort, add 1.5 gallons (5.8 L) of water and boil for 90 minutes. Add hops with 60 minutes left in the boil and Irish moss and yeast nutrients with 15 minutes left. Cool quickly and transfer to fermenter. Aerate well and pitch yeast. Ferment at 67 °F (19 °C) for one week. Transfer to secondary and, if possible, cool beer to 40 °F (4.4 °C) and hold for two weeks. Keg or bottle with corn sugar.

From "zome" to Cone

Advanced advice on growing your own hops

Story by **Bill Pierce**

One of the easier ways you can put the "home" in homebrewing is to grow your own hops. This widely distributed plant, with the latin name *Humulus lupulus*, is broadly part of the family of nettles. It is somewhat more closely related to cannabis, although it has few if any of the mind-altering properties and none of the legal consequences of its notorious cousin.

A hint of hop history

Hops likely were originally native to Asia and later were cultivated by the Greeks and Romans for their tender shoots that were cooked and eaten much like asparagus. However, the dried cones were not used for bittering and flavoring beer until the Middle Ages, and it was only in the late 1500s that they came into regular use in England.

Today, commercial hop cultivation in the United States is centered in the Yakima valley of central Washington and to some extent in the Willamette valley of Oregon. There is also some acreage in Idaho. Historical hop growing regions also have included California, central Wisconsin, central New York and western Massachusetts. In fact, hops have been raised commercially throughout most of Europe and North America, and homebrewers now successfully grow them in every US state and Canadian province.

photo courtesy of kristin grant

A hop vine nearing maturity. Hops can be grown at home from rhizomes.

What it takes

The requirements for growing hop plants include well-drained soil, sufficient moisture, a sunny location, room for the foliage to climb and trail and a growing season of at least 90 days without a hard freeze. The roots also like a dormant season and will withstand harsh winters. But this does not mean you shouldn't try growing them even if you live in frost-free Hawaii or south Florida, and some of the valleys of southern Alaska are temperate enough to produce hops during the long daylight hours of the summer.

The bines — technically differentiated from vines because they twine in a clockwise direction — are annual, dying off each winter. The roots, however, are perennial — sending up new green shoots in the early spring.

Over several seasons, the plants develop an extensive root structure and grow best in a fairly large space, but there are those who manage to raise hops in fertilized large tubs on a sunny deck. Surplus beer kegs will work if they have holes for adequate drainage.

Only the female hop plants produce the distinctive cones, technically known as strobiles, that are used in brewing. The presence of male plants will cause the production of seeds that reduce the bittering and the useful yield. This is why digging up and replanting of wild hops is not recommended. Buy female plants that have been selected for cultivation.

Where to go

Many homebrew shops, mail-order and online suppliers offer hop rhizomes for sale in late winter or early spring. Rhizomes are thickened, root-like sections about the size of a finger that look somewhat like small sweet potatoes. Check for availability at this time of year. (If your local homebrew-shop doesn't carry rhizomes, see the sidebar on page 45 for a list of internet suppliers.) Rhizomes are stored in a cool location, often refrigerated.

The varieties offered for sale may vary somewhat from year to year, depending on availability and disease restrictions. Not all of them will do equally well in a particular region or location. If you have hop-growing members in your homebrew club, they will likely have some information on what has worked well or poorly in your region.

Among the most successful for homebrewers are commercial varieties developed in North America. These include Willamette, Mt. Hood, Chinook and especially Cascade, which are prolific and reliably produce high yields almost everywhere. Other varieties have mixed results, but you are free to

try them. Keep in mind that when English or German hops are grown in the US, their character changes.

Hops spring eternal

Hops are an early season crop and can be planted soon after the soil can be worked. This likely will be anywhere from early February to mid-May depending on your location.

If you are an experienced gardener, you can think of them as being similar to peas in terms of their planting time. They will tolerate moderate frosts well, although a hard freeze — below 28 °F (-3 °C) for 24 hours or more — will damage the young shoots.

Location, Location, Location

Choose a sunny spot with good drainage. You will later need strings or wires for the bines to twine around as they grow. These can be stretched from stakes in the ground to tall poles or the edge of a building, ideally the south-facing side.

Hops are prolific climbers; they can reach a height of 25 to 30 feet (8–10 meters). However, they can be trained to grow vertically for part of that distance and then extended horizontally or at an angle along an elevated trellis or lattice. It's worth planning for the best configuration that fits your growing space.

The soil should be porous and relatively rich. Till it to a depth of about 12 inches (30 cm), adding a little sand if it is overly dense. Dig holes about 10 inches (25 cm) deep and 24 to 36 inches (60–90 cm) apart, so that the plants don't grow together. In the bottom of each hole place an inch or two (3–5 cm) of organic compost or a balanced, mild commercial vegetable fertilizer or well-seasoned manure, then set a rhizome with any rootlets pointing downward. Fill the hole the rest of the way with soil, tamp it down lightly and cover with some mulch such as straw or grass clippings. Water well but do not flood the ground.

If you are an experienced gardener, you can think of [hops] as being similar to peas in terms of their planting time.

Growth and Maintenance

Within a couple of weeks, depending on the soil temperature, the shoots should begin to emerge. It's best to select the three or four strongest shoots from each plant and trim back the others. Once they reach a length of 12 to 18 inches (30–45 cm), twine the shoots in a clockwise direction around the wires or strings and let them climb. On a warm, sunny day in late spring, it's not uncommon for them to grow 6 inches (15 cm).

The plants will require fairly frequent watering throughout most of the growing season, although the ground should not have standing water. If you are in a dry climate you should probably consider drip irrigation or a soil soaker. In order to prevent mildew — a common problem plagueing hops — do not drench the foliage.

Non-human hopheads

Hops have a few enemies, animals that enjoy hops as much as the most rabid IPA fan. Rabbits and deer are fond of the young and tender shoots; you may wish to protect the plants with chicken wire when they are small.

Bothersome insects include aphids, spider mites and Japanese beetles. Because you will be brewing with the cones, use low-toxicity measures to control pests. Ladybugs (available at some garden shops) are a natural predator of aphids, while mild insecticidal soap sprays are the best defense against serious infestations of the others. Generally these problems become less severe as the season progresses.

After the summer solstice, the plants gradually will switch their energies from growing foliage to producing small, burr-like flowers and eventually the cones. These will continue to appear and grow throughout the summer. The number of cones your bines develop will depend on the age of the plants and the growing conditions. Don't despair if you have few or even no cones in the first season. Almost all hop growers report much higher yields after a year or two as the plants develop a more extensive root system.

Bringing in the cones

Typically by late August or early September, a bit earlier in warmer climates, the first cones will be ready for harvesting. It's a little tricky to determine when hop cones are ready to be harvested, but here are a few tips:

Color The color of a mature cone should be a light yellowish-green and the individual "leaves," technically known as bracts and bracteoles, should be starting to separate.

Lupulin Glands There should be dots of powdery yellow lupulin glands on the bracts toward the stem.

Touch Test When you squeeze a cone it should feel slightly dry and papery and spring back a little after you release it. If it is somewhat moist, dense and unyielding, it is not ready. After touching a ripe cone your fingers should have a little lupulin and a resiny, flowery, citrusy or piney smell typical of hops.

The cones mature over a period of a couple of weeks, so you can harvest them progressively. If you do this you will need a ladder or other means in order to pick only the ripe cones. Be careful to avoid falling; it's best not to have a homebrew before or during climbing. The alternative is to cut the strings or wires and lower them to where they can be reached. Unfortunately this may require

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The bines will wither and die off after the harvest. Cut back the dead foliage in the fall to within about an inch (3 cm) of the ground.

discarding some of the cones that have not yet ripened.

Drying the cones

The harvested cones still need to be dried. There are several ways of accomplishing this. A food dehydrator works well, as does a cookie sheet in an oven set to no warmer than 150 °F (65 °C). Leave the oven door open and provide good ventilation. It will take the better part of a day. A slower but often more convenient method is to find a warm, dry location such as an attic or garage. Spread out the cones on a window screen supported by sawhorses, with a fan set on the floor underneath. The cones should be dry within 2–3 days if the temperature stays mostly above 85 °F (30 °C).

When the cones are dry they will still be light yellowish-green in color, but they will feel brittle and papery and be a fraction of their weight when picked, due to the loss of moisture. At this point place them in zippered plastic bags intended for freezing, squeeze out as much of the air as possible, label them and store in the freezer until ready for brewing.

The bines will wither and die off after the harvest. Cut back the dead foliage in the fall to within about an inch (3 cm) of the ground. It can be composted with other yard wastes; some people make hop wreaths for the winter holidays. Place some straw or other mulch over the plants before the ground freezes or goes dormant. This is also the best time to fertilize the soil. The roots will send up shoots again in the spring.

If you wish to replant the hops in another location or donate some of them to your fellow homebrewers, you should dig up the rhizomes in the late fall. Select and cut healthy-looking sections about as thick and slightly longer than your finger. Surround each one with a little damp soil and mulch, and place in a zippered plastic storage bag. Store in a dark, cool location such as a basement or refrigerator. They can be planted again in the early spring.

Bitter fruits

Commercial hops are analyzed for the alpha acid percentage so that the brewer knows their expected contribution in terms of bittering. Unfortunately it's difficult for the home hop grower and homebrewer to determine this without access to a well-equipped biotech or medical lab. You can estimate the bittering based on the published alpha acid ratings of commercial hops of the same variety, but these vary from season to season. Your homegrown hops are likely to be higher or lower, depending on your location, the weather and the care you lavish on them.

It's possible to brew a test batch of beer with homegrown hops and then compare it to other beers of known bittering. By this means and with a little calculation (brewing software is helpful for this task) you can approximate the alpha acid content. However, the precision will depend on your taste buds, which are notoriously inexact for such purposes, as well as the timing of the hop additions in both the test batch and the beer to which it's being compared. You can also send a sample of your hops or the beer brewed with them to a commercial laboratory for alpha acid or bittering analysis. The fees for such services are generally in the range of $25–$50.

As a result, many homebrewers use homegrown hops only for flavor and aroma additions, where the bittering is less of a factor and the fresh qualities of your own hops are far more important and appreciated.

Bill Pierce is BYO's Advanced Homebrew columnist.

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by Dan Mcmillan

Memphis, Texas is so dry that even a camel would dehydrate and die there — if the

camel drank beer instead of water, that is. The 3,000-plus people in the panhandle town have to travel 90 miles in any direction to buy beer: to Wichita Falls to the north, Amarillo to the south or Hollis to the east. It is little wonder that in 1944, in the middle of World War II, four Memphis high school seniors embarked on an ambitious plan to brew their own beer. This is their story, but the boys' last names have been omitted for their protection.

Each of the future "brewmeisters" brought a special qualification to their endeavor. Robert's father owned a big farm with a barn where the master brewers could work in relative safety. Bill had a homebrew recipe he had stolen from his father, Memphis's leading bootlegger. Frank had access to a pickup truck the boys could use to transport their brewing materials from town to the farm. Dan could steal sugar-rationing stamps (remember, this was wartime) from his mother, who was in charge of Memphis school cafeterias.

Over a case of Oklahoma beer they bought in Hollis on a Saturday night trip, these aspiring brewers sat down and went over the stolen recipe. It was a simple brew, calling for sugar, yeast, barley and water. The group immediately agreed to more than double the yeast and sugar content to make the brew stronger. They also decided that eight or 10 plugs of Brown Mule chewing tobacco would give special "character" to the brew.

To avert suspicion, the boys purchased each ingredient from a different Memphis grocery store. The group then met at Robert's barn and went up in the loft to make their homebrew. Robert had found a steel barrel on the farm that had been used to haul kerosene. It was washed out and used as the vat for mixing the brew. Our brewmasters loaded the refurbished kerosene barrel with barley, rice, water, four times the recommended sugar and yeast and eight plugs of chewing tobacco.

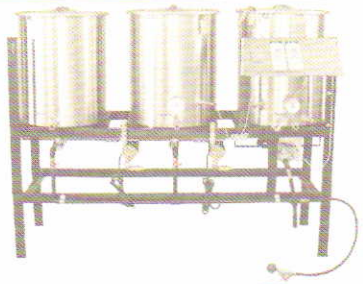
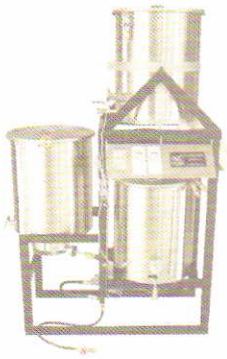
As the group stirred the concoction, Frank said he recalled hearing it was a good idea to put some Irish potatoes into the mixture to help purify it. Dan took the pickup and went to one of the school cafeterias where he swiped the potatoes when no one was around. They didn't bother to peel the potatoes and just threw them unwashed into the barrel. After all, there was plenty of water in there to clean them.

Unfortunately, when Bill swiped the recipe from his dad, he overlooked a sheet with instructions to let the mixture ferment for 48 hours before bottling. As soon as they thought the mixture had been stirred enough, the brew masters started bottling.

Robert suggested putting a rubber hose in the hole at the bottom of the barrel (which had been plugged with a sheet while the ingredients were mixed) to draw off the beer for bottling. But because there was no spigot, there was spillage while they removed each full bottle and placed an empty one under the hose. To avoid spilling their precious concoction, Frank suggested that he lie on his back by the barrel. When one bottle was full, the operator would stick the hose in Frank's mouth until another bottle could be put in its place.

Soon the others decided they should all get turns catching the brew, so each of the bottlers got in on the early sampling of the brew — except Dan, he was suffering from a sore throat and had trouble swallowing. By the time they finished bottling, our brewmasters had ample evidence that their "beer" pulled plenty of kick. Frank and Bill eventually thought they could fly out of the barn loft and, fortunately, fell on a stack of hay when they tried. In another brave attempt, Robert got thrown trying to ride a bull in a pen by the barn.

After everyone sobered up, the brewers took their bottles of homebrew to a nearby creek and buried them. They then took a solemn oath to disclose to no one else where the beer was buried. The next night, Frank and Dan had dates and told the girls they had some really great beer. Unfortunately, out of the 20 bottles they had buried in this particular case, all but six had exploded. When Frank opened one of the remaining bottles for his date, the brew shot up about 10 feet into the air. Unfortunately the "brewmeisters" never got a second chance at their Memphis homebrew because they soon said goodbye to the town to serve in the military during World War II. Although most of the bottles blew up while buried in the creek, those that did not accounted for several weeks of partying in previously "bone-dry" Memphis, Texas.

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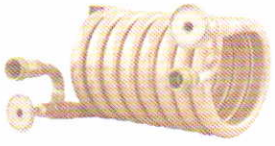
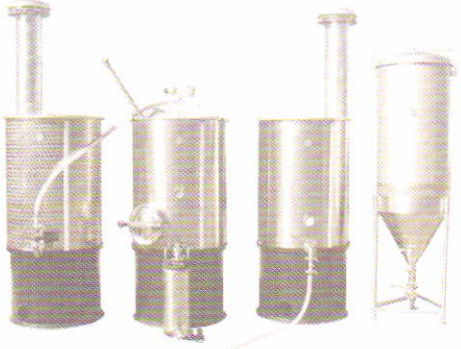


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