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OCTOBER 2003, VOL.9, NO.6

THE HOW-TO HOMEBREW BEER MAGAZINE

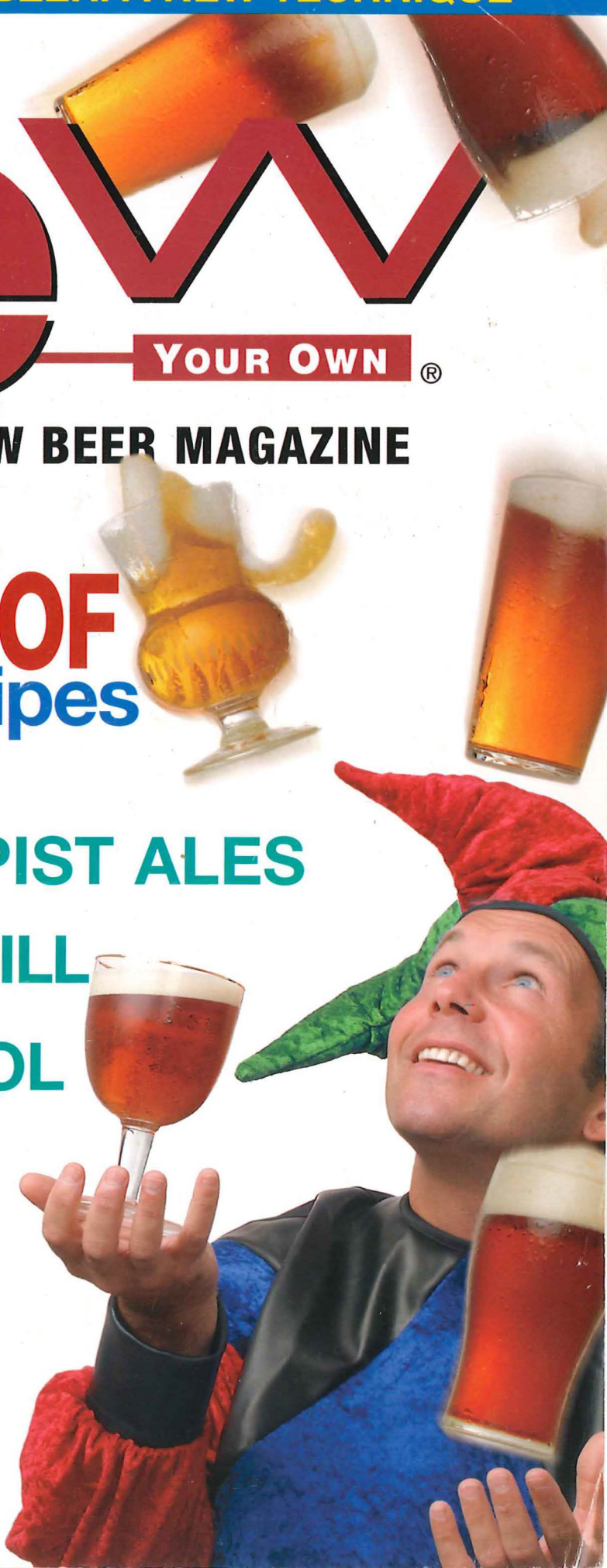
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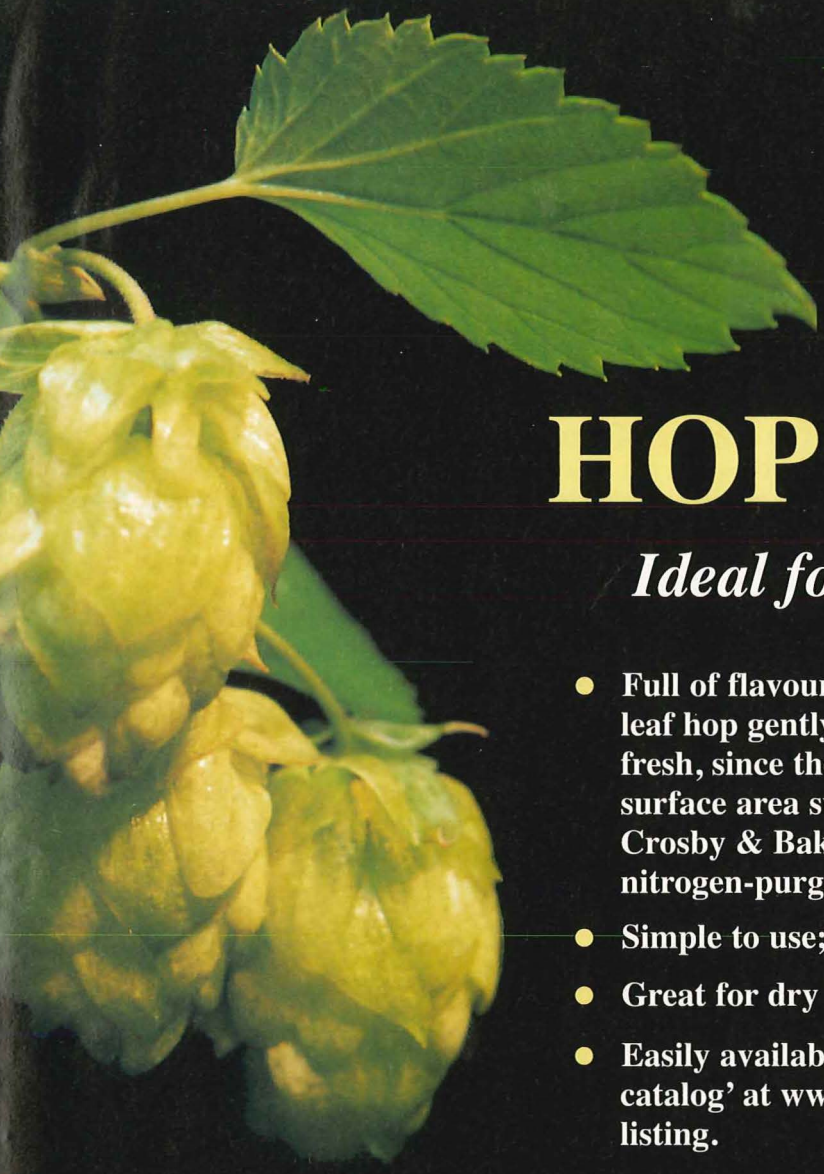
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COVER photography: **Charles A. Parker**

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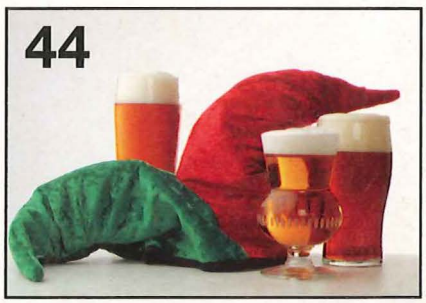
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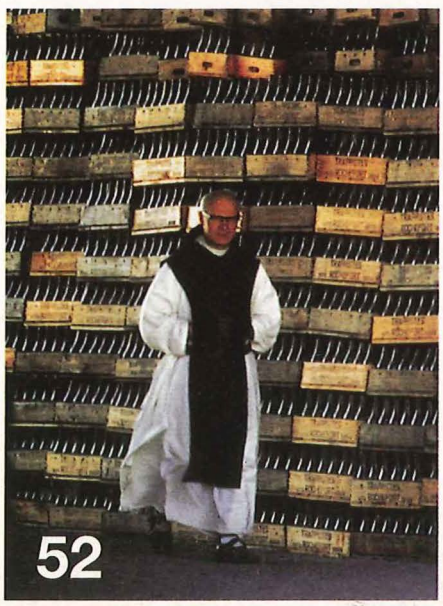
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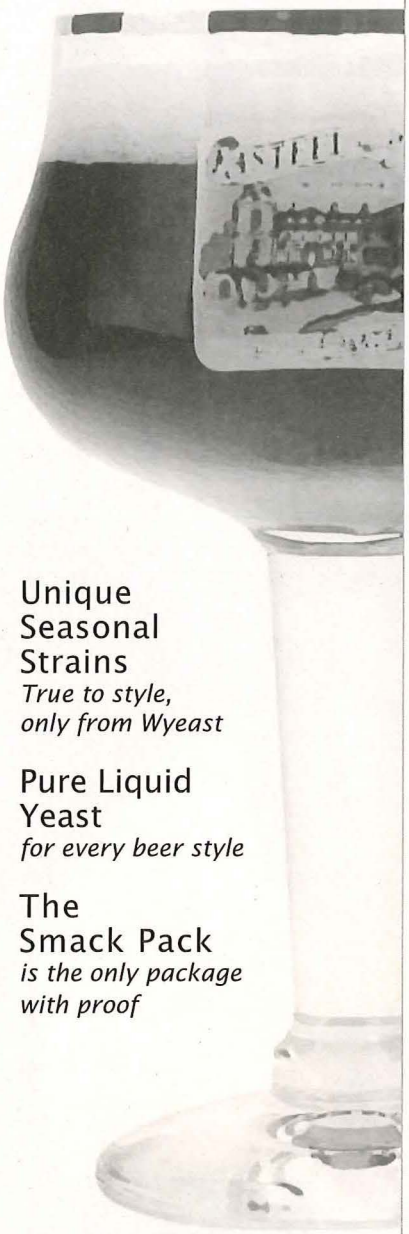
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Special Subscription Offer
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Web Site
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Brew Your Own (ISSN 1081-826X) is published monthly except February, April, June and August for $24.95 per year by Battenkill Communications, 5053 Main Street, Suite A, Manchester Center, VT 05255; tel: (802) 362-3981; fax: (802) 362-2377; e-mail: BYO@byo.com. Periodicals postage rate paid at Manchester Center, VT and additional mailing offices. Canada Post International Publications Mail Product Sales Agreement No. 1250469. Canadian Mail Distributor information: Express Messenger International, P.O. Box 25058, London BC, Ontario, Canada N6C6A8. POSTMASTER: Send address changes to *Brew Your Own*, P.O. Box 469121, Escondido, CA 92046-9121. Customer Service: For subscription orders call 1-800-900-7594. For subscription inquiries or address changes, write *Brew Your Own*, P.O. Box 469121, Escondido, CA 92046-9121. Tel: (800) 900-7594. Fax: (760) 738-4805. Foreign and Canadian orders must be payable in U.S. dollars plus postage. The subscription rate to Canada and Mexico is $30; for all other countries the subscription rate is $40.

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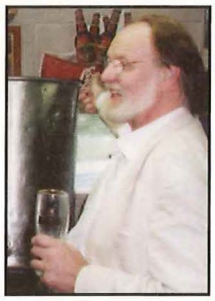
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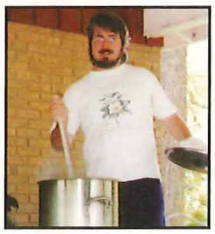
Contributors



Horst 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 — by then a student of 22 with a Fulbright grant in his back pocket — he chucked the familiar comforts of home and 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 in the Classic Beer Style series by Brewers Publications: "Altbier" (1998) and "Bavarian Helles" (2000). He also wrote "PROST! The Story of German Beer" (Brewers Publications, 1997). Horst lives and brews in West Newbury, Massachusetts. He writes the Style Profile column in every issue of *BYO* and wrote the feature story "Trappist Ale" on page 52.



Garrett Heaney came aboard as associate editor of *BYO* and *WineMaker* magazines in June. He recently 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. Heaney has been covering college basketball as a stringer to the Bennington Banner sports department for the past two years and looks forward to the upcoming season. Garrett is a native Vermonter who grew up in the Northeast Kingdom and graduated from St. Johnsbury Academy in 1997. When he's not reading and writing, he spends a lot of time at the gym and playing basketball. He also enjoys traveling and the outdoors. Hiking, camping, fishing and learning more about beer make up the majority of his weekend agenda.

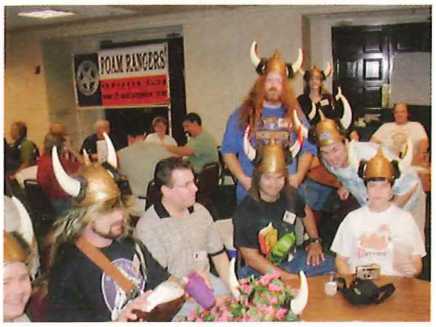


Chris Colby has been a homebrewer since 1991, after moving to Boston for graduate school and discovering good beer.

Now he lives in Bastrop, Texas and is a member of the Austin ZEALOTS homebrew club. Although he mainly brews "normal" beer styles (especially pale ales and porters), he does try a few experiments every year. Past experiments have included a sweet potato ESB and a Jolly Rancher Apple Lambic. He keeps threatening to try to brew a peanut beer.

For three years, Chris has written the "Techniques" column for *BYO*. He has also written a number of feature stories, including "Homebrew University," which won a Quill and Tankard award in 2002. In late 2001, he left his job as a science textbook editor to become the managing editor of *BYO*. As of this June, he has taken the reins as editor. Congratulations, Chris! See his feature story "The Texas Two-Step Method" on page 38 and his Techniques article, "Hitting FG" on page 60.

Belated By-Line



The profile of the Dixie Cup homebrew competition (Homebrew Nation, September 2003 issue) did not include an author's attribution. The article was written by Bev D. Blackwood II, a member of the Foam Rangers homebrew club and co-editor of Brewsletter Urquell (the club's newsletter). Bev hopes to see everyone at this year's Dixie Cup.

Extracting Information

In the September 2003 issue, you stated that you use the same set of assumptions when calculating the statistics for each recipe ("BYO Recipe Standardization," p. 10) and gave a list of potential extract values for a few common beer ingredients. Is the full list available anywhere?

Mark Johnson
Sioux Falls, South Dakota

We do not a have a full list of potential extracts compiled at this time. The books "Clonebrews" and "Beer Captured" (both by Mark and Tess Szamatulski), however, list the potential extract of a wide variety of brewing ingredients. Our numbers are very similar to theirs, only occasionally differing slightly. The most relevant difference is that they give 1.044 as the potential extract value of dried malt extract and we use a value of 1.045.

Lawnmowing Language

In the July-August 2003 issue, you had an article on lawnmower beer ("Lawnmower Beers," by Joe and Dennis Fisher). I would be most interested to know how and when you came up with that term. I agree it is an apt name to describe the beer. Our homebrew club, CSRA Homebrew Club, had a contest for what we called lawnmower beer in 1996.

Dane Scarff
via email



Editor Chris Colby responds: "We at BYO did not make up the term lawnmower beer. This designation has been kicking around homebrewing circles for as long as I can remember. I suspect, however, the term has a recent enough origin that someone out there probably does know how it arose. If you do, drop us a line at edit@byo.com and we'll print your letter."

Lose the Lid?

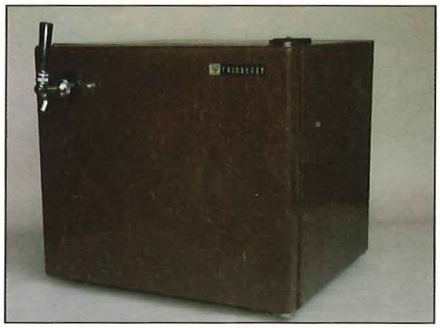
I never knew until reading your article on boiling ("Hot Wort!," July-August 2003) that light-colored worts were boiled so long. (In fact, I think someone told me the opposite once.) I do have a question, however. If my stove does not give off enough heat to bring my wort to the proverbial "good rolling boil," should I put a lid on it?

Frank Baker
Bulls Gap, Tennessee

Wort darkens as it boils. For this reason, some homebrewers recommend boiling light-colored worts for 45 minutes or less. This is not, however, how these beers were traditionally made. With a full-wort boil and a reasonable evaporation rate, a light-colored wort will only darken slightly during a 90–120 minute boil.

Putting a lid on your pot will increase the vigor of your boil. However, you are also preventing volatile substances, such as DMS, from escaping your kettle. So, you should not boil your wort with the lid on the pot. As a compromise, you can set the lid as loosely as possible on the pot. This will trap some heat, but still allow steam to escape.

Just Tap It



I am attempting to make a variation of the Tap-a-Fridge highlighted in your December '02 issue. I spoke to a company that sells cold coils and they said that the system I was making could possibly lead to a secondary fermentation in the keg if the keg was stored warm.

Geoff Keller
RAF Lakenheath, United Kingdom

If your beer fermented completely (to the attenuation level of your yeast), most of your yeast will flocculate out and be left behind in the fermenter when you rack to the keg. The remaining yeast cells in suspension in the keg won't "wake up" and start fermenting just because the beer is stored warm.

However, if you stopped your fermentation prematurely by cooling the beer, the beer can resume fermenting when warmed up. Likewise, if the beer is contaminated with bacteria or wild yeast, storing it warm could allow these organisms to ferment carbohydrates left behind by your brewer's yeast.

Hop Help

I have a question regarding hop utilization and possibly a too energetic boil. I have noticed that much of what I brew does not seem to have the hop

character I want. I always shoot for a vigorous boil and I have recently noticed that a thick line of green goo is on my kettle after the boil. This appears to be most of my hops! I have not read anything to say that a vigorous boil should be avoided as it leads to hop pellets being cast to the sides of the kettle resulting in less utilization. Could this be the problem?

Michael Wolf
Huntley, Illinois

The hop ring left in your kettle is probably contributing to your lack of hop bitterness. If the hops aren't submerged in the boiling wort, their bittering compounds (iso-alpha acids) are not being extracted from them.

"Ring around the kettle" is a common occurrence when using hop pellets. However, we don't recommend reducing the vigor of your boil as a way of dealing with this. You need a vigorous boil to obtain adequate hop utilization and a good hot break. To deal with the hop ring, take your brewing spoon or paddle and knock these into the wort as you boil.

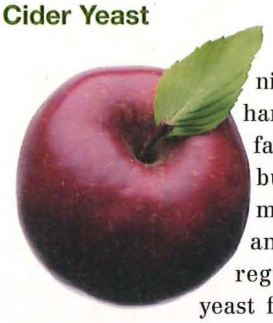
10-Gallon Batches

I recently moved to brewing larger all-grain batches (from 5 gallons to 10 gallons) and can't seem to find any info on the proper amount of yeast to use.

Bob Leigh
Goshen, Connecticut

For a 10-gallon batch of average-strength ale, a 1-gallon (3.8 L) starter with a starting gravity 1.048 would yield the optimal amount of yeast. You'd need about twice this much yeast for a lager. These are just the optimal amounts; you could get away with only half (or maybe even a quarter) as much yeast if you cool and aerate your wort properly. Pitching an adequate amount of yeast will give your beer a fast start to the fermentation and the beer will ferment down to a reasonable final gravity (FG).

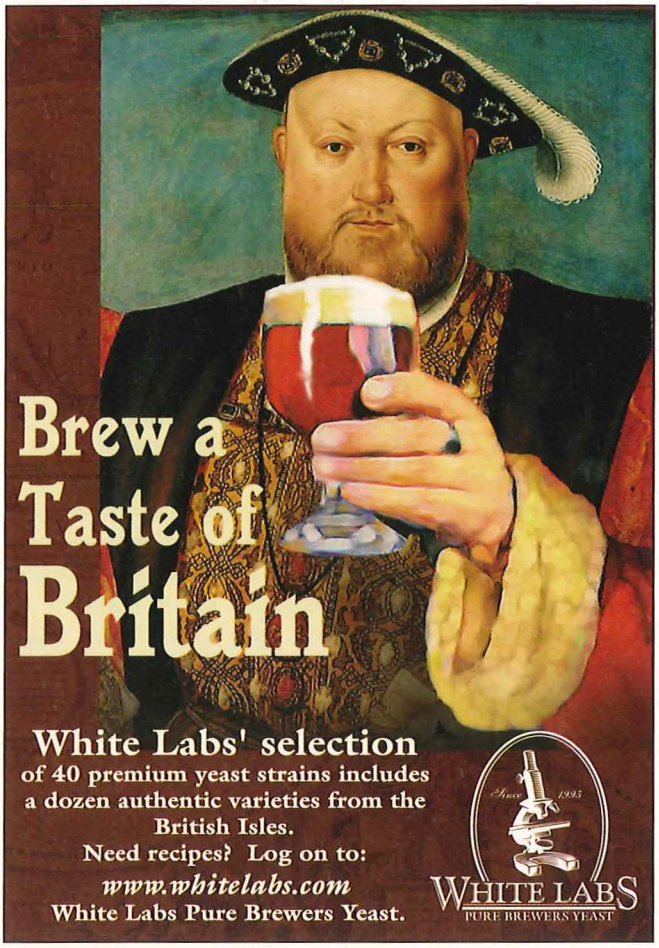
Cider Yeast



I am planning on making hard cider this fall. I have a buddy that makes cider and he uses regular baker's yeast from the grocery store and gets a great flavor. I have no idea how this is. I was wondering if you could recommend a yeast to use. I was leaning towards an ale yeast or champagne. I'm looking to retain the sweet flavor, any suggestions would be greatly appreciated. Thank you much.

Harry Carodiskey
Danville, Pennsylvania

Proulx and Nichols, in their book "Cider," recommend Champagne, Johannisberger, Sauternes, Tokay or Rhine wine yeasts. Many homebrewers simply use ale yeast. ■





brewer PROFILE

Ant Hayes • South Africa



PHOTO COURTESY OF ANT HAYES

Ant Hayes averages one brew session a month at his home in South Africa.

Being a homebrewer is tough in South Africa. With great weather and wide-open spaces, there are plenty of competing activities. However my wife and I love to braai (barbecue), and that requires a lot of great beer.

I started brewing during my final year of high school. My mother thought that a six pack was sufficient for my summer holidays, so I needed a cheap alternative source of beer. Once back at school, I found it convenient to smuggle stout into the hostel in Coke bottles. I brewed kits for five years (mainly pale ales and fake lagers) and in the process developed a taste for varied beer styles.

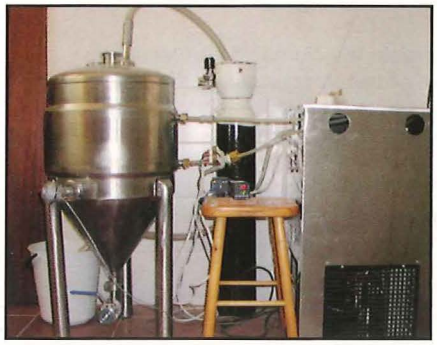
During my actuarial studies I made extract brews, adding specialty malts for color and flavor. In 1996, I finally finished studying and started mash brewing. Dave Line's "Big Book of Brewing" became a text that I read daily. My beer quality took a dip initially when moving to all-grain, but rapidly picked up again. The ability to brew pale lagers sustained me in the early days of difficult mash sessions, with hot wort spraying all over the place.

The biggest improvement in my brewing occurred when I met the Draymans Brewery brewmaster Moritz Kallmeyer. Moritz started out as a homebrewer and now runs his own brewery. His advice is to pay attention to detail every time you brew. He helped me design my stainless steel, three tier brewery and cylindroconical fermenter, with cooling jacket. (Cheap stainless steel is another benefit of living here.)

These days I brew once a month on average. I tend to brew according to the weather — mainly Axe Lager in summer, Sword Bitter in autumn and spring and Flintlock Porter and Hela's Rake (Belgian strong ale) in the winter. Every now and again I make something special. My wife gave birth to twins this year, so I brewed a barley wine (Miölnir), which I hope to share with them on their 21st birthday.

My biggest homebrewing success has been the co-founding of the Home Brew Tri Nations competition, with Scott Morgan of Australia and Bryan Myers of New Zealand. Each year the top three beers from our respective countries face off. So far, Australia has taken the team competition. There is a long history of rivalry between our three countries, and being able to extend this to home brewing has been a great pleasure.

I have done a lot of research into brewing with sorghum. Sorghum beer has been brewed in African homes since time immemorial. Here's a simple recipe: 1 kg (2.2 lbs.) ground sorghum, 1.5 kg (3.3 lbs.) maize meal and 2 L (2.1 qts.) sour milk. To brew the sorghum beer, boil 15 L (3.9 gallons) water. Empty sorghum into a 25-L (6.6-gallon) container and stir in boiled water. Add maize meal. Still stirring, add 5 L (1.3 gallons) cold water and sour milk. Let ferment for 12 hours. Strain to separate the beer from the chaff. Enjoy!



Ant's fermenter is one of many stainless steel components in his system.

reader RECIPE

Try Oktoberfest as an ale!

Fest Ale

(5 gallons/19 L, extract with grains)
OG = 1.063–1.069 FG = 1.016–1.017
IBU = 35-40 SRM = 20 ABV = 6.1-6.7%

Ingredients

3.5 lbs. (1.6 kg) light liquid malt extract
3.5 lbs. (1.6 kg) amber liquid malt extract
2.0 lbs. (0.9 kg) toasted pale malt
1.0 lb. (0.5 kg) Carapils malt
0.5 lb. (0.2 kg) crystal malt (60 °L)
0.25 cup chocolate malt
4 tbs. maltodextrine powder
12 AAU Perle hops (2.0 oz./57 g of 6% alpha acids)
6 AAU Northern Brewer hops (1.0 oz./28 g of 6% alpha acids)
1.0 oz. (28 g) Hallertau leaf hops
0.5 tsp. calcium carbonate
0.5 tsp. table salt
1 tsp. Irish moss
Wyeast 1056 (American Ale) yeast
0.75 cup corn sugar (for priming)

Step by Step

Freeze 1 gallon (3.8 L) bottled water and make yeast starter. Toast pale malt at 350 °F (180 °C) for 10 mins. Bring 5.5 gallons (21 L) bottled water to 160 °F (70 °C) and add calcium carbonate and table salt. Add all crushed grains in muslin bag. Steep for 30 mins. Dissolve liquid malt extracts and maltodextrine powder and boil. Add 1 oz. (28 g) Perle hop pellets. After 30 mins. add another ounce (28 g) of Perle pellets. After 20 minutes and add Northern Brewer hops and Irish Moss. Wait 10 minutes, add Hallertau leaf hops (in bag) and turn off heat. Immerse kettle in bath of cold water. Add ice cubes until wort temperature reaches mid-70s °F (~25 °C). Stir wort. Siphon clear wort off trub into primary fermenter. Save trub in bottle with fermentation lock in fridge. Aerate 10 minutes and pitch yeast starter. Ferment primary 2–4 days until head subsides. Skim it every day for first 2–3 days. Siphon into secondary fermenter. Decant the clear wort from trub in fridge into secondary. Let ferment until absolutely flat. Siphon off yeast at bottom. Make sure you reintroduce a small amount of the yeast to the clear beer for bottle conditioning. Bottle or keg. Condition at room temperature (60–75 °F/16–24 °C) for two weeks. Put it all in the fridge and let it stay there until consumed to maximize freshness. At 35 °F (1.6 °C), this ale will remain fresh for at least four months in a keg under CO_2.

— Roy Maddox

beer BASICS

BREWER'S DICTIONARY

A is for . . .

adjunct: any substitute unmalted grain or fermentable ingredient added to a mash. Reduces cost and produces lighter-bodied, paler, and less malty beers.

aeration: exposing a substance to air, performed at various stages of the brewing process.

airlock (or fermentation lock): a one-way valve that allows carbon dioxide gas to escape while preventing the entry of contaminants.

ale: a generic term for beers produced by top fermentation (i.e. using ale yeast strains) at temperatures higher than lager fermentation temperatures; wort usually made by infusion mashing.

alpha acid: the soft, bitter hop resin responsible for most of beer's bitterness. Alpha acids must be boiled to convert alpha acids to iso-alpha acids. Measured as a percentage of the total weight of the hop cone.

alpha acid units (AAU): percentage of alpha acids in a sample of hops multiplied by the weight in ounces of the entire sample. (One ounce of hops with an alpha-acid content of 5 percent contains 5 AAUs.) AAU values are used in the calculation of BUs and IBUs.

all-grain beer: a beer made entirely from malted grains, as opposed to beers made from malt extract.

amylase: generic name for enzymes that break the bonds holding starch molecules together.

attenuation: the drop in specific gravity that occurs as a wort goes through fermentation.

B is for . . .

bacteria: one-celled organisms that reproduce rapidly under strict temperature, pH, and other conditions. (Bacteria can be killed with disinfectants.)

barm: liquid yeast that appears as froth on fermenting beer. (Can also be used as a verb meaning to pitch or add yeast.)

beerstone (or beer scale): a hard film created by the combination of calcium oxalate, protein and sugar that is formed when the same vessel is used repeatedly.

beta acid: a soft, bitter hop resin that is harsher in flavor than the alpha acid but almost insoluble at normal wort pH values.

bitterness units (BU): a system to express the bitterness in beer with a unit based on alpha acid content. The homebrewers' bittering unit estimates the bitterness of hopped malt extract by multiplying the amount of hops by the alpha acid unit of the hops used.

body (or mouthfeel): the consistency, thickness, and sensation of fullness created by beer in the mouth.

boil: the step in brewing when the sweet wort is transferred to a brew kettle and boiled with hops to produce a bitter wort.

bottle-conditioned: beer carbonated naturally in the bottle by priming or re-yeasting.

break: the clumping and separation of protein matter during the boiling stage (hot break) and cooling stage (cold break).

brilliance (or brightness): description of beer in terms of clarity and effervescence (also called purity).

buttery: having a taste like butter or butterscotch, signifying the presence of diacetyl.

homebrew CLUB

The Raging Grainies

Victoria, British Columbia



PHOTO COURTESY OF HEATHER SHIELDS

The Grainies aren't big on formalities, but they are big on brewing.

Not to be Confused with Victoria's older women's political group, the Raging Grannies, the Raging Grainies formed as the result of informal gatherings of homebrewers. The gatherings soon evolved into a more serious club bent on all-grain methods. To this day, the club's structure and attitude remain pretty laid back. We used to have $5 monthly dues that went towards an annual bulk buy of hops and a theoretical t-shirt fund that never bore fruit — I guess we've been too busy drinking beer and talking bull to make much progress on the shirts. We also used to have an actual president and a treasurer who maintained the dues.

The Raging Grainies have been proud the last few years to see members taking most of the top honors at the local, annual CAMRA (Campaign for *R*eal *A*le) homebrew competition. Grainies members have been known to judge the competition as well, and the contest is organized by our own Ken Healy.

A few years back we acquired a 50-L (13 gallons) wooden barrel, and cobbled together a couple of our systems to fill it. Despite exhortations from cowboy-hat wearing Andrew Tessier — "yee-ha! We're brewin' in a barrel!" — we messed up something along the way and the beer was dead flat. Nevertheless, we drank it all to the last drop! We keep talking about doing it again, but as with the t-shirts, it's mostly hot air.

Our loose group of members, assorted spouses, friends and hangers-on have a good time wherever we go. We make plenty of good beer, and most importantly, share laughs while we do it.

replicator EXPORT ALE

by **Steve Bader**



Dear Replicator:

I have just finished a six-pack of Export Ale brewed by the Shipyard Brewing Company in Portland, Maine. This is the best microbrewed beer that I have tried in a long time. I really liked the balance of its great, malty taste and hoppiness. Could you assist with getting a recipe and tell me what beer style this is?

Ray Metz
Southgate, Kentucky

Shipyard Brewing company's Export Ale is described as a Canadian golden ale by 21-year veteran Master Brewer Alan Pugsley. Export Ale is Shipyard's flagship beer and they have making it for 11 years. The BJCP style guidelines do not list "Canadian Golden Ale" as a style. I would describe Canadian golden ale as a beer with a light golden color, a medium alcohol level and subdued hop bitterness. Diacetyl should be low to none, with a small amount of fruitiness. Alcohol content is 5% ABV. The closest match in the BJCP style guidelines is Blonde Ale (which lists US light ales as commercial examples.)

Shipyard Brewing employs a single infusion mash at low temperatures (148 °F/64 °C), and uses an English Ale yeast with a fairly high attenuation of nearly 75%. This high attenuation also helps to achieve the dry finish of the beer. Alan says Shipyard Export Ale has a beautiful gold color, with a malty, slightly sweet upfront flavor and a nice, full body.

For more information visit the Website at: www.shipyard.com or call (207) 761-0807.

Shipyard Brewing Company Export Ale

5 gallon (19 L) extract with grains

OG = 1.048–1.054 FG = 1.012–1.013
IBUs = 24–33 SRM = 9+ ABV = 4.7–5.2%

Ingredients

6.6 lbs. (3.0 kg) Northwestern Light malt extract syrup
0.5 lb. (0.23 kg) crystal malt (60 °L)
0.5 lb. (0.23 kg) wheat malt
7.2 AAU Cascade hops (bittering) (1.25 oz./35 g of 5.75% alpha acids)
3.75 AAU Willamette hops (flavoring) (0.75 oz./21 g of 5.0% alpha acids)
4.5 AAU Tettnanger hops (aroma) (1.0 oz./28 g of 4.5% alpha acids)
1 tsp. Irish moss
White Labs WLP007 (Dry English Ale) or Wyeast 1275 (Thames Valley Ale) yeast
O.75 cup of corn sugar (for priming)

Step by step

Steep the two crushed grains in 3 gallons (11 L) of water at 148 °F (65 °C) for 30 minutes. Remove grains from wort, add malt syrup and bring to a boil.

Add Cascade (bittering) hops, Irish moss and boil for 60 minutes. Add Willamette hops for the last 15 minutes of the boil. Add the Tettnanger aroma hops for the last 3 minutes of the boil.

When done boiling, add wort to 2 gallons (7.6 L) cool water in a sanitary fermenter, and top off with cool water to 5.5 gallons. Cool the wort to 80 °F (27 °C), aerate the beer and pitch yeast.

Allow the beer to cool over the next few hours to 68–70 °F (20–21 °C), and hold at these cooler temperatures until the yeast has fermented completely. Bottle the beer, age for 2–3 weeks. Enjoy!

All-grain option:

This is a single infusion mash. Replace the light syrup with 9.75 lbs. (4.4kg) English pale 2-row malt (for a target OG of 1.052). Mash your grains at 148 °F (64 °C) for 60 minutes. Collect enough wort to boil for 90 minutes. and have a 5.5-gallon (21 L) yield. Decrease Cascade boiling hops to 1.1 oz. (31 g) to yield a 30 IBU beer. For the remaining steps, follow the extract instructions.

homebrew calendar

October 4
X-Brew
Redmond, Washington

X-Brew: The Extreme Homebrew Competition will be held on October 4, at Bear Creek Brewing Co. in Redmond, Washington. The competition is extreme in terms of specific gravity. Entries will be accepted for all Beer Judge Certification Program (BJCP) categories, under one condition: each beer must be entered as an Imperial or a small beer (or small mead or cider). Imperial entries must have a specific gravity of 20 points above the listed max (per style). Small beers must have a SG 20 points below the listed minimum. This competition is AHA/BJCP sanctioned. For further information contact Tom Schmidlin at (206) 782-8507, or via email at tschmidlin@earthlink.net .

October 10-11
OkTOSOfest Challenge
Denver, Colorado

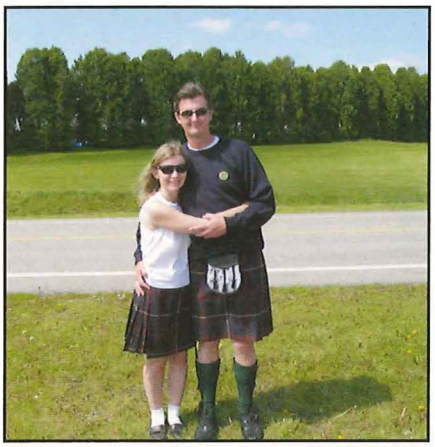
The premier OkTOSOfest Challenge will kick off at Aaron Toso's home (1846 West 35th Avenue) on October 10. "A celebration of homebrew and mayhem" challenges you to enter your best beers in BJCP category nine, including Oktoberfest and Vienna Lagers. Prizes will be awarded for the top three beers and quality feedback from BJCP judges is guaranteed. Deadline for submissions is October 3, and the fee is $6.00 for first entry, $4.00 for each additional. For more information, contact: Aaron Toso by phone at (303) 292-1524 or via email at gypsy_dog@hotmail.com.

October 16
The Dixie Cup
Houston, Texas

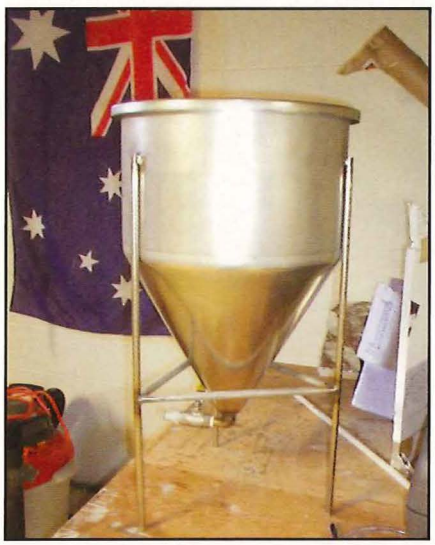
The 20th annual Dixie Cup, the United States' largest single site homebrew competition is October 16. Judging will be held for all 26 BJCP categories, along with a "first time entrants" category, and the special "Beer that will get you lei'd" category. A total of 42 medals will be awarded. Five speakers, including Fred Eckhardt and Gregg Smith, will share their expertise. The cost is $6 before October 3, and $10 until October 10. For more information visit www.foamrangers.com. (See also the Dixie Cup profile in last month's Homebrew Nation.)

homebrew SYSTEMS that make you DROOL

John Fraser • Columbus, Ohio



Fraser and fiancée Robin at a Scottish Highland gathering in Pennsylvania.



Fraser's conical fermenter the day he got it back from the fabricator.

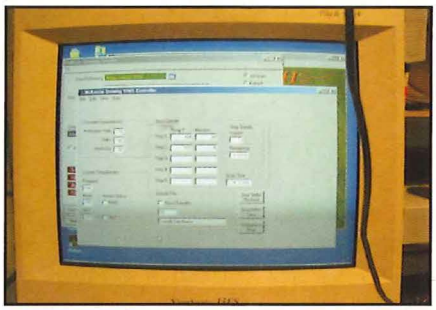
The three biggest things that have helped me brew better beer have been my lagering chest freezer, my malt mill and all-grain brewing. The chest freezer and its controller just make brewing lagers more predictable. Maintaining a constant fermentation temperature and a controlled lagering temperature is a sure way to produce great beer. The malt mill has allowed me to take full control over the freshness of ingredients and the coarseness of the grist. All-grain brewing offers me a greater diversity of ingredients than extract brewing.

After converting to all-grain brewing, my constant research opened up the world of RIMS and HERMS brewing. Being gadget-inclined, there was no resisting these systems. I researched for weeks, making sure I knew exactly what it took to construct a system. It took nearly three months to gather everything I wanted and have it all fabricated, wired and plumbed. I am exceedingly pleased with the results and especially with the consistency with which I can now brew. My recipes now come out the same every single time!

My biggest challenge in building a RIMS system was my software and the use of digital thermometeres. I am a programmer by trade, but not on the PC platform. Working with a language I had never used was difficult, but not impossible. I am now on V2 (version 2) software and it works well for me. It allows changes in temperatures and times to be entered during the mash cycle. If a starch test shows me that conversion is not quite finished, I can increase the mash duration at that step to allow for a complete conversion.

I use a variety of sources to find recipes. A regular resource for me is "Clone Brews" by Tess and Mark Szamatulski. I find this to be a good source of inspiration and can always find good commercial beers to replicate. *Brew Your Own* also comes in handy as a source of recipes and other information.

The Home Brew Digest (http://hbd.org) is a good source as well and contains lots of recipes and the like. These sources provide a great range in diversity and allow me to cross reference for quality and ingredients. All of these sources include procedure tips that are particularly useful and help me to improve my homebrew!



Fraser utilizes his own software to control the variables of his mash cycle.



The hot liquor tun with electric temperature probe at the right.



Fraser's equipment is producing consistent brews from every mash.



Send us your story!

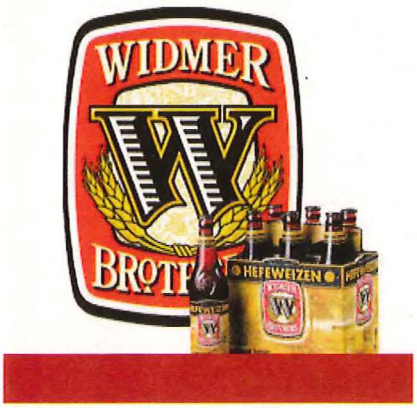
If we publish your article, recipe, club news or tip in Homebrew Nation, you'll get a cool messenger bag (compliments of White Labs) and a *BYO* Euro sticker.

Managing Beer Clarity

And appreciating turbidity in appropriate styles

by Thomas J. Miller

Want a sparkling clear beer? Or how about a muddy, yeast-filled brew? Almost anything is possible when it comes to managing beer clarity. Fining agents are readily available to clear your beer, and there are tricks to keeping turbidity around if that suits your needs. These tips from pro brewers will show you how.



Brewer: Joe Casey has been working at Widmer Brothers Brewing Company in Portland, Oregon since 1995 and is currently Assistant Brewmaster. He has a B.S. in Biology from Portland State University and is a member of the American Society of Brewing Chemists (ASBC).

Some brewers choose or accept turbidity because certain beer styles mandate it. If we traced the origins of beer haze back to the beginnings of brewing history, I'd guess we would see that brewers didn't always fully understand beer haze or, more importantly, did not have the technology to overcome it.

Certain raw materials contribute more haze material than others. Wheat is a prime example of a haze-inducing raw material. Beers with large amounts of hops, like IPAs, also tend to be hazy. This is due to the polyphenolic material contributed by vegetative matter. These polyphenols react with the proteinaceous malt compounds to form haze.

There are no flavor benefits to beer haze. In fact, hazy beers tend to be less flavor stable because of the excessive protein and polyphenol levels. High protein levels can give a beer what is known as a "protein bite," something I associate with bitterness. Likewise, high levels of polyphenols can lead to astringency.

Polyphenols are contributed by both malt and hops, though the chemistry of each is slightly different. Generally speaking, malt-derived polyphenols are more reactive and thus more detrimental than the polyphenols contributed by hops. Also, hops only contribute about 20–30% of the total polyphenols. Efforts to reduce protein and polyphenols via filtration or through the use of some additives reduce the amount of haze forming materials and, consequently, clean up the flavor.

An argument in support of turbid beer centers around the fact that it is less processed (unfiltered). Aggressive handling, exposure to oxygen and the iron contained in filter media can be detrimental to the quality of a final beer. This argument, however, ignores the fact that good filter technique prolongs beer shelf life.

Filtration extends shelf life in a number of ways. One way is limiting protein and polyphenol species that can eventually react and form undesirable haze. Filtration also helps remove most present bacteria that could persist into the finished beer. Yeast is also removed during filtration. If too much yeast exists in a finished beer, autolysis is a potential result — this causes a beer's pH to rise. High pH values lead to harsh flavors and hinder beer foam stability through the release of protease enzymes.

Beer does tend to clarify naturally, to a point. Aside from filtration, beer clarity is governed by Stoke's Law, which describes the settling rate of particles in a medium. The larger the particle, the faster it settles. The longer the time, the more particles will settle. The greater the difference in density between the particle and the medium, the quicker the settling.

Counteracting Stoke's law is the continual formation of more haze via proteins and polyphenols left in the finished product. Still, preventing clarification is not easy. Delaying it a bit is possible, but even Hefeweizens will clear up with time.

One avenue to create a turbid beer is to skip the addition of Irish moss, which helps clarify beer. Also, you can pick yeast that is non-flocculent. (Just make sure it has a flavor that fits the beer style).

For clear styles, the best fining agents for homebrewers are probably Irish moss and isinglass. At Widmer, we call Irish moss floc. Floc is great because it is simple to use and effective. The active ingredient in floc is kappa-carageenan. Make a slurry, boil it for at least 10 minutes — longer if you're using chunky floc instead of the granular stuff.

Usage rate depends widely on the particular beer in question and is heavily dependent on the wort pH. A wort pH of 5 will require almost twice the amount of floc as the same wort at a pH of 5.4. Homebrewers should be aware that, as a general rule of thumb, Irish moss fines protein and isinglass is mostly used to fine yeast. Isinglass however, is also capable of removing other proteins.

Isinglass is derived from dried swim bladders of fish such as catfish and sturgeon. The swim bladders are removed, washed, dried and eventually reduced into powder. Isinglass contains collagen in an insoluble form, which has a positive electrical charge. Its long molecular structure gives it a strong attraction to yeast cells and haze causing proteins. It also removes some polyphenol and lipid material, which improves beer foam, flavor and stability.

Brewer: **Todd Ashman has been the head brewer at Flossmoor Station Brewery in Flossmoor, Illinois since 1996. He studied with the American Brewer's Guild and worked at Bison Brewing in Berkeley, California in 1995.**

We are only doing 750 barrels each year on a 15-barrel system. That means about one brew every six days. We decided a long time ago that we weren't going to filter because we believe it strips the body and the character of the beer. We, like many breweries, put a lot of effort into getting these things into our beers and don't want to take them out just before reaching the tap.

At our brewery, yeast is mostly chosen for its flocculation characteristics. They should be at least medium, but we prefer high flocculation. It should not be so high, however, that we will need to rouse the yeast because it settles out so fast.

We use seven or eight strains in our brewery. These include the London Ale yeast (Wyeast 1318) and Belgian yeasts like Wyeast 3787 and White Labs WLP530. We also use Wyeast 3944 (Belgian Witbier), but we aren't as concerned with flocculation with this one — a cloudy beer is actually what we're shooting for in our wit beer.

We choose malt that has as low of a protein level as possible. This means 10.5–11% protein, and never above 12.5%. With protein levels beyond this, you're definitely going to run into clarity issues.

These days, malt has protein levels that run up to 14%. You will not be able to clarify beers made with this malt without having plenty of time to wait. Watching malt protein levels is a good way to recognize the importance of malt analysis.

I swear by a clarifying agent called Whirlfloc tablets. I use them religiously. We purchase Whirlfloc from Crosby and Baker, so homebrewers should be able to find it easily. Basically, it's similar to Irish Moss but powdered beyond belief and pressed into tablets. We use between 50–60 tablets in 500 gallons (1,900 L). Homebrewers should use 1–2 tablets in 5 gallons (19 L) versus 1–2 teaspoons of Irish moss.

Something else that works for us is to use top pressure when carbonating our beer. Essentially, this means the carbonation is pressing down on the beer in our Uni-tanks, which forces particulate to the bottom and lends to clarity. We apply the gas at 15 psi for about one week at 34–35 °F (2 °C). ■

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Gravity after the boil

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Defiant gravity

I am an all grain brewer and a full wort boiler. Every book, magazine and recipe I read says that the gravity of wort will increase during the boil as a result of the water evaporating and the wort concentrating. I have never seen this occur in my brewing process. I have taken readings with both a hydrometer and a refractometer, so I doubt it is a case of displaced idiocy. My raw pre-boil gravity reading is always within 0.002 of the post boil, post cool down reading. I just finished brewing the Sour Cherry Ale recipe found in the July-August issue. My pre-boil gravity was right on at 1.056. However, after boil and cool down, my gravity reading was the same 1.056 rather than the 1.062–1.065 that is called for. Knowing this, do I need to adjust my recipes to fit with my brewing process?

Doug Elrod
Des Moines, Iowa

I have made measurements on wort and ended up with seemingly impossible data. The great thing about brewing is that, even though magic sometimes appears to occur, the basic laws of science always apply! When wort boils and loses water through evaporation, the specific gravity must increase. Specific gravity is a term expressing the weight of a volume of liquid. Although the units can be anything (pounds per gallon, ounces per cubic meter, etc.), the most conventional unit is kilograms per liter.

When wort boils, the only thing that is lost is water and a relatively small amount of aroma compounds. The carbohydrates and proteins that contribute to extract (or solids) are not volatile and remain in the wort. This means that the solids content remains constant while the volume of the liquid decreases. Mathematically this means that the specific gravity must increase. You already know this, but are having doubts because of your data.

My advice on many problems begins with doubting the validity of numbers. In this case, I don't believe your data. There are two things that could cause erroneous gravity readings taken before and after the boil. The first is temperature. Hydrometers are affected by temperature and the temperature of the two samples needs to be the same, or you need to correct the indicated reading to compensate for the difference. As temperature rises, specific gravity drops. Since the temperature after the boil is obviously higher, your post-boil readings may not look right due to the temperature variance. In your question you state that the final gravity is taken after cooling, so this point may not apply to you, but you still need to make sure the wort samples are measured at the same temperature or corrected.

The other problem, which I would guess you are facing, relates to sampling. I have seen this problem myself and know that wort layers in the kettle. If you have a sample valve on the bottom of your kettle or use some sort of sampling device like a turkey baster to grab a sample, you may inadvertently take a high gravity sample of the wort before the boil. What happens when you collect wort from the mash is that the first high gravity worts are gently filled into the brew kettle, usually from the top, followed by lower gravity worts. This method of filling the kettle does not mix the wort and the specific gravity in the kettle is not homogeneous. If you grab a sample from the bottom of the kettle you will measure a higher gravity than if you take a sample from the top of the kettle.

I have actually played around with this and found that aggressive stirring is required to make the wort gravity homogeneous throughout the kettle. The easiest thing to do is to actually wait until the wort starts to boil and take a sample at this point for the initial "pre-boil" sample since boiling is a very effective way of mixing. The post-boil sample is not something to question because the wort is stirred during the boil. However, if you add water to cool the wort or "top up" your kettle to 5 gallons, you can experience the same problem with the wort layering. The last beer you brewed with a lower than expected gravity is another question entirely. The gravity may have been low due to some sampling error or you could have simply gotten a different yield than the author of the recipe got. This is a common problem and the best way to combat it is to use recipes as a guide and to "tweak" them based upon what your particular system yields with respect to efficiency.



An efficient calculator

I have read a lot of articles that refer to brewhouse efficiency, but I haven't found anything showing how to calculate it. Have you?

Ron Fore
New Braunfels, Texas

The easiest way to calculate brewhouse efficiency is to go metric! You need four pieces of information to perform this straightforward calculation. The data you need is: post boil wort volume in liters (there are 3.785 liters

(for example, 1.056 kg/L), post boil wort density in °Plato (to approximate, divide the number behind the decimal of the specific gravity by four — e.g. 56/4 = 14 °Plato) and the weight of grains used in recipe (in kg).

Once you have this information the calculation is easy. The first thing that is calculated is the weight of extract in the wort. Extract = (volume) x (specific gravity) x (°Plato — expressed in decimal form). For example, (20 liters) x (1.056 kg wort/liter wort) x (0.14 kg extract/kg wort) (Plato is a weight/weight measure) equals 2.96 kilograms of extract. This is how much stuff you extracted from the grain during mashing and lautering.

The efficiency number is determined by comparing what was extracted to what was used. For example, if 4.5 kilograms (9.9 pounds) of malt was used to produce 20 liters of 1.056 wort, the efficiency is 2.96 kg extract/4.5 kg malt or 0.658. This number can be multiplied by 100 and expressed as a percentage . . . like 66%.

Without going into the nitty gritty details of the "problem" with this number, I do want to point out that this number is pretty crude. The reason is that not all grains used in brewing have the same potential. In technical circles, brewers talk about laboratory or theoretical yields of different ingredients. Some ingredients like pale malt have a laboratory yield of around 78% and most specialty grains have laboratory yields ranging from 55-65%. This means that a pale beer without special malts has a better efficiency than beers made using special malts.

Since brewers, especially commercial brewers, want to get as much out of the grain as possible, it makes it difficult to examine efficiency. A low yield calculated the way I show above may be due to the type of beer being made or a problem in the brewing process. The solution to this dilemma is to compare the yield of a particular mash to its theoretical yield.

Malt specification sheets give the lab yield number and a theoretical yield can be estimated. If your brew contains 8.8 pounds (4 kg) pale malt with a lab yield of 78% and 1.1 pounds

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with a lab yield of 78% and 1.1 pounds (0.5 kg) of crystal malt with a lab yield of 65%, you can estimate the combined lab yield of these grains using a weighted average. Estimated combined yield = (4 kg pale/4.5 kg total malt x 78%) + (0.5 kg crystal/4.5 kg total malt x 65%) = 76.5%.

This number can then be used as something to gauge the performance of your equipment against. If you got a yield of 66% and the lab yield is 76.5%, you can calculate what is know as the brewhouse yield. In this case, it is 66 dived by 76.5 or 86%. Most homebrewers do not calculate brewhouse yield because malt specification sheets are not always available. I hope I haven't confused matters too much, but that's how to run the yield calculations. Happy number crunching!

Substituting homegrown hops

To add another dimension to my homebrewing hobby I decided to plant a Fuggles hop root last year. I had a handful of flowers at the end of the first season, but not enough to really put to use. The vine is now over 20 feet in two directions with flowers popping out all over the place. I know that it is impossible for me to know the alpha acid percentage of the hops that I am growing, but is there any conversion available for substituting fresh hops when a recipe calls for pellets?

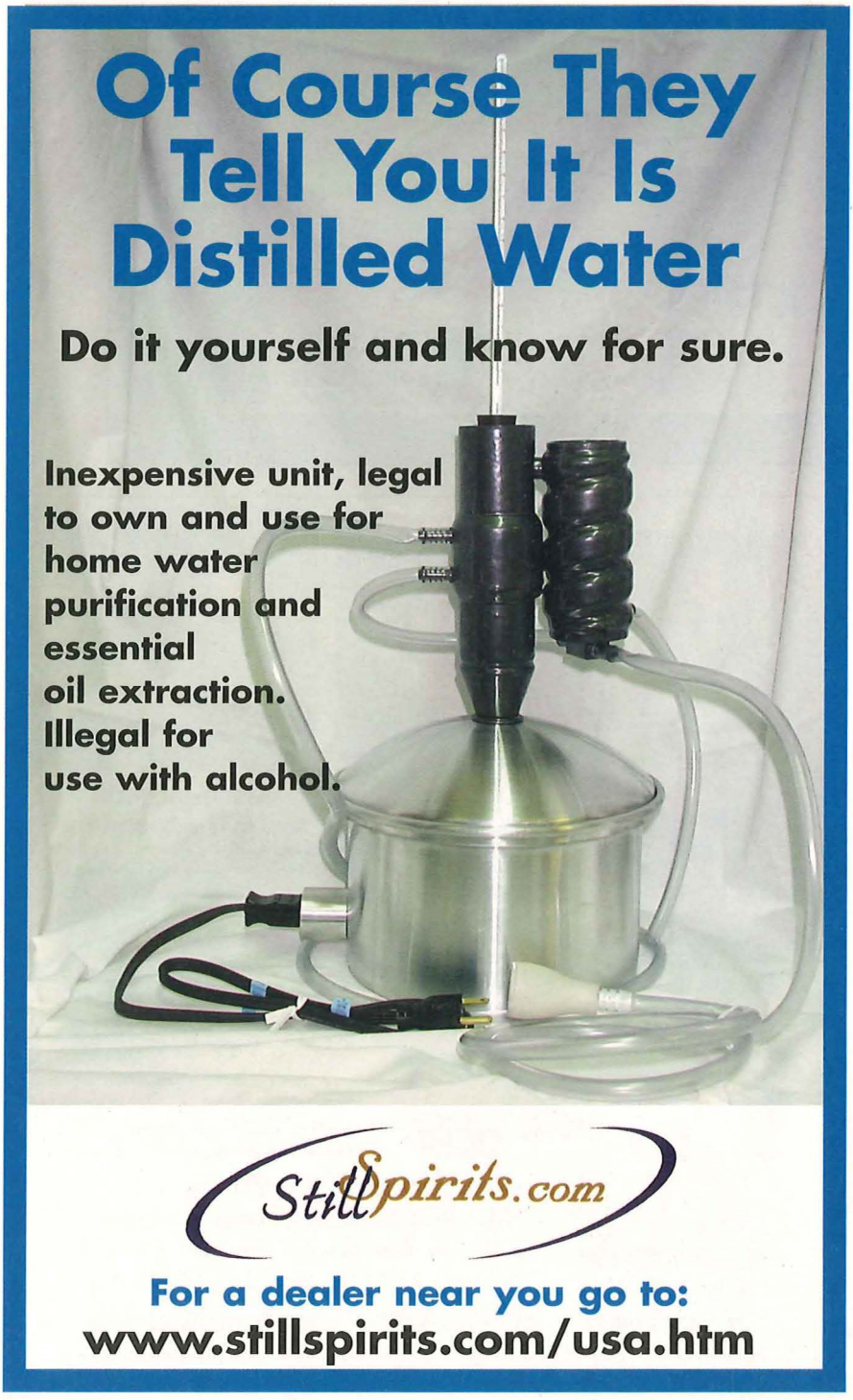
Gary Heyden
Kenosha, Wisconsin

There are several pointers I can offer on using fresh hop cones, but before I begin I have to be picky about terminology. Hops come in two sexes: male and female. Male hop plants have flowers and the flowers produce pollen. Female hop plants have the hop cone, which is a fruiting body. Female hop cones contain seeds when pollinated by male flowers. Most hop growing areas really despise male plants because brewers in general do not like seeded hops — they produce a lower yield per acre than unseeded. It is true, however, that seeded hops are more disease resistant than unseeded.

OK, so you have a Fuggles vine loaded with hop cones. The first thing you need to do is harvest the hops. You want to wait until the cones begin to open up and begin to dry before you pick them.

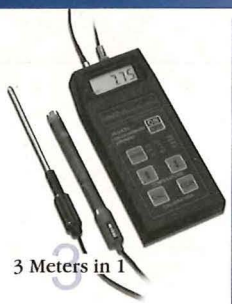
If you pick the cones before they ripen, they will have a lower oil and acid content than they will after ripening. You don't want to let them stay on the vine too long, however, because the quality drops quickly after the hops ripen and begin to dry.

When you decide to pick the hops, you have two options. The normal procedure is to dry the hops and to store them for future use. The other option is to pick the hops and use them while they are still "green" or un-dried. Breweries located near hop fields once used this traditional technique to brew very aromatic beers during the hop harvest season (usually August and September in the northern



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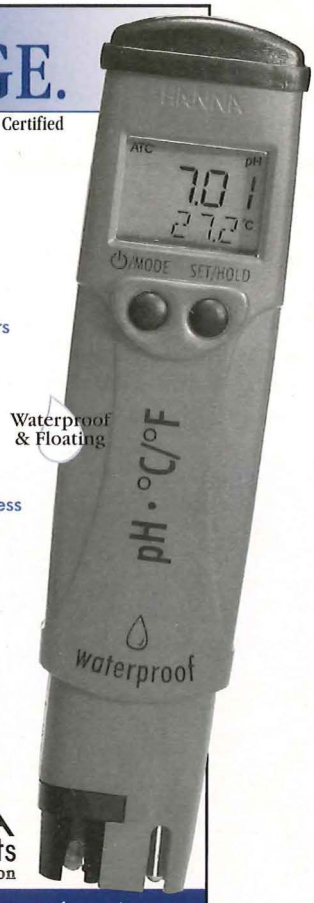
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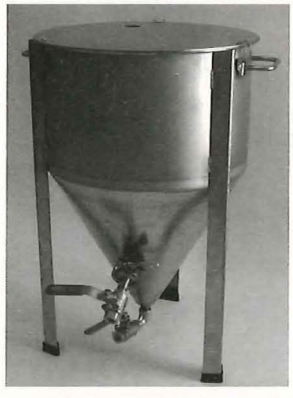
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hemisphere). Sierra Nevada brought back this interesting method to brew their Harvest Ale, first brewed in 1996. The key to this method is using the green hops very shortly after harvest since these hops begin to mold if not dried.

Hops lose about 75% of their weight when dried and a bumper crop of hops from one vine produces a surprisingly low weight of dried hops. I suggest using homegrown hops as aroma hops and using store bought hops for bitterness. This method allows you to showcase your homegrown hops in your beer.

I have used green hops at the rate of 2 ounces (56 g) per gallon (3.8 L) to produce very aromatic beers. Since these hops are added late in the boil, you don't need to worry about the alpha acid content. If you dry the hops and want to use them for aroma, you can simply use them at the same rate as store bought hops.

If you really have a huge crop and want to dry your hops and use them for all purposes in brewing, then you have to make some guesses. You can get in the ballpark by looking at the typical alpha acid content of a particular variety.

Fuggles typically falls between 4.5–5% alpha acid and your homegrown hops should too. After making your first batch, you can taste the beer and evaluate the bitterness against what you expected. If the beer is less bitter than expected, you can adjust your guesstimated alpha number down. If it is more bitter, adjust it up.

There are undoubtedly some readers who want to measure the alpha acid content of their hops. This is not a realistic practice for homegrown hops. The most common method used by hop growers is a method called the lead conductance valve (LCV). In this method, a methanol extract of hops is titrated with lead acetate and the conductivity of the solution is monitored during the titration.

The conductivity initially decreases until it hits a minimum value and then begins to increase as more lead acetate is titrated into the solution. The volume of lead acetate required to bring the

conductivity of the solution to its minimum point is the LCV and this value correlates with alpha acid content. This method is not practical to perform at home.

The other method involves using high performance liquid chromatography (HPLC). An HPLC is a very expensive piece of laboratory equipment that separates compounds based upon affinity between various compounds contained in a mixture.

The type of column used for the chromatographic separation is also a factor. After this separation occurs, a type of detector is used to quantify the amount of the various fractions contained in the mixture. This method is even less practical to perform for the homebrewer. The bottom line is that if you grow hops at home, you are probably going to be doing a little bit of guess work when it comes to alpha acid numbers!

Too much foam in the Corny keg

I have two Cornelius kegs of my first effort at home kegging. The beer tastes great, but is too foamy. I have the CO_2 set at about 6 psi. Both kegs have bleed valves. I note that when I bleed the kegs, the foam is reduced but then there is inadequate pressure to drive the beer from the tap. The alcohol content is high, but I did cut back on the priming sugar. What is a good approach to lessen the foam?

Sam Wenger
via email

Kegs are handy because it is fairly easy to change the level of carbonation as needed. I think the quickest way to reduce the carbonation of kegged beer is to reduce the pressure to zero and allow it to mellow out for a half a day or so. In your case, this can be done by cutting off the gas supply to the keg and slowly bleeding the head pressure out through the bleed valve. After a few hours you can apply pressure back to the keg and take a sample. If the carbonation is still too high, remove the pressure and allow it to mellow longer. You should be able to get the carbonation level where you want it within a day.

You say the alcohol content of this beer is high. You may have kegged the beer before fermentation completely finished, or you may not have cut back on the priming sugar enough. In either case, kegs allow you to correct the problem whereas bottling lacks such a freedom! When you do get the carbonation corrected you need to keep the keg refrigerated and under pressure. If the beer is stored at 40 °F (4 °C) you will need to keep the keg pressure between 10 and 13 psi to maintain the carbonation level found in most beers.

When water needs treatment

If a full grain recipe provides a malt extract alternative, would the water treatment normally applied to the full mashed version be appropriate for the extract version? Although I'm aware most water treatment is for the

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benefit of the mash and lowering pH, I'm still wary of making up a 23-L (6.1 gallon) brew with 20 L (5.3 gallon) or so of untreated water.

John Sadler
Barrow-in-Furness, England

The rule of thumb that most homebrewers use is to only worry about treating their water when they use grains that require mashing or steeping. You do bring up an excellent question regarding the definition of untreated water.

Unfortunately I have yet to travel to England, but with the help of the handy-dandy Internet, I see that Barrow-in-Furness is located on the Northwest coast of the country. Ground water taken from wells near the ocean often contains a high level of certain minerals that impart strong flavors to the water. I have drunk well water in coastal areas of the United States and the water usually tastes pretty awful. Strong iron and sulfur flavors are often present coupled with a briny zip. The taste of water is certainly a very important quality to consider as an extract brewer. The mineral composition is another important feature even though we are not talking about mashing. Waters that have a high sulfate content, like water from the deep wells around Burton-on-Trent, produce beers that taste drier and more bitter than beers made using waters low in sulfate.

Yeast can also metabolize sulfate and beers from high sulfate water can take on sulfury aromas. Chloride has an opposite affect on beer flavor and leads to beers with a fuller, sweeter mouthfeel. These beers also have a decreased perceived bitterness compared to beers with lower chloride levels. Many brewers intentionally add minerals to their water choosing their source of calcium from calcium sulfate or calcium chloride with the flavor affects of sulfate and chloride in mind.

My short advice to you is use your taste buds and follow your instinct. Rate the taste of your tap water on an imaginary scale based upon all the different water you have drank. I really wouldn't worry too much if my tap water tastes great and would start thinking more about this issue if my rating was below par. One must bear in mind that some really great beers are made with pretty funky water. I have heard that the water in Burton-on-Trent — held in such high regards as brewing water — is a really lousy drinking water. Good luck! ■



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Braggot

When grain meddles in the mead

by Horst D. Dornbusch



PHOTOS BY ELVA ELLEN KOWALD

Author Horst Dornbusch (Center) and members of the Cape Cod brewing club "The C-Clams," enjoy a session of braggot making. With the club's recipe for Bragging Braggot, you can enjoy it too!

"Have you ever made a braggot?" came the voice of my friend Horst Genten over the phone from his garage brewery in Osterville on Cape Cod, Massachusetts. "Isn't that an ancient Scottish brew that is as strange as a grozet or a fraoch heather ale?" I asked. "Yeah," said Horst, "Todd Marcus has come up with an extract recipe." I went down to the Cape on the appointed day. I live in West Newbury, next to the Massachusetts–New Hampshire border, about 120 miles north from Osterville — "off-Cape," as my fellow C-CLAM members would say.

This month's Style Profile is about this ancient ale that the C-CLAM brewers made on that day in 2001. C-CLAM stands for Cape Cod Lager and Ale Makers, a homebrew club not far from the very place where the Pilgrims landed in 1620, when they ran out of ale aboard the Mayflower.

All we know about braggot is that its obscure roots probably date back all the way to the mystical culture of a ferocious tribe known as the Picts — a shadowy people, whom, around the beginning of the first millennium B.C., seem to have moved from the northern parts of the Europe or from the Iberian Peninsula (the experts are not sure) to Scotland. After their migration, the Picts effectively ruled Scotland until the ninth century A.D.

When the Romans came to the British Isles under Julius Caesar in 54 B.C., they suffered many a raid at the hands of the Picts. The Romans called these people Pictii, or "the painted ones," probably because the ancient Pict warriors tattooed their bodies before they went into battle. In subsequent centuries, the Picts kept themselves busy in perpetual strife with the Celts, the Angles and the Saxons to the south, as well as with the native Scots and raiding Vikings from Scandinavia. But, in one of those great mysteries of the ancient world, the Picts suddenly disappeared around the tenth century, without leaving much of a trace. When they vanished, they took their beer knowledge with them. This is why there really isn't all that much information available today about the ingredients and brewing methods of the braggot. Instead of presenting a narrative (of either a definitive or

Braggot by the numbers

OG	1.080 (20 °P)
FG	1.010–1.020 (2.5–5 °P)
SRM	8–10
IBU	N/A
ABV	8%

RECIPE

Bragging Braggot

(5 gallons/19L, extract with grains)

OG = 1.080 FG = 1.014

IBU = N/A SRM = 8–10 ABV = 8%

Ingredients

7.75 lbs. (3.5 kg) light liquid malt extract

8.8 lbs. (4 kg) honey

1 lb. (0.45 kg) crystal malt (50–65 °L)

1.5 oz. (42 g) Northern Brewer hops (optional)

White Labs WLP715 (Champagne) (for primary fermentaion)

Wyeast 1007 (German Ale), Wyeast 3632 (Dry Mead), Wyeast 1098 (Whitbread British Ale), Wyeast 1728 (Scottish Ale), or White Labs WLP028 (Edinburgh Scottish Ale) yeast (for secondary fermentation)

Step by step

The burner under the brew kettle was turned on before the club members arrived, so the brewing liquor (water) was hot when we got there. If you wish to copy our simple braggot method, proceed as follows to generate your wort:

Place the milled crystal malt into a steeping bag, immerse it in the hot brewing liquor (for color only). The temperature should be around 190 °F (88 °C). Let the grain rest for about 30 mins. Remove the crystal malt from the water and discard. Stir the extract into the water. Bring the wort to a boil. Once the proteins start to coagulate (flake), add the hops. Add the honey about 30 minutes into the boil. By that time, most of the hops have isomerized. During the boil, skim off any scum that may appear on the surface of the wort. After a total boil of about one hour, heat

continued on page 24

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"Our individual notes and samples allow us to compare different numerical results and taste variations."

speculative nature) of the history of this ale, as you have come to expect from the Style Profile, this installment is a departure from the norm. Instead, I'll tell how the C-CLAM brewers thought this ale might have been made. With this article, I have not included an all-grain or partial-mash recipe either, simply because we did not make one.

The C-CLAMs place particular value on one member, Todd Marcus, who is both the owner of the Cape Cod Homebrew Supply store and the pub brewmaster of the Hyport Brewing Company in nearby Hyannis. Todd is always a great source of brewing information and provides important brewing supplies for the club. He is the one who ferreted out the recipe for the braggot.

On braggot brew day, Todd brought his 1974 Buick Le Sabre convertible (yes, the car is almost 30 years old!) with the trunk weighed down with plenty of extract and honey, as well as some crystal grain and hops. The objective was to make about 55 gallons (210 L) of braggot and divide it into 12 five-gallon (19-L) carboys. When we make such "collective" brews, we all start out with the same-gravity wort but after the heat exchange, each member charts his or her own fermentation course. This is like a controlled experiment, which allows us to study the effects of different fermentation temperatures, yeasts and transfer procedures. We then see how all of these factors influence the outcome of each brew. Our individual notes and samples allow us to compare different numerical results and taste variations. This way we can benefit collectively from our individual experiences.

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continued from page 21

Braggot recipe continued

exchange the wort to the temperature required by the type of yeast that you have chosen.

Fermentation

Different members pitched greatly different liquid ale yeasts either as single strains or in combination. The choices included Wyeast 1007 (German Ale), Wyeast 3632 (Dry Mead), Wyeast 1098 (Whitbread British Ale), White Labs WLP715 (Champagne), Wyeast 1728 (Scottish Ale), or White Labs WLP028 (Edinburgh Scottish Ale) yeast.

Aerate the cooled wort and pitch the yeast or yeasts of your choice. (We started two of the carboys with champagne yeast.)

Ferment the wort at the temperature required for your choice of yeast. (We fermented the two carboys with champagne yeast at around 68°F (20 °C). It may be necessary to use a blow-off tube, because this braggot ferments extra vigorously and produces plenty of carbon dioxide (CO_2).

Measure the gravity once a day to monitor progress. (At a gravity reading of 1.030, we added a German ale yeast to one of the carboys. We added a dry English yeast to the second carboy at a gravity reading of 1.020.)

After about a week of primary fermentation, transfer the brew off its lees and keep it in a secondary fermenter at about 50–55 °F (10–13 °C) for another four weeks. (The carboy with the German ale yeast finished at a FG of 1.018 and remained fairly sweet, while the carboy with the English ale yeast continued fermenting, bringing the FG down to a dry 1.010.)

These were the results from two identical worts kept under identical conditions, except for the yeast strains. The difference therefore must be due to the fact that these strains have different natural attenuation characteristics.

Rack the brew again and age it for about two months in a Cornelius keg or in bottles. There is no need to prime the brew because the residual sugars from the honey will continue to break down and create effervescence. If you condition the brew in a Cornelius keg, select a temperature of about 45°F (7°C) and set the pressure to about 13 psi. If you have the ability to measure the amount of dissolved CO_2 in your beer, the proper value should be about 2.25 volumes.

Serving tip: When you pour the braggot into a glass, allow for plenty of headspace, because this brew can be a very sparkling surprise!

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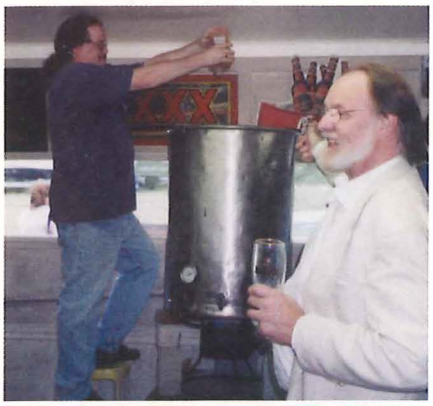
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Dornbusch (right) and fellow C-Clam add a jar of honey to the kettle.

The Genten garage (a.k.a. brewery) contains an all-stainless steel system with pumps and filters. The 1-barrel closed fermenter is a professional piece of equipment donated by Mike Sova, President of New England Brewing Systems in Gloucester, Massachusetts. Genten's brewery is the perfect setting for trying our hands at that old honey-flavored Pictish-Scottish strong ale known as braggot. This is really an odd monster, there are no binding specifications for this brew, but generally the ratio between honey and malt is about

> "There are no binding specifications for this brew, but generally the ratio between honey and malt is 60/40."

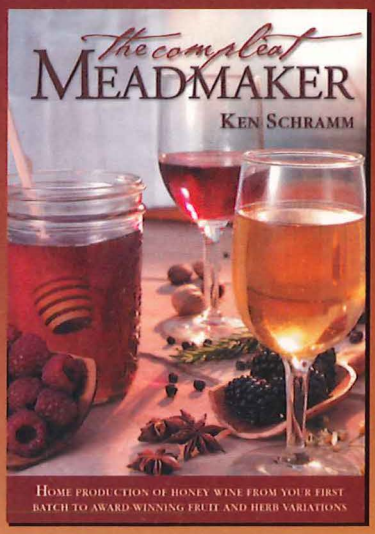
60/40. Traditionally, we believe, it should be at least 50% honey. There is no set rule for the timing, but the boil should continue long enough for the honey to become sterilized. In the old days, honey was often blended into the brew during fermentation, but we chose to add it to the kettle to ensure the brew's sterility. The color of the braggot is fairly blond. We did not think much about the braggot's color on brew day, but our guess is that the final brew was about 8 to 10 SRM.

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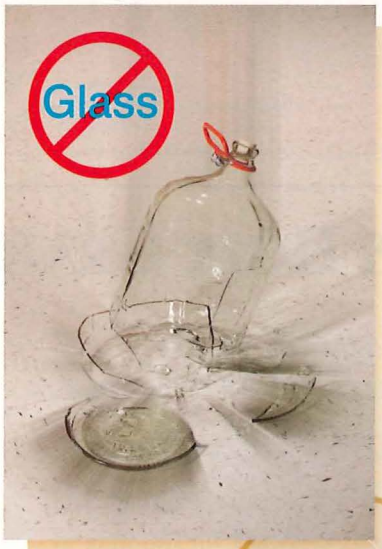
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Braggot dates from a pagan time when ale still meant a brew without hops. But we were going to use just a smidgen to placate the modern palate. The alpha-acid rating and type of hops is really not very significant. However, we chose a mild, mid-alpha Northern Brewer hop, because the honey flavor needs to remain dominant. For the same reason, we used just one hop addition, for bittering. We opted against a second hopping for flavor and a third for aroma. As best as we can figure today (as much of this is guess work), a braggot should have at least eight percent alcohol by volume, which puts it into the "big beer" category, perhaps roughly on par with a Belgian Trappist Tripel ale. ■

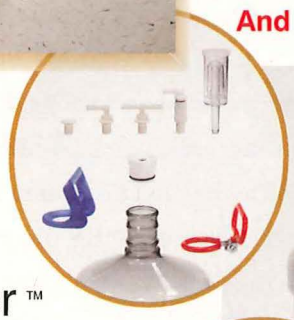
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The extended MEAD FAMILY



Braggot is among the many fermented beverages made from honey and known as mead. Mead is made up of fermented honey and water, but additional ingredients, like grain, can be added for flavor and aroma. When these additions are made, the mead takes on another name, like braggot. Here's a list of the more common derivatives in the mead family, and their accompanying ingredients:

Braggot: Mead with malted grain.

Cyser: Sweet mead with apple juice.

Pyment: Mead with grape juice.

Hippocras: Mead with grape juice and spices.

Melomel: Mead with fruit juices other than apple or grape.

Capsicumel: Mead with chili pepper

Morat: Mead with mulberries.

Rhodamel: Mead with rose petals.

Small: Meads containing less honey (1.5 pounds per gallon) and fermented faster than regular. Ale yeast starts the fermentation, which takes about a week.

Sack: Stronger meads, made with more honey to increase alcohol content or sweetness. Sack meads usually use about four pounds of honey per gallon.

Dry: These meads have no added flavoring and use about 2.5 pounds of honey per gallon.

NO-BOIL pre-hopped kits

BREWFERM beerkits are the first and only real Belgian beerkits available. Thanks to BREWFERM every homebrewer can easily brew his own Belgian-style beer. BREWFERM beerkits are always made from **100% pure malt extract** and are being produced in small special batches, according to **original Belgian recipes.** We only use the finest malts and the best hops available, guaranteeing a constant and high-grade quality. Furthermore, to Belgian tradition, other **special ingredients,** such as flakes, herbs or even fruit juices, are added to achieve the special aromas and tastes of Belgian beers.

Tips & Tricks

All **BREWFERM** beerkits are made to deliver superb Belgian-style beers without a hassle. If you want to personalise the beers even more, here are a few tips and tricks:

- Replace the sugar to be added (partially) with Belgian candy sugar.
- Want more hop aroma? Add a handful of aroma hops in your fermenting bin and leave them while fermenting.
- If the alcohol content is too strong to your taste, diminish the quantity of sugar added.
- Hooked on Wyeast liquid yeasts? Here are a few suggestions:
  - Wheat Beer: use 3944 Belgian White
  - Kriek and Framboise: use 3278 Belgian Lambic blend
  - Diabolo: use 1388 Belgian Strong Ale
  - Grand Cru: use 3522 Belgian Ardennes
  - Old Flemish Brown: use 1762 Belgian Abbey II
  - Abbey Beer: use 3787 Belgian Trappist
  - Gold: use 1338 European Ale or 2042 Danish Lager

Pre-hopped Kit Styles AVAILABLE

ABBEY BEER
AMBIORIX
CHRISTMAS
DIABOLO
FRAMBOISE
GALLIA
GOLD
GRAND CRU
KRIEK
OLD FLEMISH BROWN
PILSNER
TRIPLE
WHEATBEER



BREWFERM®

THE beerkits to make Belgian beers without a hassle !



info@brewferm.com

Contact one of our distributors for the dealer nearest you.

Crosby & Baker
1-800-999-2440

LD Carlson
1-800-321-0315

Steinbart Wholesale
1-800-735-8793

With the introduction of the COOPERS Brewmaster Series Kits, COOPERS took the next logical step in the evolution of easy-to-make, no-boil beer kits. Each kit is packaged with a stylistically appropriate yeast. The Wheat Beer comes with a North German Weisse beer yeast; the Pilsner is packaged with a German Pilsner yeast; the Nut Brown Ale and IPA are packaged with clean-fermenting British ale yeasts. For complete technical specs on all COOPERS products visit us at www.cascadiabrew.com

RECIPE

Nut Brown Ale
OG = 1.036 FG = 1.012
IBUs = 17 ABV = 2.7%

1. Mix 0.5 lbs. corn sugar and 1.5 lbs. Coopers Light Dry Malt Extract in at least 2 liters of water. **2.** Heat to 160 to 180° F (48 to 58° C). Hold for 15 minutes. **3.** Remove from heat and mix in one can **Coopers Brewmaster Series Nut Brown Ale Kit. 4.** Cool wort in pot to room temperature. Transfer into fermenter. Aerate well, then top up to five gallons if necessary. **5.** Pitch one package **Coopers Nut Brown Ale Yeast** when temp is less than 80° F. **6.** Ferment at 68 to 74° F.

Pre-hopped Kit Styles AVAILABLE

THE BREWMASTER SERIES
PILSENER
INDIA PALE ALE
WHEAT BEER
NUT BROWN ALE

THE BREWERY SERIES
LAGER
DRAUGHT
REAL ALE
CANADIAN BLONDE
CLASSIC DARK
STOUT
BITTER

FAST, EASY. SIMPLY THE BEST



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Cascadia Importers
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1-800-999-2440

LD Carlson
1-800-321-0315

Steinbart Wholesale
1-800-735-8793

NO-BOIL pre-hopped kits

MUNTONS offer you their top quality beer-making kits. Take home and savour the taste of your choice — then come back and try another kit — perhaps one that is new to you. Beer making with MUNTONS is so easy. You and your friends will discover rich flavours that can only come from a manufacturer who selects the finest barley, malts with care and then also controls the malt extract and beer kit making process. You are just a few short steps away from enjoying the many years of MUNTONS experience for yourself!

RECIPE

Put the cans from the beer kit into hot water to soften the contents. Boil about 7 US pints of water, sterilize your fermenter and stirrer and add the boiling water and can contents. Stir well, then add cold water up to the 6 US gallons mark. Now add the yeast supplied. Leave to ferment, then bottle and finally drink — sounds too easy, doesn't it?

Pre-hopped Kit Styles AVAILABLE

PREMIUM GOLD RANGE
SMUGGLER'S SPECIAL PREMIUM ALE
OLD CONKERWOOD BLACK ALE
MIDAS TOUCH GOLDEN ALE

GOLD RANGE
OLD ENGLISH ALE
CONTINENTAL PILSNER
HIGHLAND HEAVY SCOTTISH ALE
DOCKLANDS PORTER
IMPERIAL STOUT
INDIA PALE ALE

CONNOISSEURS RANGE
EXPORT STOUT
NUT BROWN ALE
BOCK
TRADITIONAL BITTER
YORKSHIRE BITTER
IPA BITTER
CONTINENTAL LAGER
PILSNER
EXPORT PILSNER
WHEAT BEER

PREMIUM RANGE
BITTER
IRISH STYLE STOUT
SCOTTISH HEAVY ALE
PILSNER
AMERICAN STYLE LIGHT
BARLEY WINE
CANADIAN BEER
MIDLAND MILD
OLD ALE
LAGER



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

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

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

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

BBC Radio 4 food & drink programme (July 2000)

This man loves brewing. But he also loves life.

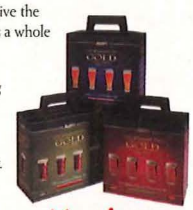
Bored with spending most of his time at home laboring over a brew he decided it was time to get out more. And now he can, thanks to Smugglers Special Premium Ale, Old Conkerwood Black Ale and Midas Touch Golden Ale - the Premium Gold range of brewkits from Muntons.

Because we use only the finest English 2-row barley and water, our kits give the same result you get from full grain mashing - except, it comes in a can, is a whole lot more convenient and frees up time to pursue life's other pleasures.

Since switching to kits our man has never looked back. He's still brewing great beer and enjoys sharing a round with friends. But his life has changed for the better with Premium Gold.

If you're a slave to full grain mashing, don't be! Switch to Muntons today.

Ask for Muntons Premium Gold at your nearest brew store.



Muntons
A World of Difference

Grain Malts • Liquid Malts • Spray Dried Malts • Brew Kits • Plain & Hopped Malt Extracts

Contact one of our distributors for the dealer nearest you.

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LD Carlson
1-800-321-0315

Steinbart Wholesale
1-800-735-8793

NO-BOIL pre-hopped kits

PAINE'S MALT LTD. range of Bulldog and Laaglander blends are simply the best concentrates made available in a can. Careful preparation, mashing and extraction has resulted in blends bursting with characteristic flavour and aroma. Brewers can customise their brew so no beer styles will be out of the reach of the extract brewer. With qualities available to suit all styles of beer, John Bull Bulldog and Laaglander blends offer infinite options to create unique beers every time you brew.

RECIPE

Masterclass 3kg beer kits are pre-boiled and pre-hopped kits that also require no brewing sugar.

- Just take any Masterclass kit and mix with 4 pints of boiled water
- Add another 36 pints of cold water
- Stir, add yeast
- Wait and enjoy!

Pre-hopped Kit Styles AVAILABLE

JOHN BULL MASTER CLASS 3KG KITS

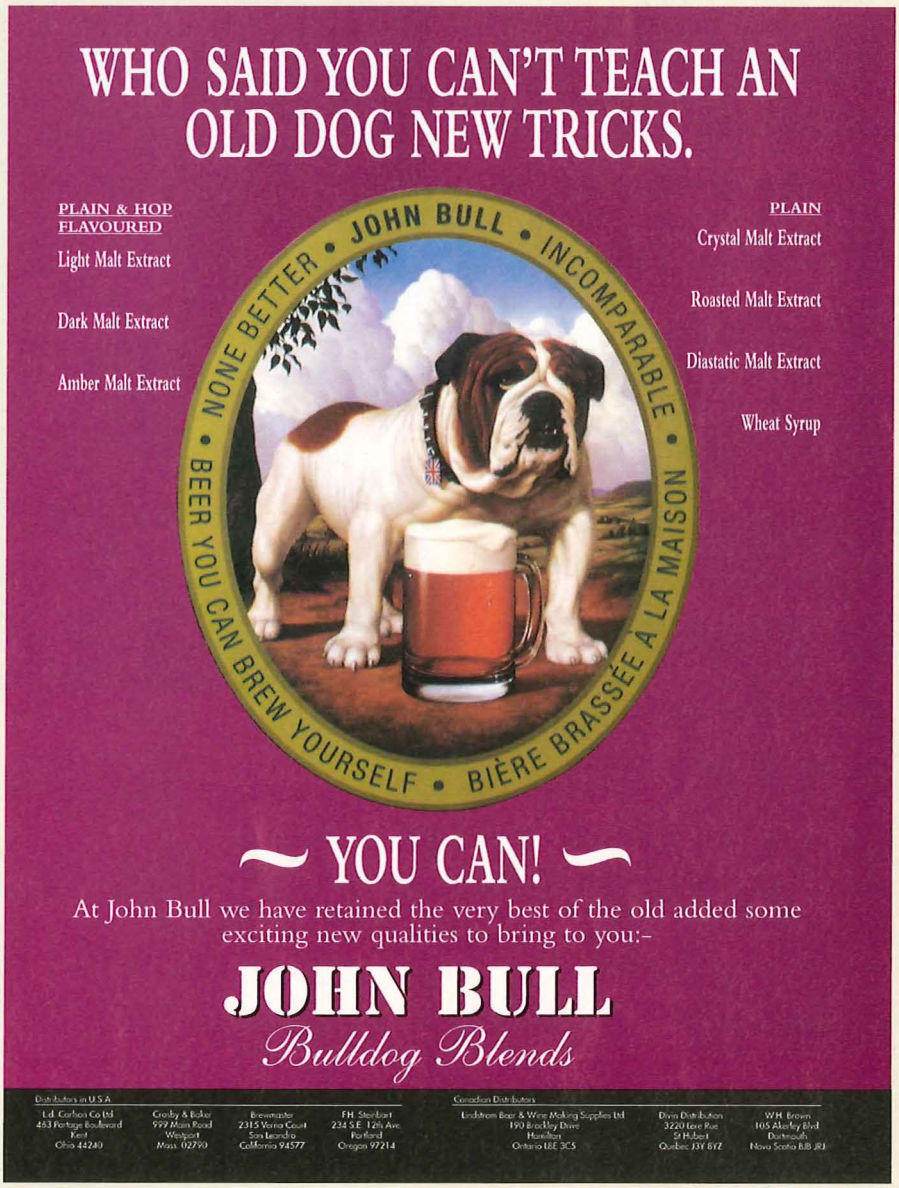
BAVARIAN LAGER
EXPORT PILSNER
BITTER EXECUTIVE
IRISH STOUT
INDIA PALE ALE
PORTER
WHEAT BEER
BARLEY WINE

JOHN BULL 1.8KG KITS

BEST BITTER
BEST LAGER
TRADITIONAL ENGLISH ALE
PILSNER
PORTER
MILD
IRISH STOUT
AMERICAN BEER
INDIA PALE ALE
DIABETIC BITTER
DIABETIC LAGER
BROWN ALE
COUNTRY CIDER
WHEAT BEER

LAAGLANDER 1.8KG KITS

DUTCH LIGHT
DUTCH BOCK
TRADITIONAL STRONG ALE
IRISH STOUT
IRISH ALE



Contact one of our distributors for the dealer nearest you.

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1-800-999-2440

LD Carlson
1-800-321-0315

Steinbart Wholesale
1-800-735-8793

NO-BOIL pre-hopped kits

The BREW HOUSE Kit produces all-grain microbrew-style beer with the convenience of a kit. Brewed from fresh grain and hops, it is pure all-grain wort, made the same way as commercial microbrewed beers. Gentle handling preserves the delicate aromas and flavours.

Fresh grains make fresh beer: The BREW HOUSE Kit is made from 100% grain. The grains are cracked just before brewing and gently steeped in water at our custom designed German-style brew house. After the sweet wort is drawn off, it's carefully boiled with generous amounts of hops. Then, without adding water or concentrate, we aseptically package it for maximum flavour and aroma. With our technology, we have total control over every step of the brewing process so you can make great beer every time you brew a BREW HOUSE kit!

RECIPE

Brew House Premium All-Grain Wort Kit

- Brew to the recipe on the box.
- Yields an all malt, beautiful, microbrew-style beer.
- Enjoy!

Pre-hopped Kit Styles AVAILABLE

MEXICAN CERVEZA

AMERICAN PREMIUM LAGER

CREAM ALE

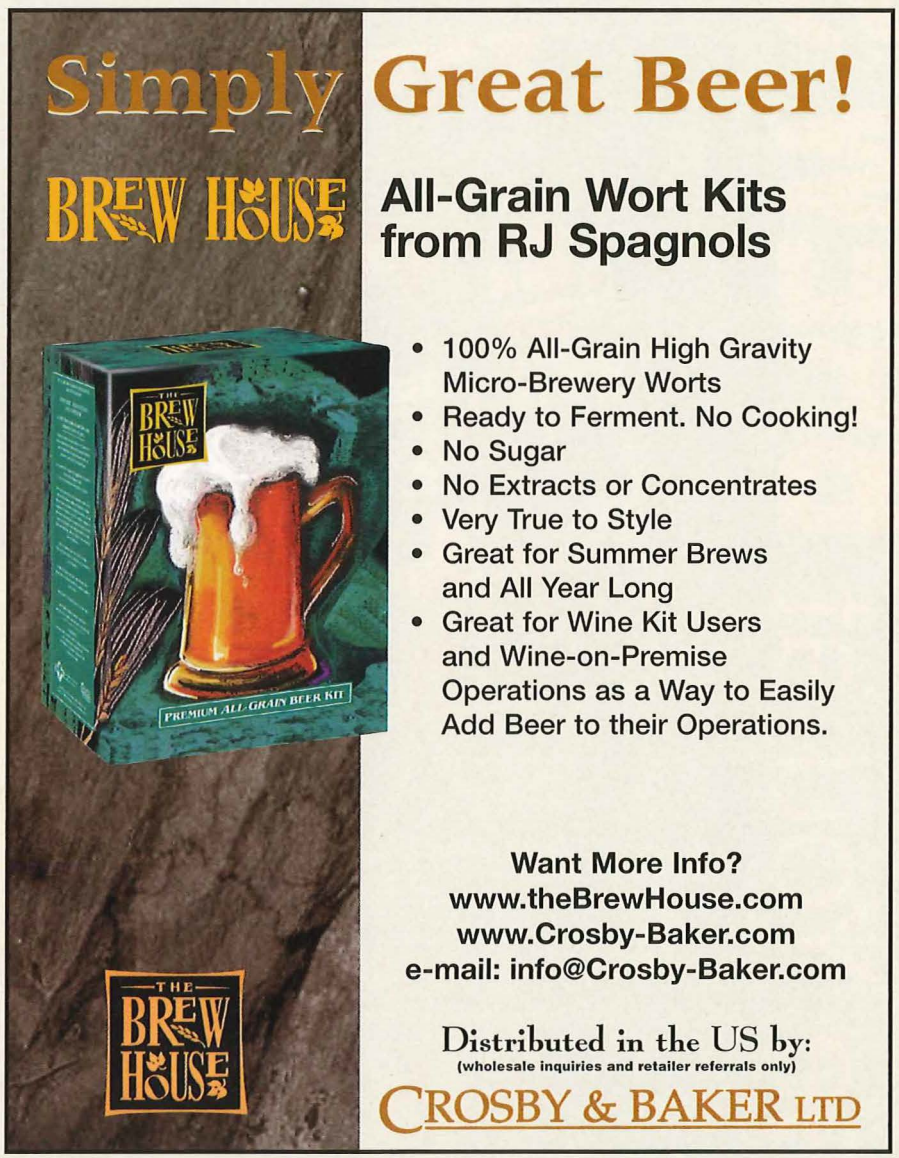
IPA

PILSNER

PALE ALE

STOUT

MÜNICH DARK LAGER

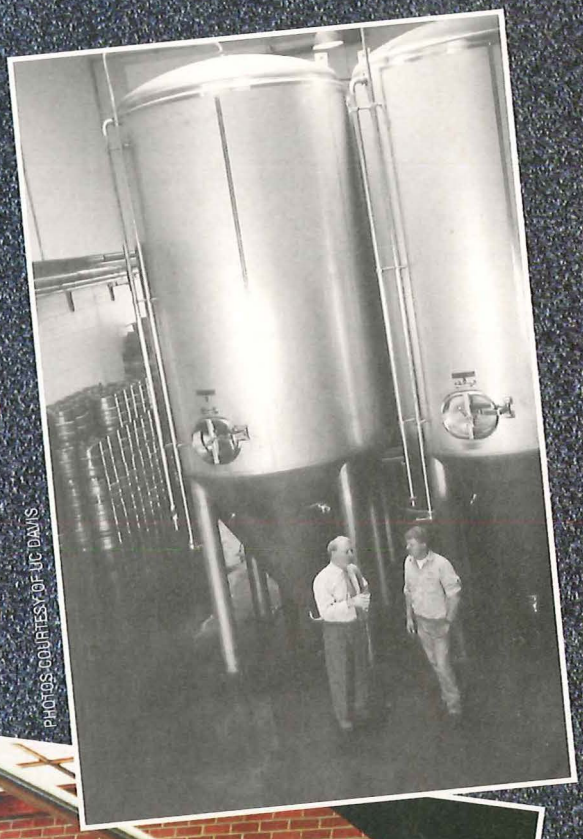


Contact us for the U.S. dealer nearest you.

Crosby & Baker
1-800-999-2440

See You at BREW SCHOOL!

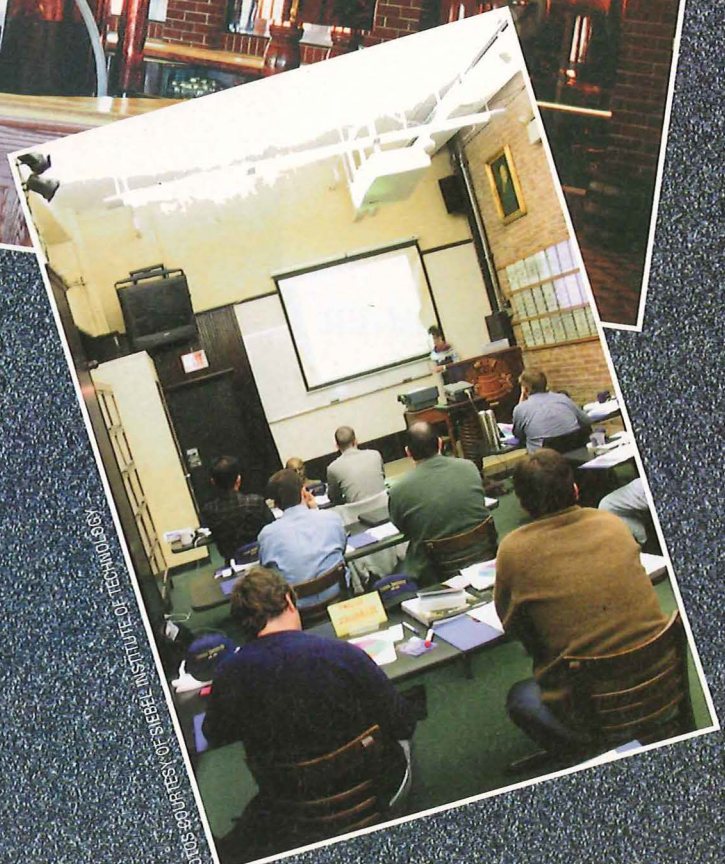
Study ADVANCED BREWING at these WORLD FAMOUS SCHOOLS



PHOTOS COURTESY OF UC DAVIS



PHOTOS COURTESY OF UC DAVIS



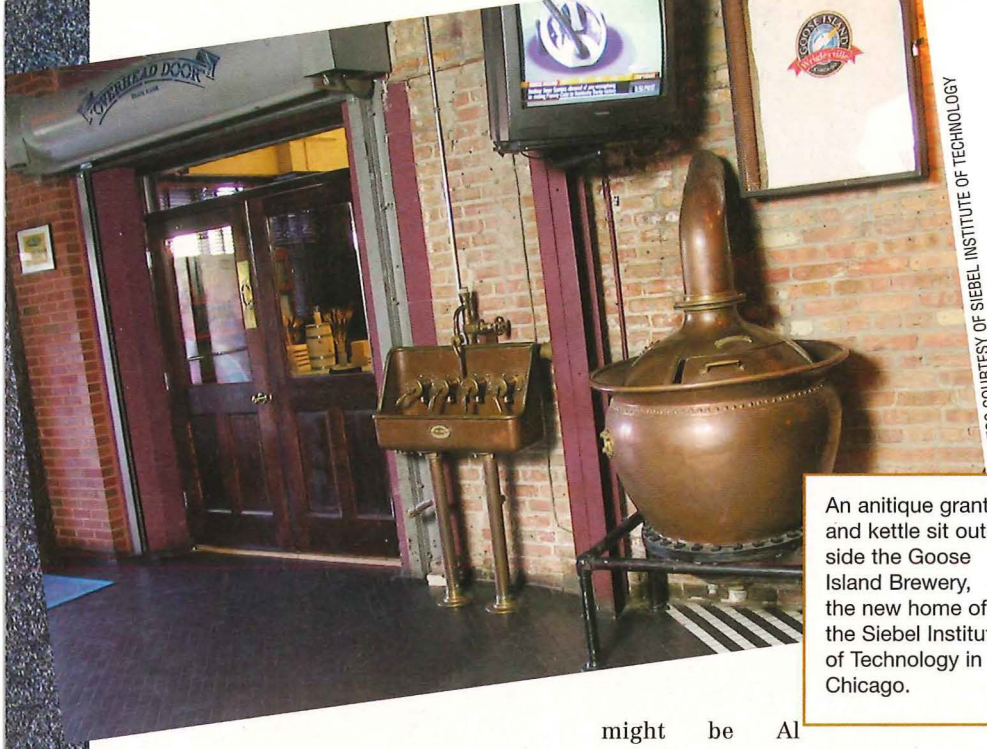
PHOTOS COURTESY OF SIEBEL INSTITUTE OF TECHNOLOGY

By **Thomas J. Miller**

The craft brewing industry has changed since the start-up years of the 80's and early 90's. It has evolved from grass-roots beginnings to full maturity. Years and sometimes decades have been dedicated to building successful businesses and recognized brands. Brewery owners demand trained professionals manning their brewhouses — very few will trust their success to someone armed only with passion and promise. This environment makes it tough for aspiring homebrewers to convert their hobby into a career.

There is a way around this roadblock, however. Go to brewing school! In exchange for a little bit of time, a chunk of money and lots of hard work, homebrewers can acquire valuable credentials. The results might translate into anything from a "learning the ropes" job in a brew cellar to getting hired as head brewer at the brewpub of your dreams.

Of course, hard core homebrewers just looking for some hands-on education might head back to school, too. Lucky for everyone, brewers of all stripes can pick from plenty of schools, both in the U.S. and abroad. To help our readers get back to school, Brew Your Own has compiled the following "catalog" of brewing colleges. Have fun exploring and good luck with your brewing career!



PHOTOS COURTESY OF SIEBEL INSTITUTE OF TECHNOLOGY

An anitique grant and kettle sit outside the Goose Island Brewery, the new home of the Siebel Institute of Technology in Chicago.

U.S. Brewing Schools — A through U

American Brewers Guild

The American Brewers Guild is headed by Steve Parkes, author of *BYO's* Homebrew Science. It offers Internet-based courses coupled with internships at breweries across the United States and hands-on brewery experience at Otter Creek Brewing in Vermont and Hoppy Brewing in Sacramento, California.

Contact:
American Brewers Guild
1001 Maple Street
Salisbury, VT 05769
Email: abg@abgbrew.com
Phone: (800) 636-1331
Fax: (802) 352-4641
Website: www.abgbrew.com

Tuition and Fees:
CraftBrewers Apprentice (CBA) $7,950
Intensive Brewing Science and Engineering (IBS&E) $5,750

Diplomas Granted:
CraftBrewers Apprentice (CBA)
Intensive Brewing Science and Engineering (IBS&E)

Siebel Institute of Technology

When you think of Chicago and beer, the first thing that comes to mind might be Al Capone. However, the windy city has another connection to beer — the Siebel Institute of Technology.

Contact:
Lyn Kruger
President
Siebel Institute of Technology & World Brewing Academy
1777 North Clybourn Ave.
Suite 2F
Chicago, IL 60614-5520
Phone: (312) 255-0705
Fax: (312) 255-1312
Website: www.siebelinstitute.com

Tuition and Fees:
Siebel Institute of Technology offers a wide variety of courses and programs. Tuition ranges from $1,650 for short, 3-day courses to $13,250 for a 12 week program consisting of six modules taught in Chicago (7 weeks) then Munich (5 weeks). See their website for detailed information. Siebel is partnered with Doemens (Germany) as part of the World Brewing Academy.

Diplomas Granted:
International Diploma in Malting and Brewing Technology
Associate in Malting and Brewing Technology

University of California, Davis

UC Davis offers students the opportunity to study under many instructors, including Michael Lewis, and learn the ropes at Sudwerk Privatbrauerei Hubsch, observing a fully automated 65-barrel Steinecker system and an original 15-barrel Caspary brewhouse.

Contact:
UC Davis Extension
1333 Research Park Drive
Davis, CA 95616
Email: aginfo@unexmail.ucdavis.edu
Phone: (530) 757-8899
Website:
http://universityextension.ucdavis.edu/brewing/index.asp

Tuition and Fees:
Master Brewers Program: $12,000
General Certificate in Brewing and Packaging: $1,650
Professional Brewers Certificate Program: $7,500

Diplomas Granted:
Professional Brewers Certificate
General Certificate in Brewing and Packaging

More Opportunities in the U.S.

Courses in brewing are also available through the Master Brewers Association of the Americas (www.mbaa.com). There are also short brewing courses offered at several universities, including Oregon State and University of Wisconsin, and new ones are popping up all the time.

If there is a university near you, inquire with their Food Science department to see if they offer a brewing course (if enough people express interest, maybe they will add one).

United Kingdom Brewing Schools — H

Heriot-Watt University

The International Centre for Brewing and Distilling

Though brewing at Heriot-Watt University has a history dating back to 1903, the ICBD was first founded in 1988. It is currently the only UK school for brewing and related studies.

Contact:
Professor Graham G. Stewart
International Centre for Brewing and

Distilling,
Heriot-Watt University
Riccarton
Edinburgh, Scotland EH14 4AS
Phone: +44 131 449 5111
Fax: +44 131 449 5153
Email: G.G.Stewart@hw.ac.uk
Website:
http://www.bio.hw.ac.uk/icbd/html/ICBD_Courses.htm

Tuition and Fees:

Tuition fees for the 2004-2005 session will range from between £7,000 to around £9,000 ($11,600–$15,000).

Degrees and Diplomas Granted:

BSc (Hons) Brewing and Distilling (on campus) — 4 years of study.
Postgraduate Diploma in Brewing and Disitlling (on campus) — 9 months of study.
Postgraduate MSc in Brewing and Distilling (on campus) — 12 months of study.
Postgraduate Diploma/MSc in Brewing and Distilling (distance learning) — 2-7 years of study.
MBA in Brewing and Distilling (distance learning) — 2-7 years of study.

German brewing schools — D through W

Doemens

Doemens is a brewing school found on Munich's outskirts. As part of the World Brewing Academy, Doemens is connected to the Siebel Institute of Technology in Chicago. Classes, then, can be taken in English from some of Germany's best known brewmeisters.

Contact:
Gisela Heller (Secretary)
Phone: +49 (89) 85805-0
Fax: +49 (89) 85805-26
Email: Info@doemens.org
Website:
www.doemens.org

Tuition and Fees:

There is an application fee of 50 Euros ($60). Per semester fees are 1,800 Euros ($2,160). These fees cover items such as books, copies, Internet access, field trips (including overnight stays), and exam fees. There may be additional exam fees.

Degrees Granted:

Upon completion of the Doemens program, graduates receive a state certificate and the title of "Brau- und Malzmeister/in (HWK)" or "Betriebsbraumeister/in (IHK)." In German, the "in" attachment at the end of "Malzmeister/in" and "Betriebsbraumeister/in" signifies a female.

Versuchs- und Leranstalt für Brauerei in Berlin (VLB)

Although located in Germany's capital, Berlin, courses at the VLB Brewing School are taught entirely in English.

Contact:
Dipl.-Kfm. Eberhard Weinmann
Phone: +49 (30) 45080-292
Fax: +49 (30) 453 60 69
Email: weinmann@vlb-berlin.org

Dr.-Ing. Josef Fontaine
Phone: +49 (30) 450 80-292
Fax: +49 (30) 453 60 69
Email: fontaine@vlb-berlin.org
Website: http://vlb-berlin.org
http://vlb-berlin.org/english/-contact.html

Tuition and Fees:

Total cost including all fees for examinations, laboratory chemicals, and registration to events and field trips is US $6500. Prices are subject to change without notice.

Diplomas Granted:

Each graduate receives a VLB Brewmaster certificate and a diploma that confirms completion of studies and shows performance in each subject.

Wissenschaftszentrum Weihenstephan

Weihenstephan is located a short tram ride away from Germany's brewing Mecca — Munich. Students attending Weihenstephan must be able to speak fluent German.

Contact:
PD Dr.-Ing. habil. Heinrich Vogelpohl
Weihenstephaner Steig 22
D-85350 Freising
Germany
Phone: +49-8161-713596
Fax: +49-8161-714515
Email:Heinrich.vogelpohl@wzw.tum.de
Website:
www.wzw.tum.de

Tuition and Fees:

Weihenstephan charges no tuition,





PHOTOS COURTESY OF VERSUCHS- UND LERANSTALT FÜR BRAUEREI IN BERLIN

Students working on computers at the Versuchs und Leranstalt für Brauerei (VLB) in Berlin, Germany. Although this brewing school is located in Germany, classes are taught in English. In contrast, students who attend Weihenstephan must demonstrate their proficiency in German by passing an exam.



PHOTO COURTESY OF THE AMERICAN BREWERS GUILD

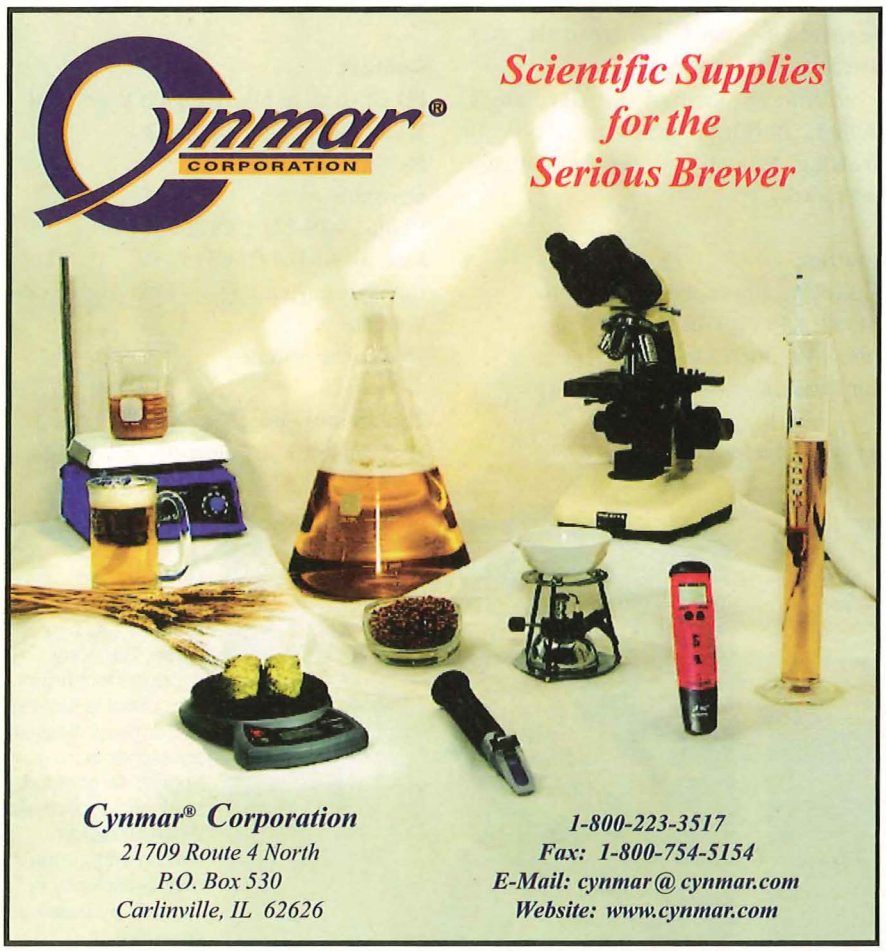
Relaxing between classes at the American Brewers Guild. ABG students study on-line and through brewery internships.

though there is a per semester student services fee of roughly 50 Euros ($60).

Diplomas Granted:

Graduates of Weihenstephan receive the coveted Diplombraumeister. A 15-month industry internship and a dissertation is required to earn this diploma.

Australian brewing schools — E through U



Edith Cowan University

Joondalup Campus, Perth, Australia

Edith Cowan University in Perth, Australia offers a brewing program designed to provide students with the knowledge and skills to succeed in microbrewing and pub brewing.

Contact:

Phone: +(61 8) 6304 5666
Phone: +(61 8) 6304 5727 (School of Marketing, Tourism and Leisure)
Fax: +(61 8) 6304 5633
Email: business@ecu.edu.au

School of Marketing Tourism and Leisure
Edith Cowan University
100 Joondalup Drive,
Building 2, Room 378
Joondalup Western Australia 6027
Websites:
www.business.ecu.edu.au/courses/undergrad/bbus/micro_brewery_management.htm
www.business.ecu.edu.au/courses/gradcert/gcMBM.htm
www.business.ecu.edu.au/courses/graddip/gdMBM.htm

Tuition and Fees:

Undergraduate Program: 6,600 AUD per Semester ($4500) — 6 semesters total
Postgraduate Program: Tuition fees for the post graduate courses are currently at $1,500 per unit. All classes are held in the evening.

Degrees and Diplomas Granted:

Bachelor of Business: Microbrewery Management
Graduate Certificate of Business: Microbrewery Management
Graduate Diploma of Business: Microbrewery Management
Successful completion of the Graduate Diploma prepares students for the Foundation Certificate of Brewing awarded by the Institute of Brewing, London (IOB).

University of Ballarat

Brewing enthusiasts who missed the pick for "Survivor: The Outback" can head down under to study brewing at the University of Ballarat. Whether an

undergraduate program, a graduate program, or a brewing short course, students can pretty much choose how much they want to learn. There's even advanced training on a state of the art, 6-hectoliter brewing system.

Contact:
Rob Greig
Phone: +61 3 5327 9247
Fax: +61 3 5327 9240
Email: r.greig@ballarat.edu.au

General Contact Info:
Phone: +61 3 5327 9018
Fax: +61 3 5327 9017
Email: prospective@ballarat.edu.au
Email: international@ballarat.edu.au

School of Science
University of Ballarat
P.O. Box 663
Ballarat
Vic 3353
Australia

Brewing Short Course
Dr Peter Aldred
Phone: +61 3 5327 9243
Fax: +61 3 5327 9240

Student Administrative Services
University of Ballarat
P.O. Box 663
Ballarat Vic 3353
Australia
Phone: +61 3 5327 9552
Email: admissions@ballarat.edu.au
Website:
www.ballarat.edu.au/ard/sci-eng/food/brewing

Tuition and Fees:
Undergraduate Program: $15,000 AUD ($10,000 USD)
Brewing Short Course: $1,760 AUD ($1,200 USD)
Graduate Program: The cost for each 15 credit point unit is $1,425 AUD ($960 USD), and $2,850 AUD ($1,910 USD) for each of the 30 credit point units. These prices include the cost of texts and course material.

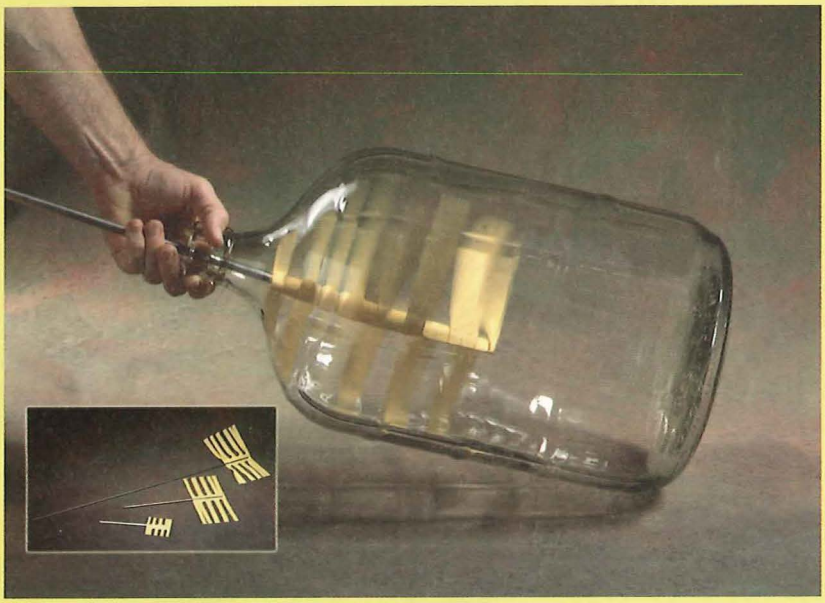
Degrees and Diplomas Granted:
Bachelor of Applied Science (Food Science and Technology)
Bachelor of Business (Brewing Studies)
Graduate Certificate and Graduate Diploma of Brewing
Honours and higher degrees in brewing (Master's and PhD)

Conclusion

So, if you are interested in going pro — or just brewing like one — you you have a variety of educational options to choose from. In fact, this list of schools is not comprehensive. Other schools exist in Belgium, France and elsewhere. A brewing education can teach you a lot about brewing — from mashing and boiling to fluid dynamics and heat transfer to business and marketing savvy. Plus, you can drink beer during class. ■

Tom Miller writes the Tips from the Pros column in every issue of BYO.

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www.carboyscrubber.com
(814) 591-0808

A&M MANUFACTURING CO.

by **CHRIS COLBY**

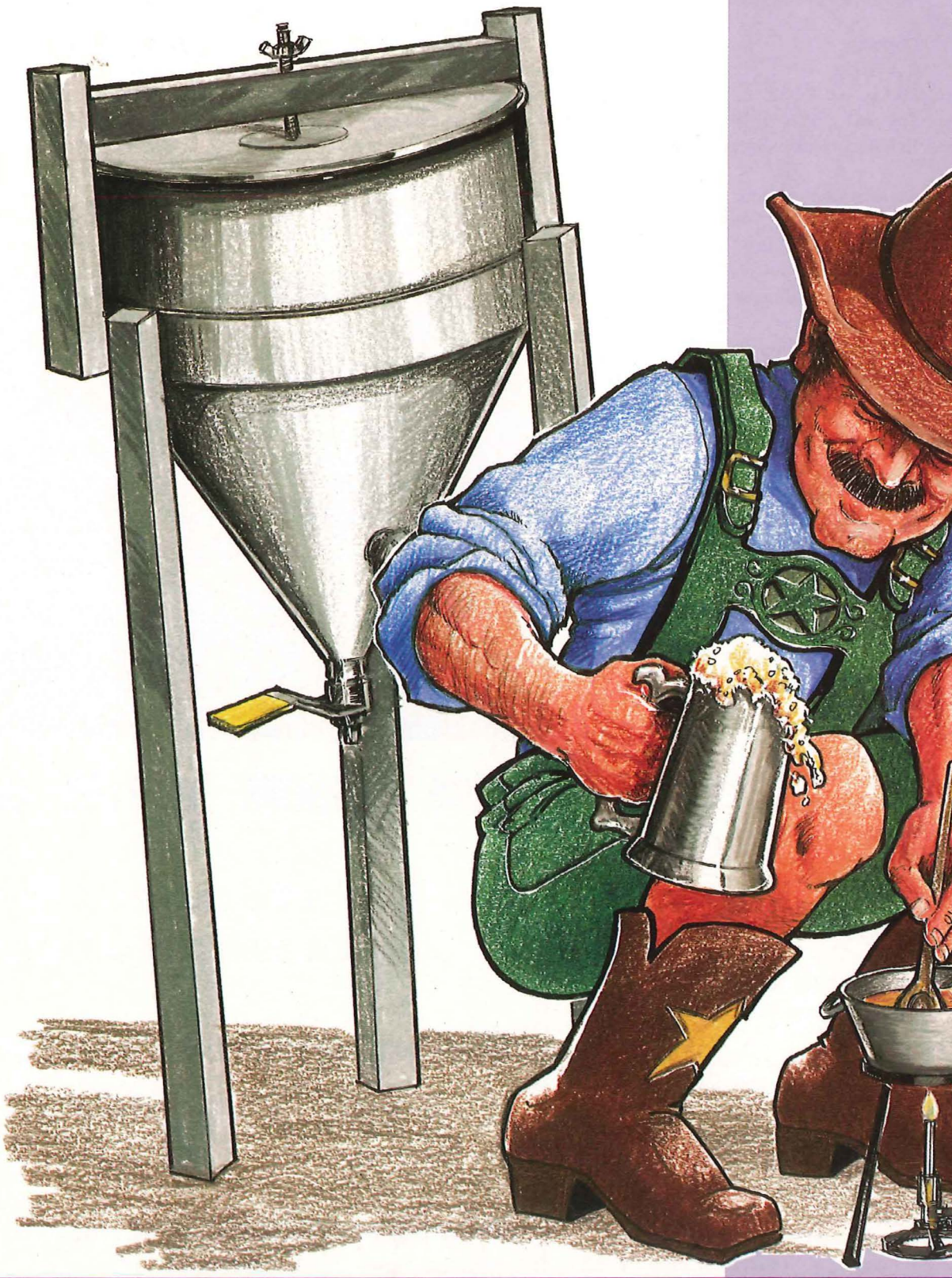
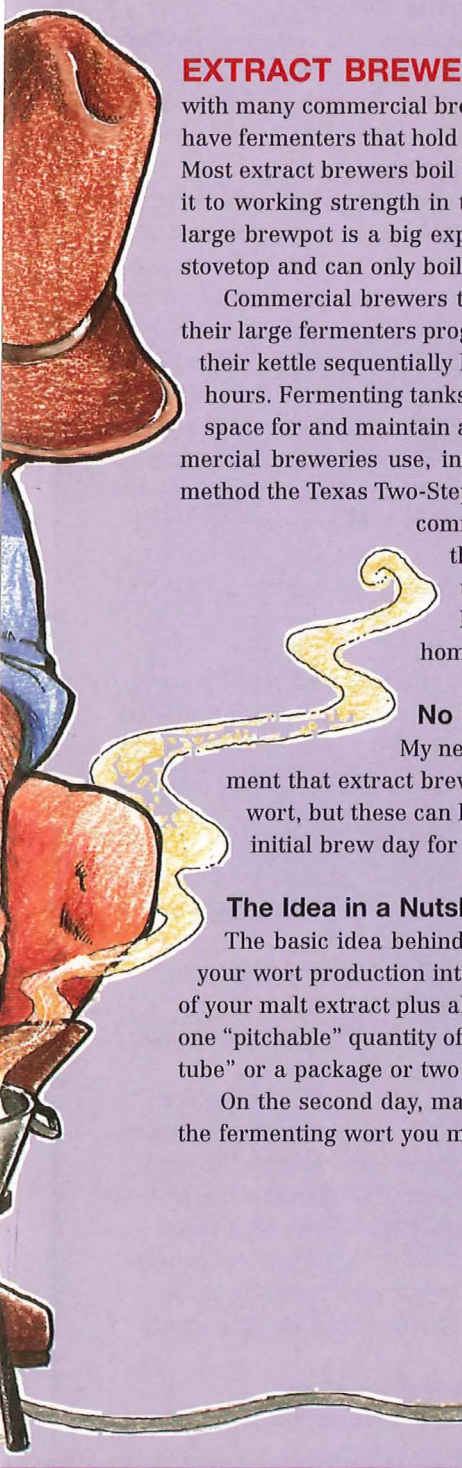
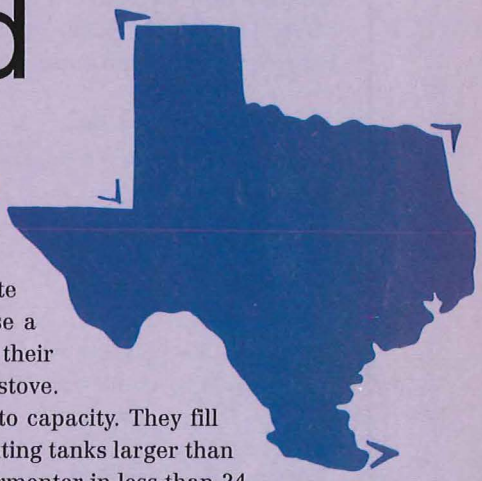


ILLUSTRATION BY DON MARTIN

The TEXAS TWO-STEP Method





EXTRACT BREWERS HAVE SOMETHING IN COMMON with many commercial brewers that they may not know about — both of them have fermenters that hold more wort than they boil in a single brewing session. Most extract brewers boil 2–4 gallons (7.6–15 L) of concentrated wort then dilute it to working strength in their 5-gallon (19-L) fermenter. Often, this is because a large brewpot is a big expense for a beginner or because they make beer on their stovetop and can only boil a limited amount of liquid given the output of their stove.

Commercial brewers take a different approach to filling their fermenters to capacity. They fill their large fermenters progressively over a period of time. Brewers with fermenting tanks larger than their kettle sequentially boil several batches of wort and add them to their fermenter in less than 24 hours. Fermenting tanks are expensive and it's cheaper for them to brew this way rather than to buy, make space for and maintain a collection of "small" fermenters. There are a variety of multi-fill procedures that commercial breweries use, including a well-known German method called drauflassen. I call my extract brewing method the Texas Two-Step because, as you will see, it's descriptive and it doesn't exactly recreate any established commercial multi-fill method (such as drauflassen). The Texas Two-Step method eliminates the problems associated with boiling a concentrated wort and results in better fermentations for homebrewers who do not make yeast starters. After describing my homebrew method for 5-gallon (19 L) extract brewers, I'll briefly explain how the all-grain home brewer can use a modified method to brew very large batches of beer.

No New Equipment Needed

My new method does not require any equipment beyond the basic set of homebrewing equipment that extract brewers already have. You do need a brewpot large enough to boil 2.75 gallons (10.4 L) of wort, but these can be found cheaply. The only thing you do need is to reserve some time the day after your initial brew day for a second brewing session.

The Idea in a Nutshell

The basic idea behind my method can be summarized in a few sentences. In the Texas Two-Step, you split your wort production into two brewing sessions. On day one, make 2.5 gallons (9.5 L) of wort with roughly half of your malt extract plus all the hops and specialty grains that the recipe calls for. Cool this wort, aerate and pitch one "pitchable" quantity of yeast — either Wyeast's large smack pack, Wyeast's "shampoo tube," White Lab's "test tube" or a package or two of dried yeast.

On the second day, make the final 2.5 gallons (9.5 L) of wort from your remaining malt extract and add it to the fermenting wort you made the day before. You then finish brewing as you normally would.

Improve Your Extract Beers With This New Brewing Procedure

Texas TWO-STEP Recipes

Here are seven recipes specifically designed for the Texas Two-Step method. The specific gravity of the first wort is slightly lower than the second to encourage yeast growth. Liquid malt extract (LME) is used in step two to allow a short (15 min.) second boil. Follow the brewing instructions in the article except as noted.

Austin Extra Pale Ale

(5 gallons/19 L, extract with grains)

OG = 1.044–1.047 FG = 1.011–1.012
IBU = 43 SRM = 6 ABV = 4.3–4.6%

Ingredients

1.9 lbs. (0.86 kg) light dried malt extract
0.33 lbs. (0.15 kg) CaraPils malt (6 °L)
0.25 lbs. (0.11 kg) crystal malt (20 °L)
10.8 AAU Northern Brewer hops (1.2 oz./34 g of 9% alpha acids)
2.25 AAU Tettnang hops (15 mins.) (0.5 oz./14 g of 4.5% alpha acids)
1.0 oz. (28 g) Saaz hops (0 mins.)
0.5 tsp. Irish moss (15 mins.)
0.25 tsp. yeast nutrients (15 mins.)
Wyeast 1056 (American Ale) or White Labs WLP001 (California Ale) yeast
3.7 lbs. (1.7 kg) light LME (step 2)
0.5 tsp. Irish moss (step 2)
0.25 tsp. yeast nutrients (step 2)
1.0 cup corn sugar (for priming)

Amarillo Amber Ale

(5 gallons/19 L, extract with grains)

OG = 1.050–1.053 FG = 1.013–1.014
IBU = 54 SRM = 11 ABV = 4.7–5.0%

Ingredients

1.8 lbs. (0.82 kg) light dried malt extract
0.50 lbs. (0.23 kg) crystal malt (40 °L)
0.33 lbs. (0.15 kg) crystal malt (60 °L)
12.5 AAU Centennial hops (bittering) (1.25 oz./35 g of 10% alpha acids)
6.75 AAU Amarillo hops (15 mins.) (0.75 oz./21 g of 9% alpha acids)
2.0 oz. (57 g) Amarillo hops (dry hop)
0.5 tsp. Irish moss (15 mins.)
0.25 tsp. yeast nutrients (15 mins.)
Wyeast 1272 (American Ale II) or White Labs WLP051 (California Ale V) yeast
4.5 lbs. (2.0 kg) light LME (step 2)
0.5 tsp. Irish moss (step 2)
0.25 tsp. yeast nutrients (step 2)
0.75 cups corn sugar (for priming)

El Paso Porter

(5 gallons/19 L, extract with grains)

OG = 1.052–1.056 FG = 1.016–1.017
IBU = 30 SRM = 55 ABV = 4.7–5.0%

Ingredients

1.5 lbs. (0.68 kg) light dried malt extract
1.0 lbs. (0.45 kg) crystal malt (80 °L)
0.5 lbs. (0.22 kg) chocolate malt
0.25 lbs. (0.11 kg) black patent malt
0.25 lbs. (0.11 kg) roasted malt
7.5 AAU Fuggles hops (bittering) (1.5 oz./43 g of 5% alpha acids)
1.65 AAU Fuggles hops (15 mins.) (0.33 oz./9.4 g of 5% alpha acids)
0.25 tsp. yeast nutrients (15 mins.)
Wyeast 1968 (London ESB Ale) or White Labs WLP002 (English Ale) yeast
4.6 lbs. (2.1 kg) light LME (step 2)
0.25 tsp. yeast nutrients (step 2)
0.75 cups corn sugar (for priming)

San Antonio Scottish Ale

(5 gallons/19 L, extract with grains)

OG = 1.055–1.059 FG = 1.016–1.017
IBU = 19 SRM = 16 ABV = 5.1–5.4%

Ingredients

2.2 lbs. (1.0 kg) light dried malt extract
0.5 lbs. (0.22 kg) crystal malt (60 °L)
2.0 oz. (57 g) roasted malt (300 °L)
5 AAU Challenger hops (bittering) (0.67 oz./19 g of 7.5% alpha acids)
0.5 tsp. Irish moss (15 mins.)
0.25 tsp. yeast nutrients (15 mins.)
Wyeast 1728 (Scottish Ale) or White Labs WLP028 (Edinburgh Scottish Ale) yeast
5.0 lbs. (2.3 kg) light LME (step 2)
0.5 tsp. Irish moss (step 2)
0.25 tsp. yeast nutrients (step 2)
0.75 cups dried malt extract (for priming)

Special instructions

Ferment at 60–65 °F (16–18 °C).

Sam Houston Stout

(5 gallons/19 L, extract with grains)

OG = 1.041–1.044 FG = 1.010–1.011
IBU = 34 SRM = 45 ABV = 4.0–4.2%

Ingredients

1.5 lbs. (0.68 kg) light dried malt extract
1.25 lbs. (0.57 kg) roasted barley (500 °L)
9 AAU Progress hops (bittering) (1.5 oz./43 g of 6% alpha acids)
0.25 tsp. yeast nutrients (15 mins.)
Wyeast 1098 (British Ale) or White Labs WLP006 (Bedford British Ale) yeast
3.6 lbs. (1.6 kg) light LME (step 2)
0.25 tsp. yeast nutrients (step 2)
0.75 cups corn sugar (for priming)

Dallas Dubbel

(5 gallons/19 L, extract with grains)

OG = 1.056–1.060 FG = 1.015–1.016
IBU = 18–19 SRM = 7 ABV = 5.4–5.7%

Ingredients

2.0 lbs. (0.91 kg) light dried malt extract
0.25 lbs. (0.11 kg) aromatic malt (26 °L)
1.0 lbs. (0.45 kg) Belgian candi sugar
5.0 AAU Styrian Goldings hops (bittering) (1.0 oz./28 g of 5% alpha acids)
1 AAU Hallertau hops (15 mins.) (0.25 oz./7 g of 4% alpha acids)
0.33 oz. (9.3 g) Saaz hops (0 mins.)
0.25 tsp. yeast nutrients (15 mins.)
Wyeast 1214 (Belgian Abbey) or White Labs WLP530 (Abbey Ale) yeast
4.5 lbs. (2.0 kg) light LME (step 2)
0.25 tsp. yeast nutrients (step 2)
0.75 cups corn sugar (for priming)

Bastrop Schwartz Wit

(5 gallons/19 L, extract with grains)

OG = 1.049–1.052 FG = 1.013–1.014
IBU = 24 SRM = 17 ABV = 4.6–5.0%

Ingredients

2.1 lbs. (0.95 kg) wheat dried malt extract
5.0 oz. (142 g) Weyermann dehusked Carafa III malt
6.25 AAU Styrian Goldings hops (bittering) (1.25 oz./35 g of 5% alpha acids)
0.33 oz. (9.3 g) coriander
0.25 oz. (7.1 g) dried orange peel
0.13 oz. (3.7 g) dried lavender flowers
0.25 tsp. yeast nutrients (15 mins.)
Wyeast 3944 (Belgian Wit) or White Labs WLP410 (Belgian Wit II) yeast
4.3 lbs. (2.0 kg) wheat LME (step 2)
0.25 tsp. yeast nutrients (step 2)
0.75 cups corn sugar (for priming)

Special instructions

Add spices to fermenter three days before bottling.

Advantages

The primary advantages of this method are easy to see. By splitting your wort production across two brewing sessions, you can boil your worts at working strength. As such, your wort won't darken due to carmelization of wort sugars, a common occurrence when boiling a concentrated wort. This will allow you to brew beers as light colored as your extract will allow.

In addition, more hop bitterness is extracted in a working strength boil compared to a concentrated boil. This will allow you to brew hoppier beers, or use fewer hops to get the level of bitterness you are used to. A final benefit is that the first half of your wort effectively becomes a yeast starter for your full batch of beer.

Some secondary advantages became apparent when I made a series of test batches. By only boiling 2.5 gallons (9.5 L) of wort at a time, I was able to get a better boil vigor on my stove than I would have been able to get if I was boiling 3 gallons (11 L) or more. This is good because hot break production is improved in a vigorous, full-wort boil. Also, if I used liquid malt extract (LME) for my wort on day two, I only needed to boil it for 15 minutes. With no grains to steep or hops to boil, wort production goes fast during step two. Plus, if I brewed with a bucket, all I needed to do was open it up and pour the wort in once it was cool — no need to clean and sanitize any equipment.

Disadvantages (real)

The test batches did reveal a couple drawbacks, however. First, and most obviously, you need to have time free on two consecutive days and overall this method takes slightly longer than brewing following normal extract procedures. Secondly, beers made this way can be diacetyl-prone if you don't follow the instructions (particularly the step two instructions) closely. (Diacetyl is a substance that results in a buttery or butterscotch character in beer.)

Finally, if you want to brew a very hoppy beer (over 50 IBU), you'll need to boil half your hops during each brewing session and won't be able to get away with a short boil on day two. You can, however, brew a very dark beer by steeping all the dark grains during step one.

Disadvantages (imaginary)

My biggest concern when I first tried this method was that the pitching rate would be too low. Even though the liquid yeast companies put out "pitchable" tubes of yeast, I always make a big starter (usually around 2 qt./2 L for most ales) when I brew. So, I suspected I would find some of the problems associated with underpitching — including sluggish fermentation, high ester levels and high final gravity — in my experimental beers. To my surprise, the yeast performed fine at this pitching rate. I would, however, recommend using yeast nutrients when using this method. And, for higher gravity beers (above, say, 1.070), I would still recommend making a starter.

Detailed Instructions

Here are the step-by-step instructions for brewing using the Texas Two-Step method. You can use this method to brew any standard extract with grains recipe. However, I've also provided a few recipes on page 40.

STEP ONE

1. Ingredients If you are using a regular extract-with-grains homebrew recipe, measure out half the amount of malt extract in your recipe. It's not important to get exactly half, anywhere close will do. In fact, adding a little less (up to 15%) malt extract on the first day may actually benefit your beer as yeast grows faster in lower gravity worts. (The malt extract amounts in the recipes on page 40 have already been divided into two portions.) If your recipe calls for Irish moss or yeast nutrients, divide these into two portions. Measure out all the other ingredients (specialty grains and hops) as specified in the recipe.

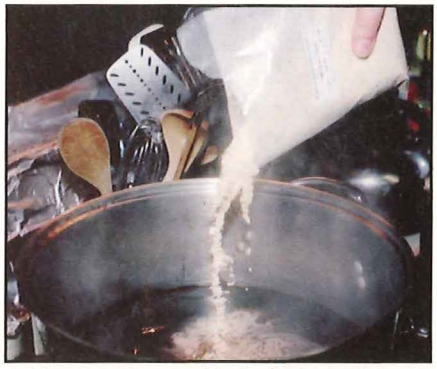
If your recipe is for a beer with over 50 IBU, measure out half the amount of hops for step one and reserve the other half for step two.

Take your yeast out of the fridge and let it warm to room temperature as you prepare your wort.



PHOTOS BY CHRIS COLBY

Steep all of your specialty grains when making the first half of your wort.



Add malt extract and boil all of your hops (unless the beer is rated at over 50 IBU).



Add one "pitchable" quantity of yeast to the wort you made in the first step.



The first half of your wort will be fermenting by the time you make the second half.



TEXAS TWO-STEP

2. Water Add some water to your brewpot. About 1.5 quarts (~1.5 L) of water per pound (0.45 kg) of grains is optimal, but any amount of water will work as long as it is enough to completely submerge your specialty grains.

Any potable tap water is fine for extract brewing. I recommend omitting any gypsum or other brewing salts. Your malt extract already contains minerals from the water used in its production. Unless you know the amounts of these minerals, you'll just be piling minerals on top of an unknown amount of minerals already present in your extract.

3. Steeping Heat this water to 158 °F (70 °C). Put all of your crushed specialty grains in a steeping bag and steep them for 30–45 minutes. Keep the temperature of your steeping water between 148–170 °F (64–77 °C). When you are done steeping, lift the grain bag out and let it drip into your brewpot for a minute or so. Don't squeeze or attempt to wring out the grain bag.

4. Dissolving Your Extract Add water to your "grain tea" until your brewpot is filled to the 2.5-gallon (9.5-L) mark and bring this mixture to a boil. Once boiling starts, remove the brewpot from heat and stir in your step one portion of malt extract. Add additional water so that you have 2.75 gallons (10.4 L) of wort in the pot. (Some of this liquid will evaporate during the boil.)

5. Boiling Bring your wort to a boil. Once the initial foam subsides, add all of your bittering hops and begin boiling for 60 minutes. Add other ingredients (other hop additions, Irish moss, yeast nutrients and/or kettle adjuncts) at the time specified in the recipe. You may want to stir your wort occasionally, once every 10 minutes or so. If you do so, use a clean spoon. If you stir during the last 15 minutes of the boil, use a cleaned and sanitized spoon.

For the final 5 minutes of the boil, rest a (clean) lid on your brewpot as loosely as possible. The steam from the wort will sanitize the inside of the lid and keep any microorganisms on the inner lid from falling into your wort and contaminating it during cooling.

6. Cooling After the boil, put the lid on your pot and cool it in your sink. Change the water in the sink whenever it gets warm. Once the pot is cool enough to touch, change the water again and start adding ice. Keep cooling until the pot is cool to the touch.

Cooling the wort adequately is important. If you pitch your yeast into hot wort, you can stun or kill it. So, don't rush this stage. While the wort is cooling, you can clean up your brewing area or go and do something else. Don't be afraid to let your pot sit in cooling water, even if it's for a couple hours, as long as the lid is still on.

If you have a wort chiller, this will shorten your cooling time substantially.

7. Racking Once the wort is cool (preferably under 75 °F/24 °C), transfer your wort to a sanitized fermenter. Either pour it into a bucket or siphon it to a carboy. Either way, leave as much of the debris at the bottom of the brewpot behind as possible. (It won't hurt if a little carries over to the fermenter.) Aerate the wort by shaking the fermenter until the wort foams. Alternatively, you can inject air or oxygen into the wort if you have the equipment for it. You won't be aerating during the second step, so don't skimp on the aeration at this stage.

8. Pitching Pitch (all of) your yeast to this half-sized batch and seal your fermenter. Don't use any strain of yeast that is diacetyl prone with this method. For example, both Wyeast's and White Lab's Irish ale strains can leave a bit of residual diacetyl in the finished beer. So does Wyeast's Ringwood Ale strain.

9. Initial fermentation Ferment for 12–24 hours at 68–72 °F (20–22 °C), then proceed to step two.

STEP TWO

Optimally, step two should occur 12–16 hours after step one. For example, if you brew your step one wort on Friday night, you should brew your step two wort Saturday morning or over lunch. However, you can wait as long as 24 hours to brew your step two wort and this might be the most practical option for many people. (I brewed all my test batches this way.)

10. Boiling Bring 2.5 gallons (9.5 L) of water to a boil. Remove pot from heat and stir in remaining malt extract. Add water until you have 2.6–2.75 gallons (9.8–10.4 °L) of water then boil wort for 45–60 minutes. If you have hops to add on step two, add them at the appropriate time. Also, add Irish moss and yeast nutrients as specified in your recipe.

As an option, you can use liquid malt extract (LME) for your step two portion of malt extract. Many LMEs have already been boiled, so you can boil them for only 15 minutes or simply hold the temperature over 170 °F (77 °C) for 15 minutes. To do this, start with just 2.5 gallons (9.5 L) of wort. Add Irish moss and yeast nutrients as specified in your recipe.

11. Cooling Cool your step two wort and add it to your already fermenting step wort. As before, don't rush the cooling stage. Make sure your step two wort is below 75 °F (24 °C) before adding it to your step one wort.

12. Aeration? When I was researching and testing this method, I got two different answers to my question, "should I aerate during step two?" One source told me to minimize the amount of aeration when blending the new wort into the old wort. This is consistent with commercial practices. If you pour the wort into a brewing bucket, pour as smoothly as possible (i.e. try to get a laminar flow). If you siphon the wort into a carboy, put the outflow end of your siphoning tube under the liquid

level in the carboy. A few small splashes at this stage won't matter, but lots of aeration may cause noticeable levels of diacetyl in your finished beer.

The other source said go ahead and aerate. Diacetyl will be produced, but the larger mass of yeast will reabsorb the diacetyl faster.

After thinking about it and trying it both ways, I came to the following conclusion. If your step one wort is strongly fermenting when it comes time to add the step two wort, don't aerate. If it isn't, go ahead and aerate the wort as you did in step one.

13. Main Fermentation Continue fermenting in your primary fermenter for 10 days at 68–72 °F (20–22 °C). Ten days is longer than most ales are kept in primary; but this ensures the beer has sufficient contact time with the yeast so that diacetyl is completely reduced. (If you are impatient, you can take a small sample of your beer and taste it. If you don't detect diacetyl — which would be very obvious in warm, flat beer — proceed to secondary fermentation. If you do taste diacetyl, wait a couple days and sample again.)

After primary fermentation, rack your beer to secondary and let it condition 3–4 days before bottling. (If this isn't convenient, it's OK to leave the beer in secondary for several weeks with no ill effects.)

14. Packaging Bottle or keg your beer as you usually would, condition and enjoy!

All-grain Adaptation

All-grain brewers can also take advantage of this basic idea to brew very large batches of beer. Many large fermenters are showing up at homebrew stores that also cater to home winemakers. Whatever your kettle size, you should be able to find a fermenter roughly twice as large.

To brew a batch using a multi-step fill method, simply make two (or more) batches of wort on two consecutive days. Use the same recipe for each brewing session. Once the first batch of wort is made, cool it and transfer it to the fermenter. Pitch enough yeast to get the initial wort strongly fermenting in time for the next wort addition.

Unless you buy two big fermenters, you may have to skip secondary fermentation or perform the secondary in multiple carboys.

A big fermenter could be the inspiration for a fun homebrew club project. If a club bought (or borrowed) a large fermenter, its members could gather with their mash tuns and kettles and hold a wort production party to fill the tank. Once primary fermentation finished, each member would receive one or more carboys of beer to condition at home. Everyone should have a good time . . . everyone except the guy in charge of cleaning the fermenter that is. ■

Chris Colby now wishes that he had a really big fermenter.



FOOLPROOF EXTRACT BEERS

CAN'T-MISS RECIPES from homebrew shops



PHOTO BY CHARLES A. PARKER/IMAGES PLUS

FALL IS HERE,

the summer heat has faded and the temperatures inside the closets and basements of homebrewers have dropped into fermentation range. If you didn't brew over the summer, you may be looking for a great recipe to kick off "brewing season." To help you out, we've assembled a collection of tried-and-true recipes from homebrew shops across the nation. These are the recipes that the shops' customers love and keep coming back to. For best results, pay attention to the cleaning and sanitation of your equipment and the health of your yeast. (These recipes are foolproof, but no beer recipes are damn foolproof.) So, get ready to once again hear the sweet sound of a gurgling airlock and to taste the best beer in the world — yours.



AHS Dry Stout

(5 gallons/19 L, extract with grains)

OG = 1.053–1.059 FG = 1.014–1.016
IBU=43–52 SRM=42 ABV=5.0–5.5%

Ingredients

7 lbs. (3.7 kg) dark liquid malt extract
1 lb. (0.45 kg) crystal malt (60 °L)
½ lb. (0.23 kg) black barley
¼ lb. (0.11 kg) black patent malt
14 AAU German Magnum hops (1.0 oz./28 g of 14% alpha acids)
White Labs WLP004 (Irish Ale), Wyeast 1084 (Irish Ale) or Muntons dry yeast

Step by step

Bring 2.5 gallons (9.5 L) of water to 150 °F (66 °C) and turn off the heat. Soak the grains for 15 minutes. Remove grain bag, allowing liquid to drip into brewpot. Discard the grains and heat liquid until boiling. Shut off heat again and stir in malt extract. Heat to a boil once extract is dissolved, stirring occasionally. Add bittering hops and boil for 60 minutes. After boiling, cool wort quickly to 80 °F (27 °C). Pour wort into the sanitized fermenter and add cool water to make 5.25 gallons (20 L). Aerate wort and pitch yeast. Ferment for 5–7 days at 69–72 °F (21–22 °C) then rack to a sanitized secondary fermenter. Let the beer clarify 5–7 days, then bottle. This beer will taste best after 3 weeks or more of conditioning.

Austin Homebrew Supply
Austin, Texas
www.austinhomebrew.com

Crème de la Stout

(5 gallons/19 L, extract with grains)

OG = 1.071 FG = 1.032
IBU = 6–26 SRM = 43 ABV = 5.0%

Ingredients

6.0 lb. (2.7 kg) extra-light dried malt extract
12 oz. (0.34 kg) lactose
8 oz. (0.22 kg) malto-dextrin
12 oz. (0.34 kg) British crystal malt (60 °L)
12 oz. (0.34 kg) British chocolate malt (400 °L)
4 oz. (0.11 kg) roasted unmalted barley (300 °L)
4 oz. (0.11 kg) torrified wheat
1 tsp. gypsum
8 AAU Columbus hops (35 mins.) (0.5 oz./14 g of 16% alpha acids)
White Labs WLP002 (English Ale) yeast

Step by step

Heat 1 gallon (3.8 L) of water to 155 °F (68 °C). Add the crushed grains to this water and steep at 150 °F (66 °C) for 30 minutes. Strain the grain water into your brew pot. Sparge the grains with 1 gallon (3.8 L) of 150 °F (66 °C) water. Bring the water to a boil, turn off the heat and add malt extract, malto-dextrin and lactose. Resume boiling and add Columbus hops. Boil for 35 minutes and then cool your wort. Transfer wort to the primary fermenter and add cool water to obtain 5 gallons (19 L). When the wort temperature is under 80 °F (27 °C), pitch your yeast. Ferment in the primary fermenter 5–7 days or until fermentation slows, then siphon into the secondary fermenter. Bottle with 5 oz. (142 g) corn sugar.

Bet-Mar Liquid Hobby Shop
Columbia, South Carolina
www.liquidhobby.com

PumpHouse Raspberry Stout

(5 gallons/19 L, extract only)

OG = 1.040–1.044 FG = 1.010–1.011
IBU and SRM depends on extract

Ingredients

4 lbs. (1.8 kg) Irish stout liquid malt extract (hopped)
2 lbs. (0.9 kg) high maltose syrup
4 oz. (0.11 kg) raspberry flavor
Ale yeast

Step by step

Bring 3 gallons (11 L) of water to 180 °F (82 °C) or higher and add to sanitized fermenting bucket. Dissolve malt extract and maltose. Top off with 2 gallons (7.6 L) of cold water. Pitch yeast at 70 °F (21 °C). Ferment in primary for 1 week then transfer to secondary for 1 week. Just before bottling or kegging, add raspberry flavor.

The PumpHouse
Struthers, Ohio
www.thepumphouse.cjb.net

Positive Perspective Porter

(5 gallons/19 L, extract with grains)

OG = 1.062–1.068 FG = 1.018–1.020
IBU = 65–75 SRM = 43 ABV = 5.7–6.2%

Ingredients

7 lbs. (3.2 kg) amber malt syrup
1 lbs. (0.45 kg) dark DME
1 lbs. (0.45 kg) crystal malt (60 °L)
⅓ lbs. (0.15 kg) chocolate malt
⅓ lbs. (0.15 kg) black patent malt
20 AAU Centennial hops (60 min) (2.0 oz./57 g of 10% alpha acids)
2 AAU Tettnanger hops (15 min) (0.5 oz./14 g of 4% alpha acids)
2 AAU Tettnanger hops (5 min) (0.5 oz./14 g of 4% alpha acids)
1 tsp. gypsum (optional)
1 tsp. Irish moss
White Labs WLP005 (British Ale) yeast

Step by step

Steep crushed specialty grains in approximately 0.75 gallons (2.8 L) for 30 minutes. Remove grains and add water to brewpot to make 3–4 gallons of liquid. Bring this liquid to a boil, shut off heat and add malt extracts. Stir well. Bring to a boil again, adding Centennial hops when foam subsides. Boil for 60 minutes. Add Irish moss and first charge of Tettnanger hops with 15 minutes left in boil. Add remaining Tettnanger hops with 5 minutes left in boil. Cool wort and transfer to fermenter. Aerate wort and pitch yeast. Let ferment 5–7 days at 68–72 °F (20–22 °C). Rack to secondary and condition for 4–7 days then bottle.

The Beer Essentials
Lakewood, Washington
www.thebeeressentials.com

Saint Paul Porter

(5 gallons/19 L, extract with grains)

OG = 1.053–1.058 FG = 1.016–1.017
IBU = 32–42 SRM = 36 ABV = 4.8–5.2%

Ingredients

6 lbs. (2.7 kg) Northern Brewer Gold malt extract syrup
1 lb. (0.45 kg) Muntons dark dried malt extract
0.5 lb. (0.23 kg) UK chocolate malt (630 °L)
0.5 lb. (0.23 kg) UK dark crystal malt (75 °L)

10.6 AAU Chinook hops (60 min)
(1.0 oz./28 g of 10.6% alpha acids)
6.3 AAU Cascade hops (1 min)
(1.0 oz./28 g of 6.3% alpha acids)
Wyeast 1187 (Ringwood Ale) yeast

Step by step

Steep crushed specialty grains in 1.5 qts. (~1.5 L) for 30 minutes. Remove grains and add water to brewpot to make 3–4 gallons (11–15 L) of liquid. Bring this liquid to a boil, shut off heat and add malt extracts. Stir well. Bring to a boil again, adding Chinook hops when foam subsides. Boil for 60 minutes. Add Cascade hops with 1 minute left in boil. Cool wort and transfer to fermenter. Aerate wort and pitch yeast. Let ferment for 5–7 days at 68–72 °F (20–22 °C). Rack to secondary and let condition for 4–7 days then bottle.

Northern Brewer, Ltd.
St. Paul, Minnesota
www.northernbrewer.com

Good Olde Brown Ale

(5 gallons/19 L, extract with grains)
OG = 1.044–1.047 FG = 1.013–1.014
IBU = 18–30 SRM = 19 ABV = 4.1–4.3%

Ingredients

3.5 lbs. (1.6 kg) John Bull amber malt extract
2.0 lbs. (0.9 kg) Muntons dark dried malt extract
4.0 oz. (0.11 kg) Briess caramel malt (60 °L)
4.0 oz. (0.11 kg) Briess special roast malt (50 °L)
4.0 oz. (0.11 kg) Briess chocolate malt (350 °L)
4.5 AAU Fuggle leaf hops (bittering) (60 min)
(1.0 oz./28 g of 4.5% alpha acids)
6 AAU Cascade hops pellets (finishing) (30 min)
(1.0 oz./28 g of 6% alpha acids)
1 tsp. Irish moss (15 min)
1–3 oz. (28–85 g) freshly grated ginger root (optional)
White Labs WLP005 (British Ale) yeast

Step by step

Heat 2 gallons (7.6 L) of water with bagged malts. Remove bags at 165 °F (74 °C). Bring to boil. Turn off heat. Stir in liquid and dry malts. Return to boil. Boil for 60 minutes. Add Fuggles bittering hops. After 30 minutes, add Cascade finishing hops. After 15 more minutes, add Irish moss. Cool to 90 °F (32 °C). Add cooled wort to 3 gallons (11 L) of cold water in sanitized carboy. Aerate well. Pitch Yeast at 70 °F (21 °C). Ferment nine days at 68 °F (20 °C). Rack to secondary for 14 days at 65–68 °F (18–20 °C). Bottle or keg.

The Brew Haus
Durango & Pagosa Springs, Colorado
www.brew-haus.com

RECIPE Statistics

The concentration of liquid malt extract varies. Thus, we've given a range of original gravity values for recipes containing liquid malt extract. The amount of bitterness you extract from your hops depends on how thick your wort is at boiling. In these recipes, IBU values are given in range starting with the expected value that will result from boiling 2 gallons of wort to the expected value that will result from boiling 5 gallons of wort. The thickness of your wort can also affect the color of your beer, thus the lower values of SRM have a plus by them, indicating that wort darkening may occur and result in a darker beer. The final gravity quoted is based on the average attenuation of the yeast strain, assuming a healthy fermentation.

Flying Barrel Scottish Ale

(5 gallons/19 L, extract with grains)
OG = 1.047–1.053 FG = 1.013–1.014
IBU = 14–24 SRM = 11 ABV = 4.5–5.0%

Ingredients

6.6 lb. (3 kg) light liquid malt extract
8 oz. (0.23 kg) Victory malt
6 oz. (0.17 kg) crystal malt (60 °L)
2.6 AAU Willamette hops (60 minutes)
(0.5 oz./14 g of 5.1% alpha acids)
2.6 AAU Willamette hops (45 minutes)
(0.5 oz./14 g of 5.1% alpha acids)
2.6 AAU Willamette hops (15 minutes)
(0.5 oz./14 g of 5.1% alpha acids)
6.1 AAU Fuggles hops (5 minutes)
(1.0 oz./14 g of 6.1% alpha acids)
Wyeast 1318 (London Ale III) yeast

Step by step

Place the crushed grains in a grain bag and steep in 3 gallons (11 L) of water, at 155 °F (68 °C) for 20 minutes. After 20 minutes, pull grain bag out, put in a strainer above the wort you just steeped. Rinse the grain with 2.5 gallons of 170 °F (77 °C) water. Discard grains. Add the malt and first addition hops to the wort. Boil for 60 mins and add the hops as called for on the recipe. At the end of the 60 minutes, pour the wort into a bucket and cool to 80 °F (27 °C). At 80 °F (27 °C), add the yeast. Ferment at 70 °F (21 °C) for 2 weeks. Prime and bottle. Age 2 weeks in bottle and enjoy.

The Flying Barrel
Frederick, Maryland
www.flyingbarrel.com

Ballpark Red

(5 gallons/19 L, extract with grains)
OG = 1.049–1.050 FG = 1.012
IBU = 31–41 SRM = 7+ ABV = 4.8%

Ingredients

1.4 lbs. (0.64 kg) light liquid malt extract
4 lbs. (1.8 kg) extra light dried malt extract
4 oz. (0.11 kg) Victory malt
0.5 lbs. (0.23 kg) CaraMunich II
10 AAU Fuggles/Willamette hops
(2.0 oz./57 g of 5% alpha acids)
2.5 AAU Fuggles/Willamette hops
(0.5 oz./14 g of 5% alpha acids)
4 AAU Hallertau hops
(1.0 oz./28 g of 4% alpha acids)
1 tsp. Irish moss
English ale liquid yeast
1¼ cup DME (for bottling)

Step by step

Crush grains and tie into a muslin bag. Add 2 gallons (7.6 L) of cold water

to your brew pot and bring to a boil. Remove from heat, add grain bag and let steep for 30 minutes. Remove grain bag and discard. Now add the malt syrup, dried malt (minus reserved amount), and 2 oz. (28 g) Fuggles hops and boil gently for 45 minutes. Add second charge of Fuggles hops and the Irish moss. Continue boiling for 15 more minutes. Add last 1 oz. (28 g) of Hallertau hops and boil for 2 more minutes. Place 3.25 gallons (12 L) of cold water into primary fermenter. Cool to 65–75 °F (18–24 °C), aerate well. Pitch your yeast. Ferment until finished gravity has been reached. Prime with 1¼ cup of reserved dried malt extract, bottle and cap. Full carbonation should be reached within 2 to 3 weeks.

Beer and Wine Hobby
Woburn, Massachusetts
www.beer-wine.com

BYOB English Old Ale

(5 gallons/19 L, extract with grains)

OG = 1.086 FG = 1.022
IBU = 51–65 SRM = 13 ABV = 8.3%

Ingredients

9 lbs. (4 kg) light dried malt extract
1.0 lb. (0.45 kg) crystal malt (10 °L)
2 oz. (57 g) chocolate malt
22 AAU Target hops (bittering)
(2.0 oz./57 g of 11% alpha acids)
8 AAU Hersbrucker hops (aroma)
(2.0 oz./57 g of 4% alpha acids)
5 oz. (142 g) corn sugar (for priming)
brewers yeast

Step by step

Add two gallons (7.6 L) of water to your pot. Add crushed specialty grains to the steeping bag. Tie bag and place into pot. Bring temperature of water and grains to 155 °F (68 °C) and steep for 30 minutes. Remove the grain bag from the steeping water, squeeze out excess water and discard bag and grains. Bring steeping liquid to a boil. Remove from heat and add all malt extract. Bring wort to a boil and add bittering hops. Allow the wort to boil for 50 minutes. Add the aroma hops and boil 10 minutes. Put 3.5 gallons (13 L) of cold water in your 6.5-gallon (25 L) primary fermenter and add the hot wort. Cool the wort to 75 °F (24 °C) and pitch your yeast. Keep the fermenter in an area that will maintain a constant temperature of below 75 °F (24 °C) , but no lower than 60 °F (16 °C) After 5 days, transfer to your secondary fermenter if you are using one. Condition your beer for 7–10 days or until it clears, but no longer than 14 days, then bottle your beer using 5 oz. (142 g) of priming sugar in 1 cup of water. Store your beer at 70–75 °F (21–24 °C) to carbonate and age in the bottle for at least 10 days.

Brew Your Own Brew
Tucson, Arizona
www.brewyourownbrew.com

Round the Cape India Pale Ale

(5 gallons/19 L, extract with grains)

OG = 1.065–1.071 FG = 1.016–1.018
IBU=22–38 SRM=12+ ABV=6.3–6.8%

Ingredients

7 lbs. (3.2 kg) light liquid malt extract
2 lbs. (0.9 kg) British pale ale malt
0.5 lb. (0.23 kg) Cara-Pils malt
0.5 lb. (0.23 kg) British crystal malt (40–60 °L)
1 cup light brown sugar (added to end of the boil)
2 tsp. Burton water salts (or 2 tsp. gypsum)
1 tsp. Irish moss
9 AAU Bullion hops (bittering) (1.0 oz./28 g of 9% alpha acids)
7 AAU Northern Brewer hops (flavor) (1.0 oz./28 g of 7% alpha acids)
2.5 AAU East Kent Golding hops (aroma) (0.5 oz./14 g of 5% alpha acids)
2.5 AAU East Kent Golding hops (dry hop) (0.5 oz./14 g of 5% alpha acids)
White Labs WLP007 (Dry English Ale), Wyeast 1335 British Ale II), Nottingham or Safale S-04 yeast
⅔ cup light brown sugar (for priming)

Step by step

Heat a gallon of water to 165 °F (74 °C) and throw in grains tied up in muslin bag. Cover kettle and maintain temperature (150–160 °F/66–71 °C) for 20 minutes. Drain grain bag and rinse with hot water until you've collected a total of at least two gallons (7.6 L) of grain "tea." Bring to a boil and add the malt extract, water salts, and bittering (Bullion) hops. Maintain boil for 45 minutes and add the flavoring hops (Northern Brewer) and Irish moss. Boil another 10 minutes, then turn off heat and add the ½ oz. (14 g) of Kent Golding hops for finishing. Cool immediately, pour into your sanitized fermenter and pitch your yeast. Ferment below 70 °F (21 °C), if possible. Pulverize the remaining half ounce of hops and add to the bottom of the secondary fermenter immediately before siphoning the wort over from the primary. This will add a wonderful hop bouquet to the final product. Prime with ⅔ cup light brown sugar dissolved in a cup of boiling water. Allow to carbonate at room temperature for at least two or three weeks before sampling. This one's hoppy enough to benefit from some additional aging.

DeFalco's Home Wine and Beer Supplies
Houston, Texas
www.defalcos.com

Seven Bridges Organic IPA

(5 gallons/19 L, partial mash)

OG = 1.059–1.064 FG = 1.018–1.020
IBU = 11–26 SRM = 13 ABV = 5.3–5.7%

Ingredients

6 lbs. (2.7 kg) organic pale liquid malt extract
2.5 lbs. (1.1 kg) Briess organic pale 2-row malt
¾ lbs. (0.34 kg) Briess organic Munich malt
½ lbs. (0.23 kg) Weyermann Carahell malt
½ lbs. (0.23 kg) Briess organic caramel malt (60 °L)
½ teaspoon Irish moss
12.75 AAU New Zealand Pacific Gem hops (bittering) (0.75 oz./21 g of 17% alpha acids)
6 AAU organic English Kent Goldings leaf hops (flavor) (1.0 oz./28 g of 6% alpha acids)
8 AAU organic New Zealand Hallertaur hops (aroma) (1.0 oz./28 g of 8% alpha acids)
1 oz. (28 g) organic German

Hallertauer Mittlefrueh hops (dry hop) (optional)
Wyeast 1968 (London ESB) or White Labs WLP023 (Burton Ale) yeast
8 oz. (0.23 g) (1 ¼ cups) organic dried malt extract (for bottling)

Step by step

Heat 1.75–2 gallons (6.6–7.6 L) of water to 160–165 °F (71–74 °C), then turn the heat off. Add the grain bag with grains in it and stir well. The temperature should drop to 150 °F (66 °C). Adjust the temperature if necessary by adding heat, hot water, or cold water. Allow the grains to soak for 40–60 minutes at 150 °F (66 °C). (Optional: Do a starch test to see if the partial mash is done — add a drop of iodine to a sample taken from the wort. If it turns black, the mash is not yet done). Heat 1–1.5 gallons (3.8–5.7 L) of water to 170 °F (77 °C) in a separate pot. Sparge the grains with this water when the mash is complete. Add water to the liquid collected from the grains to make up to 5.25 gallons (20 L).

Heat the water to almost boiling and then turn the heat off. Add the malt extract and dissolve the extract completely. Turn the heat back on and bring to a boil. Once the wort has reached a rolling boil, add ¾ oz. (21 g) organic New Zealand Pacific Gem hop pellets (bittering) and boil for 40 minutes. Add 1 oz. (28 g) organic English Kent Goldings hops. If desired, add the Irish moss flakes. Boil for 15 minutes more. Add 1 oz. (28 g) organic New Zealand Hallertaur hops (aroma), boil 5 more minutes and turn the heat off. Cool the wort to 65–75 °F (18–24 °C). Transfer the chilled wort into your sanitized primary fermenting vessel. Aerate the wort, add the yeast and ferment in a cool dark place for 4–7 days at 65-75 °F (18–24 °C) in the primary fermenter. If you have a secondary fermenter, transfer the beer to it when fermentation activity has subsided (after 4–6 days). If desired, add 1 oz. (28 g) Hallertauer Mittlefrueh hops to the secondary fermenter for dry hopping. Ferment for an additional 7–14 days, or until fermentation is complete. Bottle beer with 8 oz. (0.23 kg) or 1 ¼ cups organic dried malt extract. Store the beer at room temperature (about 70 °F/21 °C) for the first few days, then in a cool dark place (55–65 °F/13–18°C) for 1–3 weeks. Your beer is ready to drink when it is clear and nicely carbonated.

Seven Bridges Organic Homebrewing Supplies
Santa Cruz, California
www.breworganic.com

HBS American Pale Ale

(5 gallons/19 L, extract with grains)
OG = 1.051–1.056 FG = 1.013–1.014
IBU = 11–28 SRM = 15 ABV = 4.9–5.4%

Ingredients

6 lbs. (2.7 kg) extra light LME
1 lb. (0.45 kg) 2-row brewers malt
4 oz. (0.11 kg) crystal malt (20 °L)
4 oz. (0.11 kg) crystal malt (40 °L)
4 oz. (0.11 kg) crystal malt (60 °L)
4 oz. (0.11 kg) crystal malt (90 °L)
8 oz. (0.23 kg) dextrin malt
5 AAU Cascade hops (1.0 oz./28 g of 5% alpha acids)
18 AAU Amarillo hops (2.0 oz./57 g of 9% alpha acids)
White Labs WLP001 (California Ale) yeast
1 cup corn sugar (for priming)

Step by step

Steep grains in grain bag in 1 gallon (3.8 L) of 154 °F (68 °C) water for 30 minutes. Strain the grains (do not squeeze) and rinse with 0.5 gallons (1.9 L) of 170 °F (77 °C) water. Place bag in strainer to do this. Add water to the brew pot for 1.5 gallons (5.7 L) total volume. Bring the water to a boil, remove the pot from the stove and add the light malt extract. Dissolve completely. Add water until total volume in the brew pot is 2.5 gallons (9.5 L) or more. Bring to boil and add Cascade hops. Boil for 40 min and add 0.5 oz. (14 g) Amarillo hops. Boil for another 10 min and add 0.5 oz. (14 g) Amarillo hops. Boil for 5 more minutes and add 0.5 oz. (14 g) Amarillo hops. Boil for final 5 minutes, turn off heat and add final 0.5 oz. (14 g) Amarillo hops. (Total boil time is 60 minutes.) Cool the wort rapidly to 70 °F (21 °C). Place in primary fermenter and top up with cool (70 °F/21 °C) water to obtain 5 gallons (19 L). Pitch the yeast and stir (or shake) well. Cheers.

Home Brew Shop
St. Charles, Illinois
www.homebrewshopltd.com

Green Zinger

(5 gallons/19 L, extract only)
OG = 1.049–1.051 FG = 1.012–1.013
IBU = 19–36 SRM = 4+ ABV = 4.7–5.0

Ingredients

3 lbs. (1.4 kg) Dutch extra-light dried malt extract
3.3 lbs. (1.5 kg) Northwestern light syrup (20% rice extract)
17.5 AAU Czech Saaz hops (5.0 oz./142 g of 3.5% alpha acids)
White Labs WLP001 (California Ale) yeast

Step by step

Bring extracts to boil in 2 gallons (7.6 L) water. Boil for 50 minutes, adding 1 oz. (28 g) hops at 10, 20, 30, 40 and 50 minutes. Cool wort to 72 °F (22 °C) or cooler and pitch yeast. Ferment 66–68 °F (19–20 °C). This beer is best when it is aged for 6 weeks after bottling.

Asheville Brewers Supply
Asheville, North Carolina
www.ashevillebrewers.com

Epicurean Kölsch

(5 gallons/19 L, extract with grains)
OG = 1.048-1.053 FG = 1.012-1.013
IBU = 9-18 SRM = 5+ ABV = 4.7-5.2

Ingredients

6.6 lbs. (3.0 kg) extra light liquid malt extract
1 lbs. (0.45 kg) Vienna malt
4.4 AAU German Hallertau hops (60 minutes) (1.0 oz./28 g of 4.4% alpha acids)
4.4 German Hallertau hops (5 minutes) (1.0 oz./28 g of 4.4% alpha acids)
1 tsp. Irish moss (15 minutes)
Wyeast 1007 (German Ale) or White Labs WLP029 (German Ale/Kölsch)

Step by Step

Add 2–2.5 gallons (7.6–9.5 L) of water to a brew pot bring water up to 150–160 °F (66–71 °C). When water

gets to proper temperature place the crushed grain into a steeping bag, close bag and place bag into brew pot. Steep grains for 20–30 minutes at 150–160 °F (66–71 °C). When steeping is completed, remove bag and let most of the water that was absorbed by the grain drain back into the brew pot. (Do not squeeze.)

Bring water in brew pot to a rolling boil. Once water is boiling, add malt extract. Stir very well to keep malt from sticking to the bottom of your brew pot. Add hops according to the recipe's hop schedule. Add 1 tsp. Irish moss to boiling water for the last 15 minutes of the boil. Once the wort has finished boiling, remove brew pot from heat and let stand 10 min.

Add enough room temperature water to your sanitized primary fermenter so that when you add your wort the total amount of liquid will be 5 gallons (19 L). Add wort to your sanitized primary fermenter, stirring vigorously to incorporate wort with water. Cool wort to 65–75 °F (18–24 °C) and pitch yeast. Ferment for 5—7 days.

After primary fermentation is complete — or 7 days, which ever comes first — transfer beer into your carboy or secondary fermenter. Let your beer sit for another 3–5 days for clearing and finish fermentation. After the secondary fermentation is complete, the beer is now ready to bottle with 0.75 cups of corn sugar. Let the bottled beer sit at room temperature for 1–2 weeks for the beer to condition. Here is the best part, get a glass and slowly pour the beer into the glass being careful to leave behind the yeast from conditioning and enjoy!

The Epicurean, Inc.
Wooster, Ohio
www.epicureanhomebrewing.com

Kennywood Bavarian Wheat

(5 gallons/19 L, extract only)

OG = 1.044–1.049 FG = 1.011–1.012
IBU = 8–15 SRM = 4+ ABV = 4.2–4.7%

Ingredients

6.6 lbs. (3.0 kg) Briess CBW Bavarian Weizen extract
3.8 AAU US Perle hops
(0.5 oz./14 g of 7.75 % alpha acids)
0.93 AAU Czech Saaz hops
(0.25 oz./7 g of 3.75% alpha acids)
Wyeast 3068 (Weihenstephan Weizen) yeast

Step by step

Add 3 gallons (11 L) of water to a fermenter. In a large pot, bring 1.5 gallons (5.7 L) of water to a boil. Add the Briess Weizen extract and stir vigorously to dissolve. Add the first hops, bring to a rolling boil. After 45-50 minutes of a rolling boil, add the finishing hops. Remove from heat, stir vigorously and let stand for 45 minutes, (preferably) in a sink of cold water. Transfer to primary fermenter, being careful not to disturb sediment. Cool wort to 75 °F (24 °C) or below. Add yeast and top fermenter to 5-gallon (19 L) mark with cold water. Let stand in a cool dark place for 7 days. Your beer is now ready to bottle or it can be siphoned into a secondary fermenter for further conditioning. If so, rack to secondary and lager at 60–65 °F (16-18 °C) for 7 days. Bottle or keg as usual.

Kennywood Brewing Supply
Crown Point, Indiana
www.kennywoodbrew.com

Cinco de Mayo Cerveza

(5 gallons/19 L, extract with grains)

OG = 1.039–1.042 FG = 1.010
IBU = 0–3 SRM = 4+ ABV = 3.8–4.1%

Ingredients

3.3 lbs. (1.5 kg) Muntons or Brewmart Cerveza Extract
1 lb. (0.45 kg) extra light dry malt
1 lb. (0.45 kg) corn sugar
4 oz. (0.11 kg) CaraPils malt
3.5 AAU Saaz hops
(1.0 oz./28 g of 3.5% alpha acids)
Brewer's yeast
1 cup corn sugar (for priming)

Step by step

Place 1 gallon (3.8 L) of water into the brew kettle. Put the CaraPils malt into one of the boiling bags and place in the water. Bring the water to a boil and remember to remove the grain bag just prior to the boiling point. Place the hop pellets into the other boiling bag and tie it closed. Place into the kettle and boil for 10 minutes. Measure out ¾ cup of the corn sugar and save this for priming the bottles. Stir the remaining corn sugar and the dried malt extract into the kettle. Stir the kettle frequently to prevent darkening the wort. Boil for 5 minutes. Turn off the heat and stir in the Cerveza malt extract. Keep stirring until the malt is completely dissolved. Add one gallon of cold water to the kettle. Pour remaining water into your fermenter then add the cooled wort. Pitch yeast when temperature is between 70–74 °F (21–23 °C). Ferment and bottle using your usual methods.

Leener's Brew Works
Northfield, Ohio
www.leeners.com

CW Bohemian Pilsner

(5 gallons/19 L, extract with grains)

OG = 1.050 FG = 1.015
IBU = 28–46 SRM = 5+ ABV = 5.7%

Ingredients

6 lb. (2.7 kg) Dutch extra-light dried malt extract
1 lb. (0.45 kg) crystal malt (10 °L)
10 AAU Hallertau Tradition hops (60 minutes)
(1.0 oz./28 g of 10% alpha acids)
3.1 AAU Czech Saaz hops (30 minutes)
(1.0 oz./28 g of 3.1% alpha acids)
3.1 AAU Czech Saaz hops (20 minutes)
(1.0 oz./28 g of 3.1% alpha acids)
3.1 AAU Czech Saaz hops (5 minutes)
(1.0 oz./28 g of 3.1% alpha acids)
1 tsp. Irish moss
White Labs WLP800 (Pilsner Lager), White Labs WLP820 (Oktoberfest Lager), White Labs WLP830 (German Lager) or Superior Lager yeast
¾ cup corn sugar (for priming)

Step by step

Measure 3 gallons (11 L) of water and place in the refrigerator overnight, making sure one gallon (3.8 L) of the three is distilled water. Measure 1 gallon (3.8 L) of distilled water and 0.5–1 gallon (2–3.8 L) of tap or spring water into your boiling pot. Heat to 150 °F (66 °C). Turn off the heat and add the crystal malt in a straining bag. Let the grains steep for 20 minutes. After 20 minutes, remove and discard the grain bag and grains.

Bring the water to a boil. Once the wort begins to boil, add the dried malt extract. Stir thoroughly. When the wort comes to a boil again, add the first hop addition for bittering (Hallertau Tradition). Adjust heat so the wort does not rise to the top of the kettle and overflow. Stir occasionally to avoid scorching. Add flavoring hops 30 and 40 minutes into the boil. Add Irish moss at 30–45 minute into the boil. Add the final addition of hops, for aroma when you are 55 minutes into the boil (the last 5 minutes). (Total boiling time is 60 minutes.)

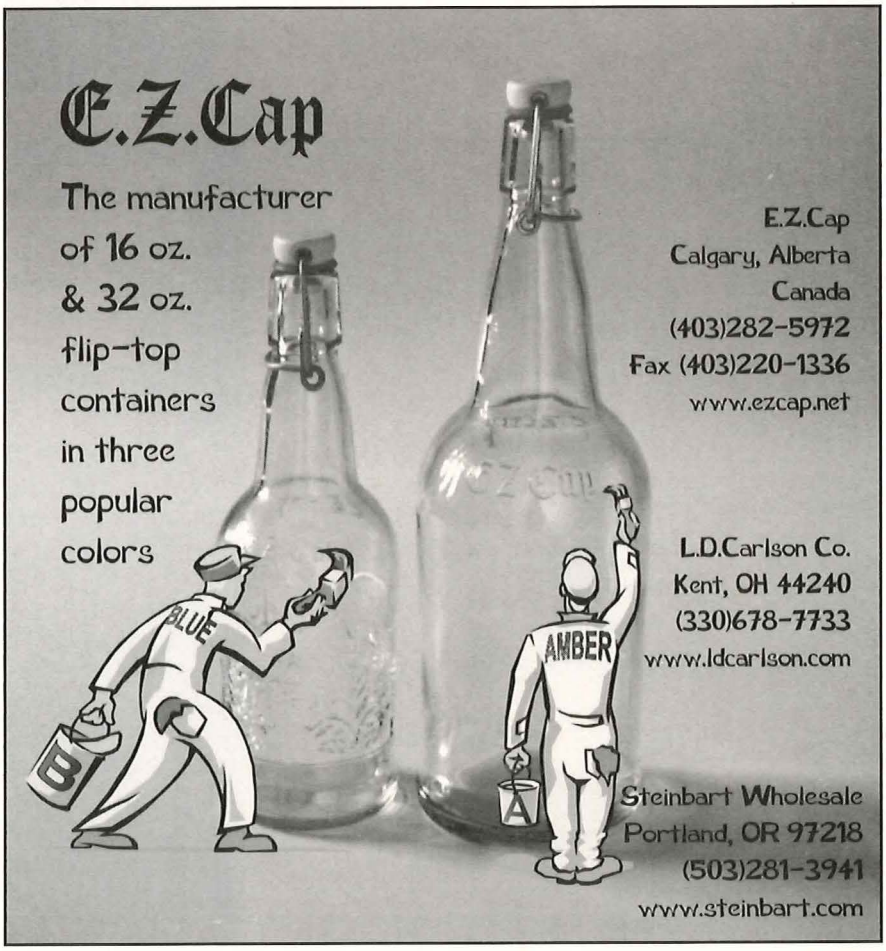
Place the covered pot in a cold-water bath (approximately 30 minutes) to force-cool the wort to 120 °F (49 °C). Pour the wort into your fermenter. You may wish to use a strainer to remove the hops. Add the cold water from fridge to make 5 gallons (19 L). Stir well. When wort is between 70–75 °F (21–24 °C), stir vigorously for 60 seconds. Pitch (add) the yeast culture or the hydrated yeast into the wort. Stir again.

Put the potential "liquid gold" in a warm place (65–75 °F/18–24 °C). Fermentation will last about 5-10 days, depending on the temperature. If you are going to ferment at lager temperature (50–60 °F/10–16 °C), start fermentation at room temperature, once fermentation has commenced movement of air through the airlock, slowly lower the temperature, not more than 2–4 °F (1–2 °C) per day, until your desired temperature is reached. If fermenting at lager temperatures, fermentation may take 2–4 weeks. You will also want to bring the beer up to room temperature for 1–3 days before bottling.

Siphon beer into a clean and sterile bottling bucket. Prime with ¾ cup corn sugar boiled in saucepan with ½ cup water or beer and bottle. Allow beer to age upright at room temperature for at least 15 days until carbonation has formed. Now move it to a cooler temperature (30–35 °F/1–1.7 °C) for further aging. You may wish to taste it at this time but peak flavor is reached after four weeks of additional aging. Enjoy! ■

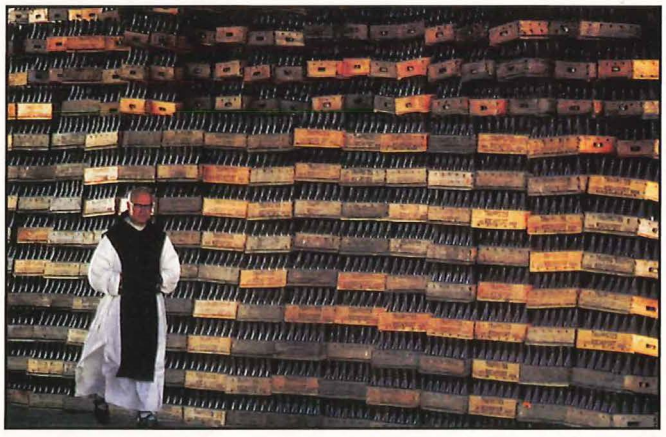
Country Wines
Pittsburgh, Pennsylvania
www.countrywines.com





trappist Ale

A heavenly potion of earthly pleasures



Story
HORST DORNBUSCH
Photos
Belgian Tourist Board

TRAPPIST ALE by the numbers

OG	1.050–1.100 (12.5–25 °P)
FG	1.010–1.020 (2.5–5 °P)
SRM	3–20
IBU	20–45
ABV	4–12%

YOU MIGHT BE SURPRISED TO LEARN that the most indispensable and defining ingredient in an authentic Belgian Trappist ale is apparently . . . monks! According to a 1962 Belgian court decision, only monastic breweries may legally call their beers Trappist ales (Trappistenbier in Flemish-Dutch and Bière des Pères Trappistes in French). Today, only the Achel, Chimay, Orval, Rochefort, Westmalle, and Westvleteren breweries qualify.

There are secular breweries such as Affligem, Corsendonk, Duinen, Leffe and Maredsous that brew Trappist-like ales. A beer from such a brewery is made the Trappist way, but it must be labeled an "abbey beer" (Abdijbier in Flemish or Bière d'Abbaye in French) to distinguish it from the real thing. As a

homebrewer, of course, you cannot make real Trappist ale. All your Trappist-style ales are abbey beers.

It is virtually impossible to categorize Trappist or abbey beers save for the fact that they are all bottle-conditioned ales. Modern Trappist beers can range in color from pale-blond or bright gold, perhaps just a shade darker than the average Pilsner, to dark copper or tawny. Their alcohol by volume (ABV) may range from 4–12%. A Trappist ale's head should be big, dense and creamy. The aroma and flavor should be complex, yeasty, fruity and estery, sometimes with a sweet finish. The numerical bittering levels can be high, but the perceived bitterness is usually fairly low. The stronger, well-aged Trappist ales — with their sour-cherry notes, oakiness and delicate balance — can be more complex than the grandest wines.

So what remains to tie all these beers together is perhaps just their legal definition as a monastery brew. In a sense, each Trappist ale is somehow unique — its own style, with only one unifying ingredient, les pères trappistes . . . indeed, monks.

Brewing is God's Work

The Trappist order of monks is an outgrowth of the Cistercian monastic movement of the eleventh century. Over the centuries, the Cistercians build some five hundred houses all over central Europe. One of them, the Abbaye de la Grande Trappe in Normandy, founded by Rancé de la Trappe in the seventeenth century, served as the Cistercian headquarters until the monks moved back to the original abbey site in Citeaux, in 1898. Père Rancé made it clear in his writings that he considered beer an essential part of a working monk's diet. It is from this friar and his grand abbey that the designation "Trappist" derives — both for the taciturn Cistercians and for their nourishing brews.

Trappist ales were originally brewed just for the monastery's internal consumption. The abbey of Westvleteren, for instance, made its first cask of beer in 1839, but sold its first beer to the general public only in 1877. Only after the Second World War did Trappist beer begin to be sold in substantial quantities to secular civilians.

A Seventh Trappist Beer?

The Trappist abbeys covered by the law all happen to be located in Belgium, but they need not be. Rather, the stipulation that separates genuine Trappist beers from all others in the world is that they be brewed exclusively and directly by the friars themselves. This means that Trappist ales may not be brewed under license off the monastery premises, not even if the recipe remains unchanged and the arrangement is just for overflow demand. For this reason, a seventh monastery brewery that is run by bona fide Trappist monks is not considered by some purists to be part of the circle of accredited Trappist ale makers. The brewery in question is the Trappist Bierbrouwerij De Konigshoeven, near Tilburg just across the border in southern Holland. Konigshoeven has a licensing arrangement with a large brewing conglomerate, but it labels its beers unmistakably La Trappe.

The Nomenclature of Strength

In the twentieth century, Belgian Trappist and abbey ales began to be made with well-modified grains and



RECipes

Silent Tripel

(5 gallons, all grain)

OG = 1.078 FG = 1.011
IBU = 30 SRM = 11–12 ABV = 8.7%

Ingredients

12.5 lbs. (5.7 kg) pale ale 2-row malt
1.0 lb. (0.45 kg) light Munich malt (~10 °L)
0.4 lb. (0.18 kg) crystal malt (~60 °L)
0.63 lbs. (0.29 kg) table sugar (sucrose)
0.63 lbs. (0.29 kg) corn sugar (glucose)
4.33 AAU Hallertauer Magnum (bittering) (0.33 oz./9.4 g of 13% alpha acid)
4.33 AAU Tettnanger hops (bittering) (1.1 oz./31 g of 4% alpha acid)
0.5 oz. Hallertauer Mittelfrüh hops (flavor)
1 tsp. Irish moss
Wyeast 1388 (Belgian Strong Ale) or White Labs WLP500 (Trappist Ale) (primary fermentation)
Wyeast 1762 (Belgian Abbey II) or White Labs WLP530 (Abbey) (conditioning)
1 cup table or corn sugar (for priming)

Halo Dubbel

(5 gallons, all grain)

OG = 1.064 FG = 1.012
IBU = 20 SRM = 15 ABV = 6.6%

Ingredients

10.75 lbs. (4.9 kg) pale 2-row Pils malt
0.5 lb. (0.22 kg) crystal malt (120 °L)
0.5 lbs. (0.23 kg) table sugar (sucrose)
0.5 lbs. (0.23 kg) corn sugar (glucose)
5.6 AAU Styrian Goldings hops (bittering) (0.8 oz./23 g of 7% alpha acid)
0.5 oz. (14 g) Saaz hops (flavor)
0.5 oz. (14 g) Tettnanger hops (aroma)
1 tsp. Irish moss
Wyeast 1388 (Belgian Strong Ale) or White Labs WLP500 (Trappist Ale) (primary fermentation)
Wyeast 1762 (Belgian Abbey II) or White Labs WLP530 (Abbey) (conditioning)
1 cup table or corn sugar (for priming)

Step by Step

The grain bill for this brew and the resulting color values have been calculated for a system with a hypothetical extract efficiency of roughly 65%. One pound of sugar is assumed to contribute about 10 to 13 gravity points to 5 gallons of wort. Depending on your actual results, you may have to liquor down your wort at the end of the boil to achieve the specified target original gravity.

Use a single-infusion process with a 90-minute rest at roughly 152 °F (66 °C). Then sparge with about 180 °F (82 °C) water for about 75 minutes. Make sure that the mash temperature at the end of the sparge has reached 168–170 °F (76–77 °C).

Boil your wort for 90 minutes. Add the bittering hops about 30 minutes into the boil. Add the flavor hops and Irish moss about 15 minutes before shutdown. Add the aroma hops (for the dubbel only) directly at shutdown.

Heat-exchange the wort to 68 °F (20 °C) and aerate. Because Trappist brews have a relatively high starting gravity, it is a good idea for a healthy cell count to pitch two packages of either the Wyeast 1388 or the WLP500. Alternatively you can use just one package of yeast and save money by making a yeast starter. Rack the brew off its debris after about two weeks. Then keep it undisturbed for another two to three weeks. Rack the beer again and prime it with sugar. At this point, to aid in bottle conditioning, add the remaining package of yeast. This yeast ought to be fairly alcohol-tolerant (such as Wyeast 1762 or WLP530). Package immediately after priming and inoculating.

The Wyeast 1388 performs best at a temperature of 65–75 °F (18–24 °C), the WLP500 at 65–70 °F (18–21 °C), the Wyeast 1762 at 65–75 °F (18–24 °C), and the WLP530 at 66–72 °F (19–22 °C). So regardless of your choice of yeast, you are safe if you keep both your fermentation and your conditioning temperature constant at around 68 °F (20 °C). You can start tasting the beer after about a month, but it will get much better after a conditioning rest of about half a year.

Silent Tripel

(5 gallons, extract only)

OG = 1.072–1.079 FG = 1.010–1.011
IBU = 30 SRM = 11 ABV = 7.9–8.5%

Ingredients

7.5 lbs. (3.4 kg) pale ale malt syrup (such as Edme Maris Otter, Coopers, Muntons or John Bull)
1 lb. (0.45 kg) amber malt syrup (such as Weyermann Munich)
0.75 lbs. (0.34 kg) plain dark malt extract (such as Alexander's, Briess, Coopers, Glen Brew, John Bull or Muntons)
0.63 lbs. (0.29 kg) table sugar (sucrose)
0.63 lbs. (0.29 kg) corn sugar (glucose)
4.33 AAU Hallertauer Magnum (bittering) (0.33 oz./9.4 g of 13% alpha acid)
4.33 AAU Tettnanger hops (bittering) (1.1 oz./31 g of 4% alpha acid)
0.5 oz. Hallertauer Mittelfrüh hops (flavor)
1 tsp. Irish moss
Wyeast 1388 (Belgian Strong Ale) or White Labs WLP500 (Trappist Ale) (primary fermentation)
Wyeast 1762 (Belgian Abbey II) or White Labs WLP530 (Abbey) (conditioning)
1 cup table or corn sugar (for priming)

Double Halo Ale

(5 gallons, extract only)

OG = 1.058–1.064 FG = 1.011–1.012
IBU = 20 SRM = 15 ABV = 6.0–6.5%

Ingredients

5.7 lbs. (2.6 kg) pale liquid malt extract (such as Weyermann Bavarian Pilsner)
1.8 lbs. (0.82 kg) plain dark malt syrup (such as Alexander's, Briess, Coopers, Glen Brew, John Bull or Muntons)
0.5 lbs. (0.23 kg) table sugar (sucrose)
0.5 lbs. (0.23 kg) corn sugar (glucose)
5.6 AAU Styrian Goldings hops (bittering) (0.8 oz./23 g of 7% alpha acid)
0.5 oz. (14 g) Saaz hops (flavor)
0.5 oz. (14 g) Tettnanger hops (aroma)
1 tsp. Irish moss
Wyeast 1388 (Belgian Strong Ale) or White Labs WLP500 (Trappist Ale) (primary fermentation)
Wyeast 1762 (Belgian Abbey II) or White Labs WLP530 (Abbey) (conditioning)
1 cup DME or corn sugar (for priming)

Step by Step

Mix the malt extracts with your hot brewing water in the kettle and bring the wort to a boil and add the bittering hops immediately. Boil for one hour. Add the bittering hops immediately and boil for one hour. Add the flavor hops and Irish moss about 15 minutes before shutdown. Add the aroma hops (for the Dubbel only) directly at shutdown. Then follow the all-grain instructions for cooling, fermenting, conditioning and packaging the brew.

fermented with laboratory-controlled yeast strains, often in modern computer-regulated brew houses and cellars. Historically, however, these ales have much in common with the varied old-style, open-fermentation methods practiced in the Middle Ages in all the Low Countries. Because of that brewing tradition, Trappist ales are much more varied in ingredients and processes than their prevailing reputation as simply strong, high-alcohol beers suggests. It is indeed true that the "big" Trappist ales may weigh in at an alcohol by volume (ABV) level as high as 12%, but it is equally true that some of these beers may be as "small" as 4% ABV. While the heftier Trappist ales clearly age better and thus give the style its signature reputation, the weaker ones are legitimate Trappist beers, too. In the monasteries, these are often brewed just for the daily consumption of the monks themselves and are not sold to the general public.

Throughout the Middle Ages, it was common for the brew monks to divide their beers into three grades according to strength. The heavy brews from the first runnings of the mash were called celia. They were often fortified with honey and reserved for the abbot and his noble friends. No doubt they were early versions of the modern strong triple (French) or tripel (Flemish) ales. Generally, though not always, tripels tend to be the paler brews. They are so named because they are generally made with up to three times the amount of malt used for the small beers.

The middle beers, called cervisia and perhaps more akin to the modern double or dubbel, were the brews for the regular rank-and-file monks. By analogy, dubbels are made with up to twice the amount of grain.

The monastery's small beers from the final runnings of the mash, called conventus, were often sold to the peasants and tradesmen or doled out for free to the poor. Now they have become the everyday beer for the working monks. The precise grain loadings for the different sub-styles, however, depend entirely on the preferences of the particular abbey. So a dubbel from one brewery may actually be more potent than a tripel from another.

Variations on a Trappist Theme

Many Trappist breweries, such as Chimay, are exceedingly secretive about their ingredients and procedures, while others do reveal a few details about they way they make their brews. What strikes me above all is the lack of uniformity in the specifications and methods. This also suggests that the origins of grains and hops for these ales are not all that crucial. The monks of Westvleteren use exclusively indigenous raw materials, but other Trappist breweries import theirs.

Some Trappist ales are made only with German hops (such as Tettnanger, Spalt or Perle), while others are given a mixture of hops from Bavaria (Hallertauer or Tettnanger), Bohemia (Saaz) and Slovenia (Styrian Goldings).

Trappist or abbey ale brewers usually add rock candy, sugar syrup or regular sugar to the brew kettle to increase the brew's amount of fermentables and thus alcohol. This has a similar effect on the modern brew as honey had on the medieval celia. Blond (or even white) sugars are often favored for tripels, while darker sugars are favored for dubbels for extra depth of flavor. The various sugar preparations used by Belgian brewers contain between 25 and 99% sucrose (better known as common table sugar). Sucrose is fully fermentable and thus keeps the beer's body surprisingly light in spite of its strength. The other major portion of the sugar is usually dextrose, which we know as corn sugar or glucose.

If there is one signature ingredient for these ales, though, it is the yeast. Just as you should ferment altbiers and Kölsch ales only with special alt and Kölsch yeasts, so should you ferment abbey brews only with yeasts explicitly designated as Belgian Trappist or abbey strains. All abbey ale specialist yeasts are bred for high alcohol tolerance; 12% is not unusual. They tend to throw rocky heads on top of the brew during fermentation and sink to the bottom (flocculate) only reluctantly afterwards. These yeasts contribute a good deal of esters to the brew, which however do not become overpowering because of the strong malty notes of Trappist ales. Rather, the esters add complexity and depth of flavor to the beers, especially after the brews have nicely mellowed out.

Some Trappist ales, such as Westmalle's, have a complex grain bill of four types of malt. Others, such as Orval's, have a simple grain bill of pale malt with only a small proportion of caramel malt added in. Several breweries use two types of Pils malt and a good dose of Munich malt for color and residual sweetness. Some monasteries, such as Chimay, keep their grain bill a secret.

At Westvleteren, the monks use only Belgian malt to make four different beers, all dark-brown in color with a relatively sweet and fruity finish. In this brewery, the Dubbel (with the green cap) is the weakest of the lot. With only 4% ABV, it is reserved just for the monks themselves. The Spéciale (red cap) contains 6.2% ABV, the Extra (blue cap), 8% ABV, and the Abbé (yellow cap), 11.5% ABV. The hops in Westvleteren beers are also all locally grown in Belgium. Instead of rock candy, the Westvleteren monks use caramelized sugar syrup to give the beers their dark color. They use regular table sugar to modulate the brew's alcoholic strength. The quantity of sugar is the only difference between these four beers. After fermentation, the brews mature in steel kegs for three weeks (wooden casks were used until 1964). The kegs are then emptied into vats, where the beers are primed with sugar and inoculated with fresh yeast for bottle conditioning. The brew is ready for consumption six months after packaging.

The brothers of Westmalle, who started brewing in 1836, use the Extra designation for their smallest brew,

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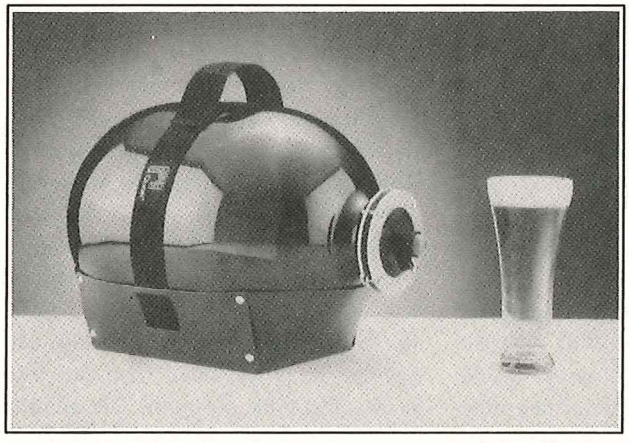
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which, at 4 to 5% ABV, is a bittersweet, amber-colored beer brewed only once a year. Their Dubbel, on the other hand, with about 6.5% ABV, is readily available for secular consumption as well. It is brownish-red, with a slightly sweet aroma, a bittersweet middle, and fairly hop-bitter aftertaste. Finally, the Westmalle Tripel is amber-colored, much like the Westmalle Extra, but it has an ABV of 9%. The brew's head is creamy white. Its malty-fruity notes predominate when the beer is young. It ages well, but its maltiness mellows out so that the beer tastes increasingly bitter the longer it is kept.

The Trappist brothers in the Dutch Bierbrouwerij De Konigshoeven also brew four types of beer: La Trappe Blond at 6.5% ABV is golden-blond, malty, and fruity, while La Trappe Dubbel at the same ABV of 6.5% is dark-red and more hop-aromatic. La Trappe Tripel is a dark, fruity and bittersweet brew of 8% ABV. Then there is the La Trappe Quadrupel, with 10% ABV, brewed only once a year, and intended as a full-flavored, bitter winter warmer.

Brewhouse and Fermentation Processes

The Trappist mash is usually a simple one-step infusion process that tends to last for about 90 minutes. The sparge, too, tends to last for 90 minutes. In some breweries (at Orval, for instance), the wort is filtered before it reaches the kettle.

Boiling times for Trappist ales may be as long as four hours, but never shorter than 90 minutes. When rock candy or regular sugar is used, it is added at the end of the boil.

Some Trappist ales are fermented with pure yeast strains, others with a yeast blend. Some ales are made by the partigyle method and then blended; some are blended from young and old ales (as at Achel). (Parti-gyle is a technique in which different runnings from the same mash are fermented separately — usually a first strong, high-gravity wort and a second weak, low-gravity wort.)

Primary fermentation of a commercial Trappist ale may last for five to seven days at anywhere between 56–70 °F (15–21 °C), depending on the yeast strain in use. Some breweries pitch their yeast at about 77 °F (25 °C) and then pull the temperature down to the correct level a few hours later. After primary fermentation, some beers may be filtered and re-inoculated with fresh yeast for a secondary fermentation. This may last three to five weeks, generally at a temperature of 46–50 °F (8–10 °C). The secondary fermentation may also be carried out at a slightly higher temperature for a slightly shorter period: 56 °F (15 °C) for two to three weeks. Orval is the only Trappist brewery to dry hop their beer. They add Hallertauer and Styrian Goldings at the secondary fermentation stage.

Trappist beers are typically bottle-conditioned ales, which is ideal for homebrewers who usually prime their (unfiltered) beer before packaging anyway. The priming sugar may be rock candy, white cane or beet sugar, or corn sugar. If filtration was used, fresh yeast must be added at this point, to start a third fermentation, in the bottle.

Bottle conditioning generally takes three weeks, at a temperature of about 70 °F (21 °C), though some breweries bottle condition at a temperature as high as 82 °F (28 °C) to accelerate the process. Because conditioned beers contain yeast sediments, the monks do not like to sell them in kegs — or if so, only to local pubs. Bottle conditioning may take five weeks, if the temperature in the cooler is kept to 56 °F (15 °C). At this point, the beer has spent two to three months in the cellar and is now drinkable. But it will improve greatly, if it is allowed to rest for another three to four months, in a dark place, at a temperature between 46–56 °F (10–15 °C). This is also the temperature at which a Trappist/abbey ale should be served — best in a majestic chalice or snifter-like goblet. ■

Horst Dornbusch is BYO's Style Profile columnist. On page 21 of this issue, he discusses braggot.

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Story by Chris Colby

From: "stuck" <stuck@noferm.org>
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To: <byo@byo.com>
Subject: high FG

Help! I brewed a stout three days ago and now it's stopped fermenting at a specific gravity of 1.023. The recipe said the FG should be 1.012. What can I do?
— Stuck

The email message above is fake, but many letters similar to this come to BYO or appear on brewing boards on the Internet all the time. A beer finishing too high is one of the most common complaints of homebrewers, especially those new to the hobby. A beer that stops fermenting at a higher than expected gravity will taste sweeter than it was meant to be. Also, the unfermented sugars in the beer will render it more susceptible to contamination. In this article, I'll explain what to do if your beer will not ferment down to an appropriate final gravity and — more importantly — how to prevent this from happening the next time you brew.

How low should it go?

In order to determine if your beer finished too high, you need to know how to estimate a reasonable final gravity. The most straightforward way to do this is to use the following equation:

$$FG_{target} = (1 - A_{yeast})OG$$

In the equation, FG_{target} is the final specific gravity you hope to reach. The original specific gravity of your beer is OG. Both of these values are given in "gravity points," the decimal portion of specific gravity. For example, if you brewed a English bitter with a starting gravity of 1.043, the OG would equal 43. In the equation, A_{yeast} is the attenuation value of your yeast strain, expressed as a number between zero and one. For example, if your yeast has an attenuation of 81%, A_{yeast} would equal 0.81. You can find the attenuation range of Wyeast and White Labs yeast strains on their websites (www.wyeastlab.com and www.whitelabs.com). Pick a value from the middle of the range for use in the equation. Many homebrew yeast strains have an attenuation value around 75%. Thus, for a quick estimate, you can simply divide your original gravity by four.

The number you get from this equation is the final gravity you should reach, assuming that a few things are true. The degree of attenuation you achieve depends on the size and health of your yeast population and the composition of your wort.

If you do not pitch enough yeast, your beer is less likely to reach a reasonable final gravity than if you pitched adequately. Likewise, you need to pitch your yeast to adequately aerated wort and this wort needs to have sufficient nutrients for it to ferment properly. (See the September 2003 issue for more information on how to ensure you pitch enough yeast and the October 2000 issue for information on aeration.) Most all-malt worts contain a more than adequate amount of nutrients for your yeast. If your wort has a substantial amount of adjunct, you may want to consider adding ¼–½ tsp. of yeast nutrients per 5 gallons (19 L) of wort.

Some worts are more fermentable than others. Highly fermentable worts contain mostly fermentable sugars and a low percentage of non-fermentable sugars and other carbohydrates. Less fermentable worts contain a higher percentage of non-fermentable carbohydrates. Worts made entirely from pale malts or pale malts with adjuncts are typically very fermentable. On the other hand, worts made with lots of specialty grains tend to be less fermentable.

All-grain brewers can additionally influence their wort fermentability by manipulating two key mash variables — temperature and thickness. Thin mashes (around 1.5 quarts of water or more per pound of grain) that rest at the low end of the saccharification temperature range (148–152 °F/64–67 °C) result in a highly fermentable wort. Conversely, thick mashes (around 1 qt. water or less per lb. of grain) that rest at the high end of the saccharification temperature range (156–158 °F/69–70 °C) produce less fermentable worts. Finally, malt extracts vary in their fermentability. So basically, using proper yeast handling techniques will help you ferment all (or most) of the usable sugars in your wort, leaving only the unfermentable portion.

If your actual final gravity is within 20% of your calculated value, you probably don't need to do anything to your beer. If your beer contains more than 1 pound (0.45 kg) of specialty grains per 5 gallons (19 L), or is made from malt extract, your beer may finish higher than expected and still be fine. If your final gravity is higher than this, however, there are a couple different options to bring it down. Remember, however, that a normal-strength ale should ferment completely in 5–7 days, but a sluggish fermentation may take twice this long. Lagers will take roughly one day per every degree Plato (four specific gravity points) of wort. Thus, don't start worrying about the final gravity (FG) of your beer until it has stopped fermenting.

Little or no fermentation

If your beer has attenuated very little — moved less than one-third of the way from the OG to the target FG and stopped — something has gone seriously wrong with your fermentation. You will need to act quickly if you want to rescue your batch.

If your fermenter is too cold, bring it to a warmer location — optimally a

temperature at the upper end of your yeast's fermentation range. Stir the yeast sediment to rouse it and this may revive the fermentation.

If the temperature is in a reasonable range, you should aerate the wort thoroughly and pitch a full dose of fresh yeast. Making a yeast starter would be a good idea, but it would take too much time. Ideally, you should add more yeast the day you discover your fermentation has stopped prematurely. The best approach is to take two packages of dried yeast, rehydrate the yeast (following manufacturers instructions) and pitch as soon as possible. You may also want to add ½ tsp. yeast nutrient to your wort.

Some fermentation

If your wort stops fermenting between one third and two thirds of the way between your OG and target FG, your approach to restarting the fermentation is similar to that given above. Check the fermentation temperature and repitch with fresh yeast. You can use dried yeast or, if you are confident in your cleaning and sanitation, you may want to take the time to make a yeast starter for this purpose. A 1–2 quart (~1-2 L) starter should do the trick for 5 gallons (19 L) of average strength ale. Do not, however, aerate the wort. Aerating wort that has partially fermented will lead to diacetyl in your finished beer. Diacetyl lends a buttery or butterscotch flavor and aroma to beer. You may also want to add ¼ tsp. yeast nutrient to either the yeast starter or the main wort.

Mostly fermented

If your wort ferments two-thirds of the way or more towards your target FG, but stops 20% or more short of it, fixing it should be relatively easy. And, unlike with a beer that fermented much less before quitting, your final beer has a much better chance of turning out respectable. If you just need to shave a few points off your beer, take the time to make a mini yeast starter, around ½ quart (~0.5 L) in volume. Add ⅛ tsp. or less of yeast nutrients to the starter and aerate the starter well. (Don't aerate your main wort.) Pitch about 1 tsp. of yeast solids — not a whole smack pack or test tube — to the mini starter. Let the mini starter reach high kraeusen then pitch the whole thing into your beer. If adding a small starter fails to move the specific gravity of your wort lower, then it is likely that unfermentable sugars are keeping your final gravity high.

Bring on the Beano

There is one final option to lowering your final gravity. If your final gravity is too high due to low wort fermentability, you can degrade some of the unfermentable carbohydrates into simpler sugars by adding the enzyme alpha-aminoglucosidase. The simple sugars can then be fermented by the yeast.

The enzyme alpha-aminoglucosidase degrades complex carbohydrates into simpler sugars. The product Beano, used by people who have

Attenuation Facts

Will the real degree of fermentation please stand up?

Attenuation expresses the reduction in the concentration of wort sugars during the course of fermentation. It is typically reported as a percentage.

There are actually two measures of attenuation used by brewers. The most common is apparent attenuation. Apparent attenuation is equal to the original wort density minus the final density divided by the original wort density. A hydrometer is used to measure wort density (beer gravity) for both the original and final measurements. This is easy to understand if we turn it into an equation: AA = (OG-FG)/OG. For example, a beer with an OG of 12 °Plato (SG 1.048) and a FG of 3 °Plato (SG 1.012) has an apparent attenuation of 0.75 or 75%. Apparent attenuation is also called apparent degree of fermentation, or ADF.

The term "apparent degree of fermentation" implies that there must also be a real degree of fermentation, or RDF. And, in fact, there is. The real degree of fermentation takes into account the fact that alcohol has a lower specific gravity than water. When you take a final gravity reading by with a hydrometer, its buoyancy is affected by the amount of sugar in solution (as it was when you took the original gravity). However, your hydrometer reading is also affected by the presence of alcohol (which was not present when you took your original gravity reading). Alcohol in the beer makes the hydrometer float lower than it would than if the beer did not contain alcohol. To correct for this, RDF is measured by distilling the beer to remove the alcohol, replacing the volume of alcohol removed with an equal volume of water and taking a hydrometer reading.

Very few homebrewers or small-scale commercial brewers have the tools required to determine real extract. (In the US, you need a permit to do this as distilling alcohol solutions is illegal.) Instead, they rely on apparent extract and ADF for routine monitoring of their brews. The various attenuations mentioned in this article are all apparent attenuations.

Equations and Example

Let's say you brewed an extract pale ale with an OG of 1.048 that finished at 1.016, though it should have finished at 1.012. Follow the steps below to determine how to alter you recipe to make a more fermentable wort next time you brew this beer.

1. Calculate actual attenuation

$$A_{achieved} = 1 - [\frac{FG_{actual}}{OG_{actual}}]$$

In our example, A = 1 - (16/48) = 0.66

2. Calculate your partial OG

$$OG_{partial} = \frac{FG_{target}}{[1 - A_{achieved}]}$$

In our example, OG = 12/(1 - 0.66) = 36

3. Calculate the amount of malt extract to add

$$LME_{pounds} = \frac{[OG_{partial} \times Volume_{gallons}]}{37}$$

If you are using liquid malt extract, LME = [36*5]/37 = 4.86 lbs. LME

problems digesting beans, contains this enzyme. Thus, adding Beano to your wort can lower the final gravity. To try this, add ¼–½ tablet of Beano to your beer and wait for a couple of days. If the specific gravity is still too high, add another ¼–½ tablet. Using Beano should be a last resort as it can lead to unpredictable results. Adding too much Beano to your beer can lead to an overly dry beer, so go slowly when using this approach. Unless you are trying to make a very dry beer, you are much better off using other methods to hit your desired final gravity.

More fermentable extract beers

So let's say you take care of your yeast every time you brew. You pitch from a starter and give your army of yeast cells a nice home in your aerated, temperature-controlled wort, but your final gravity is still consistently too high. If this is the case, you need a way to lower the fermentability of your wort. All-grain brewers have the option

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of tweaking their mash variables, but what about extract brewers? What if your base extract is not as fermentable as you would like it to be? Fortunately, there's a simple way to alter the fermentability of any wort. This method works with all-grain worts, but is especially useful to extract brewers who have fewer options to alter their wort fermentability.

A simple way to increase wort fermentability is to swap some of your less fermentable ingredients for more fermentable ingredients. For extract brewers, you can leave out some of the malt extract in a recipe and add some corn sugar to make up for it. Corn sugar is entirely fermentable and adding it in conjunction with your malt extract will increase the fermentability of your wort. Corn sugar is added to the boil just as you add malt extract.

To calculate how much corn sugar to add, check your brewing notebook for the original and final gravity of a beer you'd like to brew again, but

If you are using dried malt extract, use this formula

$$DME_{pounds} = \frac{[OG_{partial} \times Volume_{gallons}]}{45}$$

4. Calculate the amount of sugar to add

$$SUGAR_{pounds} = \frac{[(OG_{target} - OG_{partial}) \times Volume_{gallons}]}{37}$$

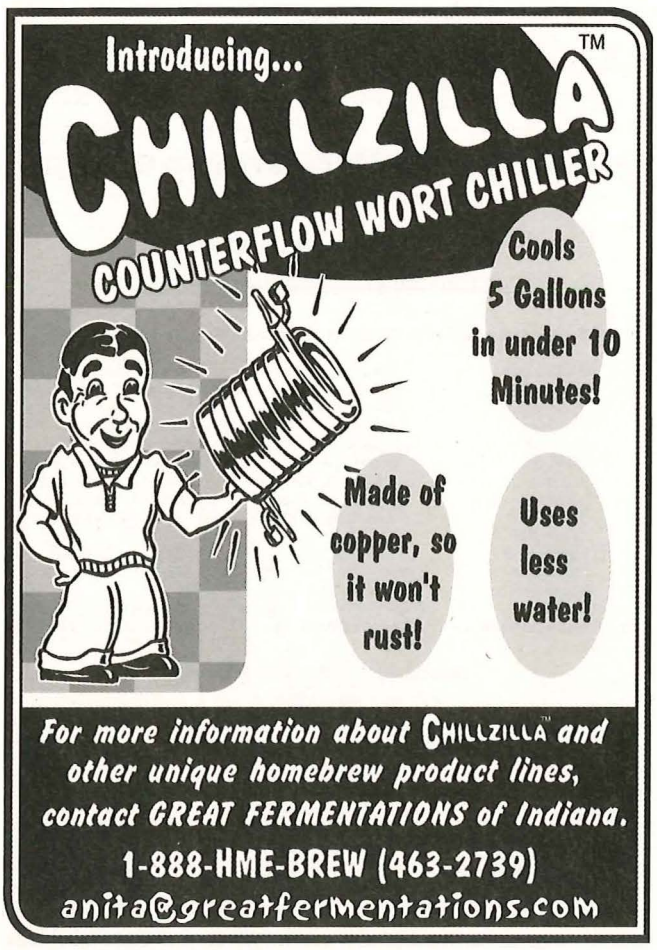
Finally, to get to an OG of 1.048, we'd need (S = [(48-36)*5]/37 =) 1.6 lbs. of corn sugar.

5. Specialty grains

If there are specialty grains in your extract recipe, subtract the amount of specialty grains from your liquid malt extract (LME). For example, if you had 0.5 lbs. crystal malt in the recipe, keep this in the formulation and subtract the half pound from the total amount of LME. (For a slightly more accurate swap, subtract the amount of specialty grains multiplied by 0.95 from the amount of LME. In our case, you'd subtract 0.48 lbs of LME to "make room" for the specialty grains, leaving 4.38 lbs. LME) For dried malt extract, subtract the amount of specialty grains multiplied by 0.77. If you end up adding more than 10% corn sugar to your batch, you may want to add 1/2 tsp. yeast nutrient.

6. Brewing procedure

Brew your beer as you did before. Corn sugar can be added at almost any time during the boil, from the beginning to 15 minutes before the end.





achieve a lower final gravity. Then, you need to calculate your actual attenuation ($A_{acheived}$) from the final gravity ($FG_{previous}$) and original gravity ($OG_{previous}$) of your previous beer. (See the sidebar for the equations. Use "gravity points" for your calculations.) Next, pick a final gravity (FG_{target}) you would like to achieve and figure out the original gravity ($OG_{partial}$) that would yield this final gravity based on your actual attenuation figure. Then calculate the amount of malt extract required to reach this partial OG. Finally, calculate the amount of corn sugar needed to reach your target original gravity (OG_{target}) for the beer.

Now, brew your beer as usual with this new formulation and you should hit your chosen final gravity target. If you end up adding more than 10% corn sugar to your beer, you should add some yeast nutrients (¼–½ tsp. should do the trick). Note that this method only works if you've taken care of your yeast. The highly fermentable wort can remain unattenuated if there are not enough healthy yeast to ferment it.

Won't it be "cidery?"

Some homebrewers may worry that adding sugar will make their beer taste "cidery." Many old homebrewing books, in fact, recommend replacing any sugar with malt extract for this reason. In reality, however, corn sugar doesn't add cidery flavors to beer. This was a just a myth. If you use fresh ingredients and good brewing techniques, a little sugar in your beer won't cause off flavors.

Applications

There are a couple different reasons why you might want to add sugar to a batch of your beer. First, as discussed, it can help you if your beers are not fermenting down to a reasonable final gravity. Secondly, if you like your beers on the dry side, you can add some sugar to your recipe formulation and get a drier, less sweet, beer. Belgian brewers have long used this approach to lower the body of their big beers. A well-brewed Belgian Tripel is a strong beer, but one that doesn't taste sweet. A dose of sugar — often in the form of Belgian candi sugar or rock sugar — adds fermentables to the wort, but doesn't contribute much to the body. (See Horst Dornbusch's article on Trappist ales — on page 52 — for recipes that use this approach to manipulating wort fermentability.)

If overly high final gravities are a consistent problem for you, your first response should be to pitch more yeast. If pitching an adequate amount of yeast and paying attention to aeration and yeast nutrition doesn't work, then try lowering your wort fermentability by adding sugar. ■

Chris Colby, Editor of BYO and WineMaker magazines, likes his beers as he likes his humor — dry and bitter. *See his feature "The Texas Two-Step Method" on page 38.*

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Motorized Mill

Crushing your grain has never been easier

story and photos by Thom Cannell

Although you can make a good pale ale, porter or wheat beer with an all-extract kit, most brewers use crushed grain in their brewing. Inevitably the urge to add "just a touch of something special" motivates brewers to steep specialty grains or even perform mini-mashes. That requires grain — malted, roasted, toasted, even raw.

Most homebrew shops, local and internet-based, will supply pre-crushed grain. However, like every agricultural product from peanuts to pomegranate, freshness is key. Recently crushed grain is more fresh.

So, you ask, *how* is grain crushed? The answer is, properly milled grain is squeezed, fractured and pressed into pieces by grooved plates (corn mill or burr-type mill) or rollers with a textured finish. Well crushed grain should have large pieces (halves and quarter kernels) with minimal amounts of flour and bits (slivers of grain).

According to Briess Malting, a good mill will separate the grain husk from the endosperm, leaving the husk relatively intact, then break the endosperm into several pieces instead of shattering it into small slivers and flour. An ideal distribution of size would have 80+% of the grain particles sized to a "14–30 mesh screen." This means that if you dump your crushed grain into an ordinary wire kitchen colander, which has 14–30 holes per inch, 80% of the crushed grain should remain after some vigorous shaking. This is a good way to check both your own crush and your homebrew store's.

"Excessive finer endosperm and husk particles create a compound challenge facing many small-scale breweries — lautering time," says Briess Malting. In other words, too many fine particles gum up the works, slowing down the lauter and increasing leaching time for tannins and other harsh or astringent flavor notes.

Commercial brewers, many microbrewers and maltsters have large mills that use multiple pairs of rollers to crush grain. After each step the grain can be run through a sieve that separates smaller particles to prevent them from being crushed again. Home mills typically have one pair of rollers, though some use three rollers.

Why not just purchase grain pre-crushed from your local home brew shop? Three good reasons are: uncrushed grain is usually cheaper, crushing just before mashing provides maximum freshness and you can adjust crush for maximum yield and lautering (filtering the wort through the grain bed) in your system.

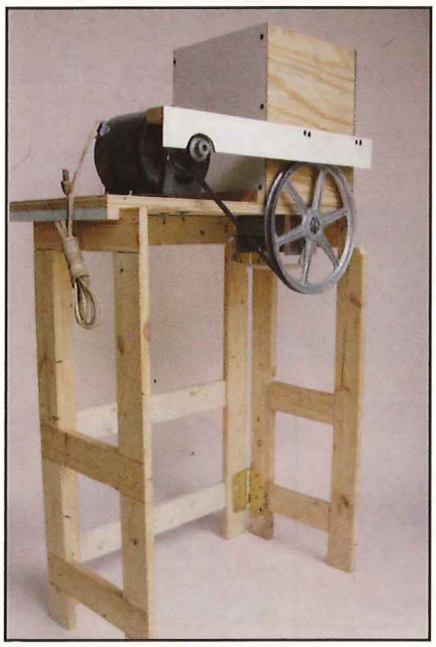
PARTS LIST

Sheave, 1/2" diameter x 1.5"	$3.50
Sheave 1/2" x 10"	$15.00
1/2" x 44" L3 belt	$7.00
Plywood for base	$4.00
Plywood/MDF for grain hopper	$2.00
Masonite for grain hopper	$2.00
Bolts for grain mill	$1.50
Screws for hopper and motor mount	$2.25
Miscellaneous nails, screws, tape, glue	$2.00

How to and why to

A common drill motor can motorize most mills. The problem with this approach is, while it works, it simply works too fast. Optimum roller speed for small homebrew mills is 150–200 rpm. Drills and most AC motors run at 1,750 rpm (U.S. 60 cycle AC.) The answer is to use pulleys and belts or an expensive gear reduction motor to run your mill more slowly.

Motors are ubiquitous. Cruise any neighborhood for a couple of weeks and you'll undoubtedly find a salvageable ⅓ horsepower motor from a furnace, washer, dryer, dishwasher — the list is endless. I have at least three! A couple of pulleys and



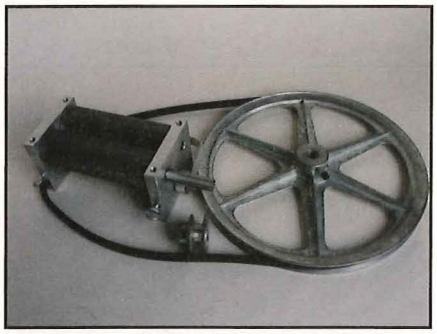
Motorizing a mill is a good project for brewers who crush their own.



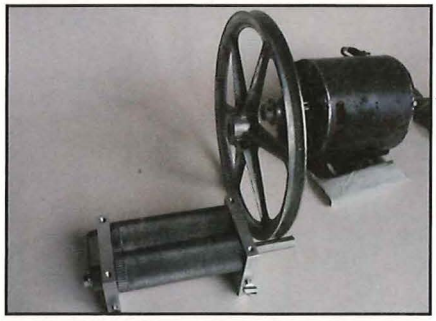
The pulley system slows the motor to an optimum crushing speed.



Most AC motors run at 1,750 rpm. The sheaves reduce the rotations on a mill.



Sheaves and belts like these make attaching a motor to your mill simple.



Salvage a ⅓ horsepower motor to power your malt mill.

you're almost there — but the trick is in the details.

If you're starting from scratch, you'll need to mount your new mill onto a supportive structure that will hold the mill and motor, construct a grain hopper of suitable capacity, and add pulleys and a belt. If you've been running your mill by hand or drill, we'll show you how to add a proper motor.

Most mills can be mounted above or below their supporting platform; many manufacturers recommend positioning the mill below its support. This makes mounting the grain hopper easy, but slightly increases the complexity of fitting the large driven sheave. (Sheave is the correct terminology for what most of us call a pulley.)

Hand driven mills can be mounted to a plank and drop the crush directly into a bucket. A motorized or hand-driven mill can be mounted on a larger plank clamped to a table, with a bucket below the mill to collect crushed grain. Or you may want to create a stand-alone grinding station. That's the option I chose — a simple stand that supports the mill and motor, with a bucket below.

If you already have a mill, you'll have only a few steps to follow. First determine the speed of your motor. A few are slower than 1,750 rpm. Assuming your motor is 1,750 rpm, you need to calculate the correct input sheave diameter and driven wheel diameter. (See the following formula). Most of you will end up with a ½" (13 mm) x 1.5" (40 mm) drive sheave and a ½" x 10" (250 mm) driven sheave. Adaptors to increase ⅜" drive shafts to ½" are available so don't give up because your mill came with a smaller input shaft.

To insure the slowest possible speed, I used a 1.5" input and a 10" driven sheave. Instead of the "proper" 4L V-belt (½" x 5/16") I used a thinner 3L belt (⅜" x 13/32".) Because the thinner belt rides lower in the pulley, I get a smaller effective drive of 1.05", and the

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driven sheave is relatively unchanged at an apparent driven diameter of 9.55". The result is that my mill runs at approximately 185–200 rpm.

The best way to calculate the correct drive and driven sheave diameters is to use charts published in Grainger and other industrial supply catalogs (www.grainger.com/Grainger/wwg/catalog), or this online calculator: www.csgnetwork.com/pulleybeltcalc.html.

Step by step to a proper malt mill

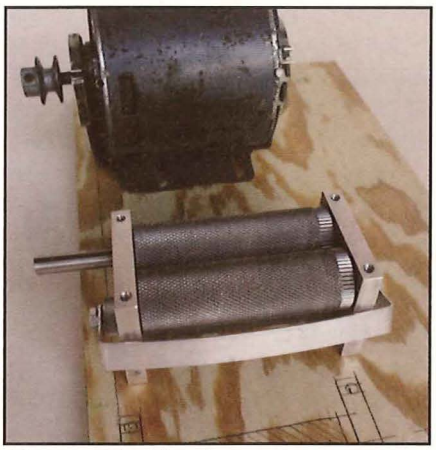
Step one: Make a support stand (if desired). Some of you will prefer to clamp the structure to a stout table (the complete assembly weighs approximately 40 lbs. or 18 kg.) I made a folding stand, an open "U" shape that sits tall enough to accommodate most buckets underneath the mill discharge. The stand has three "H" legs joined with hinges. To the under side of the mill platform I added 1" x 1" (25 mm x 25 mm) cleats. The completed "U" support wraps tightly against the cleats and the shorter legs are clamped to end cleats for extra rigidity.

Step two: Mount mill to a support structure. I made mine of plywood, ¾" x 12" x 24" (20 mm x 305 mm x 610 mm) to allow room to mount the motor and hopper.

Step three: Cut a rectangle in the support base to pass grain to the mill. Mine is offset 1" (25 mm) from the side and measures 4.5" x 1.5" (120 mm x 40 mm.)

Step four: Mount the mill. I can't give you locations; every mill is different. Drill larger holes than necessary to allow for adjustment. For my CrankandStein mill, I drilled 5/16" (8 mm) holes for ¼" (6 mm) bolts. Use flat head bolts and washers to allow for mill adjustment. (I didn't use them initially and encountered some binding of the rollers until I changed to flat head.)

Step five: Build a grain hopper. I used dimensions similar to the polyethylene



After you decide what motor you are going to use, mount it and your mill.



The grain hopper is easily assembled with plywood and masonite.

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container I use to haul up to 14 pounds (7 kg) of grain — that's the maximum capacity of my mash tun. The hopper is 10" x 12" (250 mm x 300 mm) tall with 45° angles to funnel grain to the mill.

I first cut ¾" (20 mm) plywood to size for sides, then two end pieces of thin masonite. To form the 45° angles was simple. I found the center of each sidepiece, measured ¾" (20 mm) to each side of the center to form a 1.5" (40 mm) throat similar to the opening in the support base. Adding ½" x ½" (13 mm x 13 mm) cleats (supportive wooden blocks) on a 45° angle took moments. They're screwed to the plywood and trimmed flush.

Finally I screwed both masonite ends to one side and hot glued both 6" x 8 ¾" pieces of masonite to the cleats. Then I screwed on the other side. This created a box with sloping sides that directs the grain into the mill. (It's not perfect, almost 4" of floor remains exposed. I can live with that, or add another piece to complete the funnel.)

You'll want to secure the hopper to the base board in some manner once you're done with construction and have aligned all the pieces. I made mine removable by permanently attaching wooden blocks to two sides of the hopper and screwing those blocks to the base platform. When I need to clean or modify the hopper or mill I can conveniently remove the screws in seconds.

Step six: Attach the large driven sheave to the grain mill and the smaller sheave to the motor. Line them up accurately and secure the motor to the base plate. Most motors already have a carriage, if not they are available. Be sure to cut mounting slots, not holes, in the base so you can adjust belt tension as well as easily fit the belt.

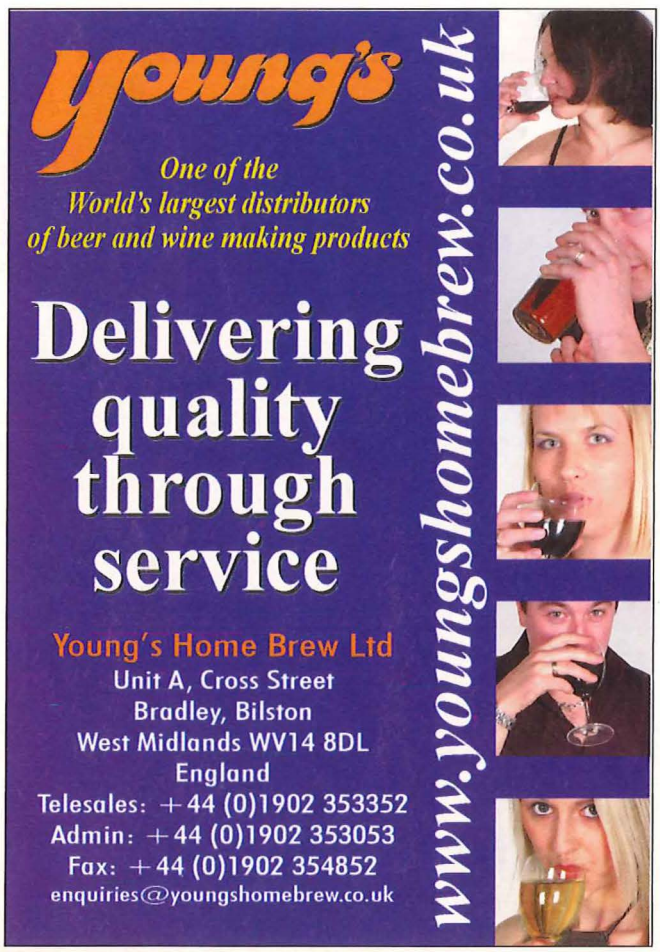
Step seven: Measure the belt length. The easiest way to measure is to use a cloth measuring tape. My belt is 44" (117.6 cm) long.

Step eight: Attach the belt and apply tension to the motor. Do not make the belt overly tight; the belt must be able to slip should the mill's rollers get jammed. My mill requires a clockwise rotation; the motor is mounted to provide this rotation. Check your motor's rotation and mill's requirement.

Step nine: Make a belt guard. Do not neglect this step. If your finger gets caught between the belt and sheave you are quite likely to suffer an amputation. I made a belt guard out of scrap masonite 2½" x 20" and scrap ¾" x 1½" board. It is basically an "L" shape and attaches to the grain hopper with screws. The 2½" lip extends over the driven wheel and the drive sheave.

With all construction completed, disassemble the mechanical parts and seal, then paint or varnish the wooden surfaces to protect them. Reassemble, take a picture and send it to *BYO* to share! (Send us a beer, too, while you're at it!) ■

Thom Cannell writes the "Projects" column in every issue of BYO.





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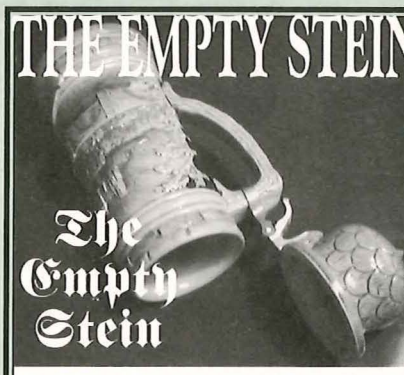
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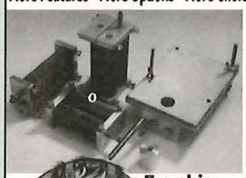
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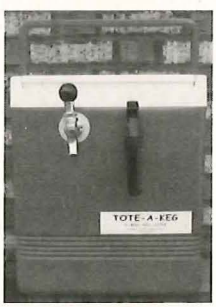
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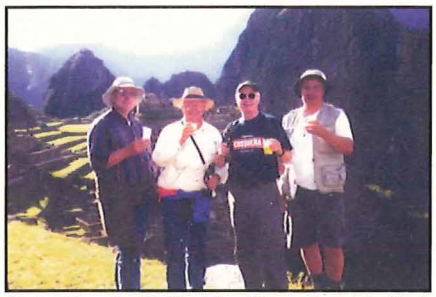
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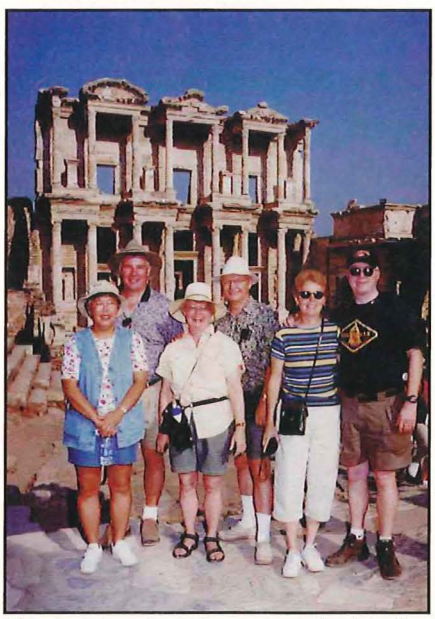
Inca Pale Ale

IPA for Machu Picchu

by Bob Haechrel and Randy Stewart



Bob Haechrel, Randy Stewart and their tasters, Vic and Bill, enjoy an Inca Pale Ale 8,700 feet above sea level at Machu Picchu.



The traveling homebrewers make location specific brews. They brewed another IPA (Istanbul Pale Ale) for their trip to Turkey.



This photo, taken on the Great Wall of China, was found in our January 2001 archives. "Great Wall Ale" was the brew for this trip.

Machu Picchu is an ancient Inca ruin located high in the Peruvian Andes (elevation 8,700 feet). It's a perfect place to enjoy a brew after an exhilarating day of exploration. We have created several special homebrews to drink at specific sites around the world (see "Great Wall Ale," in *Pot Shots*, *BYO* January 2001). This summer both of us brewed a lightly colored and well-hopped brew called IPA (Inca Pale Ale) to take on our tour of Peru and Bolivia. The day at Machu Picchu was hot and involved several hours of hiking and climbing amidst the ruins. After exploring the spectacular ruins from top to bottom, the time for the "special" event had arrived. (Our wives probably refer to it as the "silly" event.) This was an extraordinary occasion at an incredible site. We'd bet that it was the first homebrew opened, poured and consumed at Machu Picchu since Incas drank chicha (their homemade corn beer) 500 years ago. It normally would have been time for a "tall cool one," but what we had was our special Inca Pale Ale, warm and well shaken. We opened the beers with great anxiety, expecting a shower of foam. Fortunately, the onlooking llamas and tourists were not treated to an eruption. After our two tasters, Vic and Bill, did their duty, we shared the brews with wives and friends. The final golden drops were poured to the ground. This last act was done with the enthusiastic approval of a local Peruvian who offered his congratulations for honoring the ancient Inca custom of returning a portion of the beverage back to earth.

"We'd bet it was the first homebrew opened, poured and consumed at Machu Picchu since Incas drank chicha 500 years ago."

Several days later while visiting an Inca burial site, our tour guide explained the significance of the four steps leading up to the temple. We were told they represented water, earth, air and fire. Moments later, our fellow traveler and official taster Vic, wryly gave us an alternative explanation. He speculated that the four steps represented water, grain, hops and yeast.

Meanwhile back at home in The Dalles, Oregon Phil, our "official taster" at The Great Wall, was garden-sitting for Bob. His duty this time was to taste the Inca Ale at home (elevation 500 feet), cold and in a frosty glass. We are all still in the process of investigating the effects of temperature and altitude, but we all agree it was a fine brew.

Taking homebrew abroad entails a certain amount of uncertainty at the airports. We wonder if we are going to be doing some fast talking to get the brew past security or if we will be bellying up to the x-ray machine, opening and consuming the brew to authenticate it. Thus far, we have been trouble-free at every airport of our world travels. Not that everything always comes off without a hitch though. Two years ago we took another IPA, Istanbul Pale Ale, to Turkey, but did not get a chance to consume it because we inadvertently left the beer in the back seat of a taxi. Beer in Turkey seemed to be limited to Efes, a good Pilsner brew named for the city of Ephesus. It has been fun imagining the lucky driver sampling our darker, richer ale.

We plan to continue our quest to combine homebrewing and traveling. We are currently exploring possibilities for an ale for a trip to the Netherlands — Wooden Shoe Ale perhaps. Our trip motto could be, "Wooden shoe rather have a homebrew?" ■

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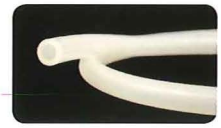


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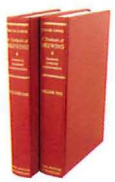
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