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MARCH-APRIL 2002, VOL.8, NO.2

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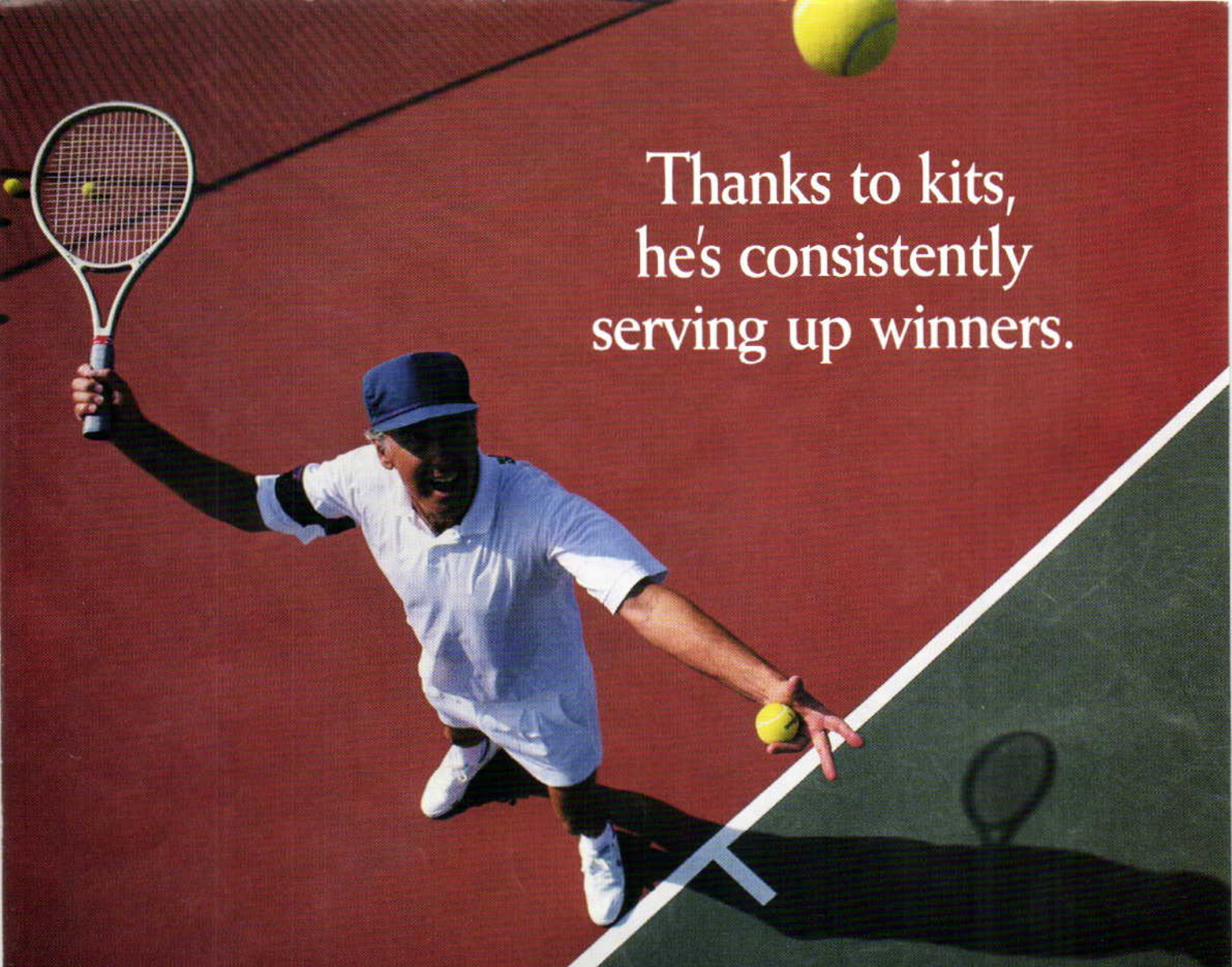
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Thanks to kits,
he's consistently
serving up winners.

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

Richard Neill
"Weekend Telegraph" (April 99)

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

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

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

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

This man is a dedicated brewer. But he also loves to play tennis.

More and more his brewing was keeping him at home when he wanted to be out in the sun. Then he discovered Smugglers Special Premium Ale, Old Conkerwood Black Ale and Midas Touch Golden Ale - the Premium Gold range of brewkits from Muntons.

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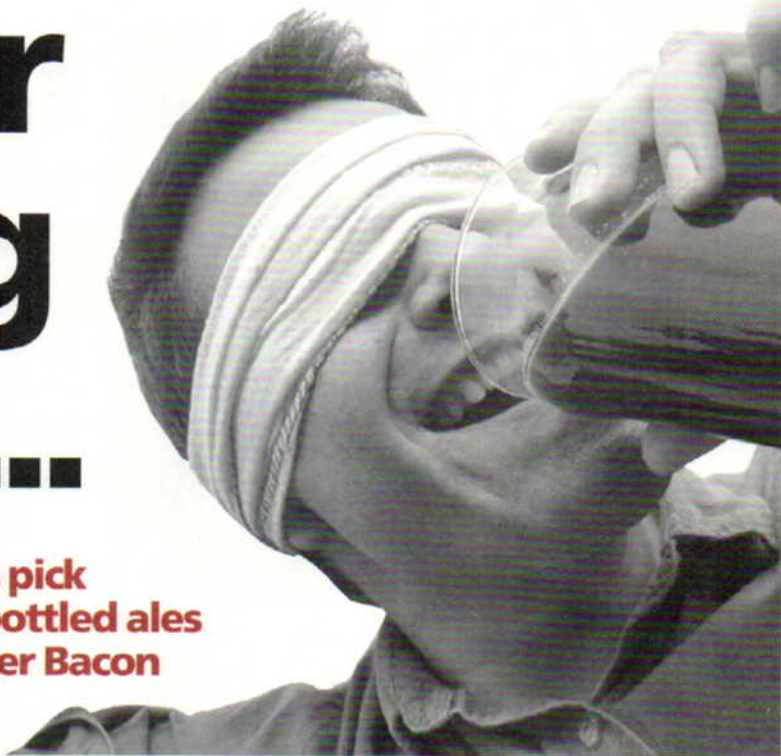
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CIRCLE 25 ON READER SERVICE CARD

Another blinding success...

Can it be true? Beer connoisseurs pick homebrew in preference to top bottled ales in a blind tasting. Beer lover Roger Bacon explains...



It's 22nd September 2001. The venue is The Floral Halls, Southport - a busy exhibition hall near Liverpool, England. Birthplace of the Beatles and now the scene for what I believe to be one of the most startling homebrew revelations in recent years.

The exhibition is being staged by the Home Beer and Winemakers Manufacturing Association - basically Europe's leading homebrew kits, ingredients and equipment manufacturers. On the Muntons stand an interesting scene is developing. It's a simple set up. There are three glasses of beer in line. In the left hand glass is a bottled beer called Fullers ESB - a famous beer with an ABV of 6.3%. The middle glass contains Marstons Pedigree Ale - one of the most popular independent brewery bottled beers in the UK with an ABV of 4.5%. The glass on the right is filled with Woodfordes Wherry - an award winning traditional English Bitter of 4.5% ABV (a beer so good it won the Camra Best Bitter award outright in 1996). The difference is that the Woodfordes Wherry

on show is a kit beer which has been carefully formulated to match the brewery original. Oh, and no-one knows which one is which because they are all in identical, unmarked glasses.

So there you have it. The scene is set. Volunteers are blindfolded and asked to state their preference.

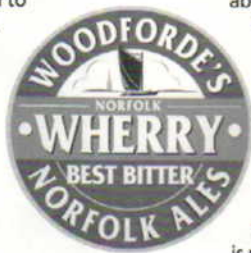
From where I was standing the response was incredible. Virtually every blindfolded taster I saw picked the Wherry Homebrew as their preferred choice. Remember, this beer is being pitched against two of the most famous and revered beers in England. When the Muntons guy revealed the choice the Wherry picking volunteers had made there was genuine shock on their faces. "Surely a kit beer cannot taste this good?" It was truly unbelievable.

Fascinated by this, after the show I asked Muntons if I could see the stats relating to the tasting. A staggering 61% had chosen Wherry in preference to

the other beers. Now I find this information so exciting and groundbreaking. What the statistics prove is that it really is possible to produce a beerkit beer that more than matches England's finest brewery beers. It actually beats them! I don't know

about you but I think that's fantastic. Of course not all kit beers are going to score so highly. Woodfordes Wherry is a very special beer but like all the kits in the Muntons stable, it is made with the finest 2 row barley malt and carefully hopped with the brewery's specified mix. The result is a truly fantastic beer which is so much like the beer made by the brewery it's virtually impossible to tell them apart.

Intrigued, I decided to have a go at making some Wherry myself. I bought a kit (it's not the cheapest) and followed the easy step-by-step instructions (basically sterilise all equipment, add water, contents of can and yeast, leave for a week and then bottle).



I know I keep on saying this but the beer was fantastic. It *did* taste like a top quality brewery beer but, of course, essentially that's what Wherry is - brewery-formulated ingredients which you use to make beer.

Wherry is a delicious, light coloured bitter with a distinctive hoppy aroma - a blinding beer that every beer lover will enjoy.

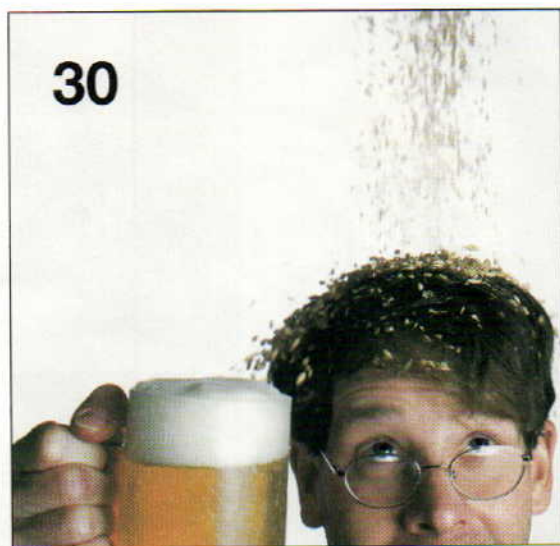
Ask for a kit at your local brew store and discover Wherry for yourself.



The Woodfordes range of brewery-formulated beerkits

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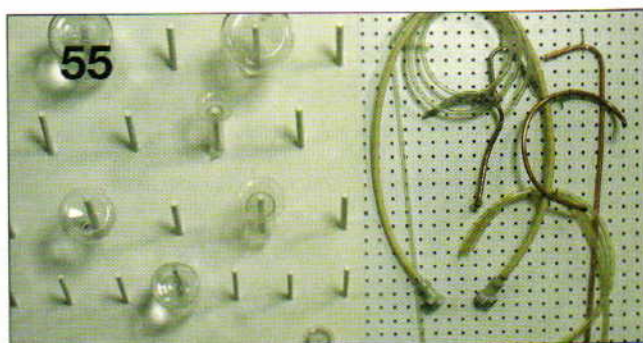
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THE VIKINGS AND SAXONS
BATTLED OVER LAND.

We beg to differ.



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Brew Your Own's 7th Annual Homebrew Label Contest

Send us your best homebrew labels and you could win some great brewing prizes from **BYO** advertisers. Enter as often as you like, but you can only win one prize. Winners will see their artwork featured in the July-August issue. Deadline to enter is April 15, 2002.

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Sparging Skepticism

I was really excited to see the Szamatulskis' barleywine recipe in the December 2001 issue of *BYO* ("Style Calendar"), especially since it contained an all-grain option that doesn't rely on sugar to boost the original gravity, as many other recipes do.

However, I was surprised to read that they call for only 5.5 gallons of sparge water. Most recipes that approach 20 pounds of grain would call for nearly 10 gallons of sparge water. Why the reduced volume of sparge water in this case? Is this an effort to make a manageable quantity of wort to boil?

Michael McCrary
Columbus, Ohio

Co-author Mark Szamatulski responds: "As the size of the mash increases, the amount of water needed for sparging does not necessarily increase in a linear manner. If using a tall lauter tun, the sparge water will spend more time in contact with the grain as the grain height increases, thus reducing the amount of sparge water required. If you're using a short, wide lauter tun, more sparge water may be needed. A safe rule of thumb is to sparge with 168° F water with a pH of 5.7, keeping 1/2 inch of water on top of the grain bed. Keep the grain bed level. Continue sparging until the specific gravity of the runoff drops to below 1.010 or the pH rises above 5.8. Sparging should take at least 45 minutes for an average beer and about 60 to 75 minutes for this barleywine."

(Don't) Feel the Burn

I was very pleased to find a safety-minded article in the December issue of *BYO* and have one additional comment regarding burn safety.

When checking the temperature of a surface with your hand, be sure to use the back of your hand instead of the front. There are two reasons for this. First, the skin on the back of your

hand is thinner and more sensitive to temperature. Second, the instinctive reaction to touching a hot surface is to curl the fingers and elbow. By using the back of the hand to check the temperature, the instinctive movement serves to pull your hand away from the heat rather than into it.

This piece of advice was given to me by a welding instructor years ago and has saved me from serious burns on many occasions.

Aric Datesman
via email

Author Chris Colby responds: "Good advice, Aric. Incidentally, this safeguard also applies when you are testing anything that may be electrified. If you touch an electrified surface with your palm, the current will directly stimulate your muscles and cause your fingers to grasp it tightly and you will be unable to let it go. (Of course, if I suspect that something is electrified, I'm going to go to my fridge, pour myself a homebrew, and call a professional electrician.)"

Home Burn Remedy

In regards to the burn safety article, I spilled some scalding hot liquid on my hand last year while transferring water. It immediately took off the skin. I ran cold water on the burn for approximately 20 minutes and covered the burn with gauze. My neighbor suggested that I cut open a vitamin E tablet and spread the ointment onto the burn. I did this for approximately two weeks and now, a year later, I have no scar. A doctor wouldn't be able to tell that anything happened to the area. Thought your readers might like to hear about this remedy.

Randy Drummer
Minneapolis, Minnesota

Thanks for the tip, Randy. Of course, it's important to stress that you should only apply any lotion, ointment, or medication after cooling the burned area completely. Applying salves or ointments on top of a recent burn can trap heat inside the burned area and increase the tissue damage associated with the burn.

Two Readers See the Light . . . and They Don't Like It

I was shocked by the recommendations in the article "Chill Out" (January-February 2002). In the story, author Glenn BurnSilver describes how to build a warming box with a cardboard box and a light bulb. Won't the fermenting wort become "skunked" in the light? Although the light from a light bulb doesn't contain as much of the harmful spectrum as sunlight does, it's still present.

Rama Roberts
San Jose, California

In your article, "Chill Out," you gave directions and an illustration for building a cardboard warming box. This box uses a garage mechanic's droplight for a heat source. Everything that I've read says to keep light away from your brew. Have I been going to great lengths to keep my beer in the dark needlessly?

Dave Chase
Saint Johnsbury, Vermont

Author Glenn BurnSilver responds: "According to lighting experts, the amount of ultraviolet (UV) light given off by the 'average' incandescent light bulb is fairly negligible. Exact numbers are, I am told, a tightly kept secret but UV light levels should not be high enough to turn beer skunky. Many homebrewers have used this method of temperature control successfully."

Of course, the main reason for the light bulb inside the warming box is to provide heat. To shield the carboy from the light, cover it with a blanket or T-shirt while it's inside the warming box. This would also help retain heat from the fermentation while shielding the brew from any possible light damage.

There are also light bulbs on the market that are encased in a rubber coating, often called 'Tough Skin,' 'Rhino Skin' or 'Ultra Guard.' The rubber coating allows the light and heat through, while effectively blocking all ultraviolet light. These are most often used in restaurant applications, so check with a lighting distributor if the local hardware store doesn't have them in stock." ■

brewer profile

The Long and Winding Road • John Weerts • Kansas City, Kansas



John enjoys a pint of ale in a glass from Molokai Brewing Company.

I was introduced to homebrewing in 1992 by a college buddy who was very enthusiastic about brewing, but didn't really know what he was doing. Within a few months, I joined the Kansas City Bier Meisters homebrew club. While a member of the Bier Meisters, I benefited from contact with many homebrewers — such as Alberta and Jackie Rager — who did know what they were doing. I held a number of offices within that organization over the years, from club newsletter editor to president. I also founded the Nancy I. Weerts award — named for my mother — for the best female brewer in our annual homebrew contest.

One of my favorite beer styles is rye beer. Rye has the reputation of causing lautering problems, but I've never experienced this. My former brew partner — Danial Turner — and I used to brew an annual holiday ale. This beer won 1st place in "specialty beers" twice and was once runner-up for "best of show." We brewed this beer in twenty-gallon batches using mashed grains, malt extract and six spices — lemon peel, orange peel, cinnamon, cardamom, coriander and ginger.

Dan and I have brewed for a number of special occasions. We even had our brewery and brewing process

deemed kosher by a rabbi so we could brew for two Jewish weddings. In a kosher beer, you cannot fine with gelatin since it is made from cow's hooves. I never use finings anyway, preferring instead to use a lot of Irish moss in the boil. Most introductory homebrewing books recommend using 3/4 teaspoon of Irish moss for a five-gallon batch of beer. I use close to double this amount. This makes for a lot of trub, but if the beer is stored cold it always turns out clear. Before adding the Irish moss to the kettle, I let it soak in a little bit of water.

In 1997, Danial and I took a 14-day brewpub tour starting in Cleveland, Ohio and ending when we returned to Kansas City. During the tour we stopped at brewpubs in Buffalo, Toronto, Boston and New York City. The highlight of our two-week trip was our tour of the RedHook brewery in Portsmouth, New Hampshire. We got an extended tour of the plant and were able to sample many incredible beers, one of the best being a cask-conditioned version of their ESB. We made the entire trip in an orange 1974 Buick LeSabre convertible. The parking tickets from Boston may still be in the glove box.

In 1999, I left the mainland — and my brewing equipment — behind and moved to Hawaii. While there I worked at the Molokai Brewing Company. Although my official title was restaurant manager, I also filled in as bartender, waiter and cook, as needed. The Molokai Brewing Company brewed a variety of beers, including an American pale ale, a dark mild and a wheat beer. The brewery's Scottish ale won best of show at the 2001 Kona Brewfest. Unfortunately, the brewery closed its doors in 2001. The three most important things in business are

location, location and location. In this respect, the Molokai Brewing Company was zero for three; it was just far enough off the beaten path that it didn't attract enough tourists to sustain itself. I enjoyed my time in Hawaii, although the beaches and humpback whales were a constant reminder that I wasn't in Kansas anymore.

I recently moved back to Kansas City and look forward to spending some serious quality time with my brewing equipment. Dorothy was right when she said, "There's no place like home." Of course, Dorothy probably doesn't enjoy hula dancers as much as I do.

reader tip



Cool Your Carboy

We have found a method for keeping your carboy cool that is relatively inexpensive and works great for ales. Place your carboy or bucket inside a 20-gallon trash can and fill it with water up to the level of the beer. If you use a strip thermometer on the carboy or bucket you can see the temperature through the water. I add blue ice packs several times a day to maintain fermenting temperature. We bought the Rubbermaid trash can that has a dolly attachment on the bottom. Once it's full it's easy to roll around and out of the way.

*Gerry and Colleen Muhl
Honolulu, Hawaii*

homebrew club

The Green Mountain Mashers • Burlington, Vermont



The logo of the Green Mountain Mashers, based in Burlington, Vermont.

I started my brewing career in the early 1990s and soon heard about a homebrew club that was a lot of fun and had lots of good brewers. I waited until I had brewed two or three times and then I went to my first meeting. The living room was full of men drinking beer and talking loudly, with great animation.

I learned two things before anyone even introduced themselves: First, there weren't many (or any) women doing this hobby; and second, people talking about beer can get pretty excited. Eleven years later, my first observation is not true anymore, but my second one is still very accurate. What I learned after introductions were made is that this is one of the nicest group of people that I could ever hope to share a hobby with. Luckily, that fact is still true today.

The Green Mountain Mashers were "organized" in 1989 and many original members still are active. The club meets on the first Monday of every month during the academic year and has a picnic in the summer. We have about 30 active members and about 50 members total on our list. Most meetings are at members' houses, with a core of 10 people hosting the majority of the meetings.

The club has made beer crawls, or "trub treks" as we've nicknamed these expeditions, throughout Vermont and to Montreal, Boston and Portland, Maine. Fodder for many good stories, some of which are actually true, the

various treks are legendary among club members. Our next one will take us back to Montreal in March. We're pretty sure that the statute of limitations has expired.

Each year the club sponsors its annual Green Mountain Homebrew Competition, an AHA-sanctioned event that is part of the New England "Homebrewer of the Year" circuit. We usually get 200–275 entries, work hard and have a good time, too. One brewer is crowned Vermont Homebrewer of the Year and receives some cheap prizes and a lot of glory. Greg Noonan, who's either our patron saint or godfather (we can never decide which), picks one brew out of the best of show round to brew at his legendary Vermont Pub and Brewery on Church Street.

Each fall the club puts on a special crush of apples at a local orchard. Each year the blend varies and can include more than ten different varieties, including some antique cider apples.

Each year we also challenge ourselves with the aptly named Masher Challenge. A style is selected — or created — by the winner for the club to brew the next year. This year the Green Mountain mashers are meeting Steve Lefebvre's challenge to brew a cherry wee heavy.

We have had various club brew sessions and have at times brewed in a 55-gallon oak barrel. Our most famous (or notorious) Masher is Bob Johnson of Magic Hat, a Burlington microbrewery that's well-known for its great beer and oddball marketing slogans. Once a year our club meets at Magic Hat for a tour and usually a sampling of special Magic hat beers.

Tim Cropley compiles the Barleycorn Press monthly for the club and distributes it via e-mail to the members. Hopefully, seeing his name in this national publication will encourage him to do it for one more year. The current president is Rich "Monk" Evans. Information about the club can be found at www.mashers.org. ■

—Anne Whyte

reader recipe

Mountain Brew

(5 gallons, extract with soda)
OG = 1.046 FG = 1.006 IBUs = 22

I have a recipe that is truly different and makes a good beer. It occurred to me that my favorite non-beer drink was Mountain Dew and that maybe I could combine the two. So I brewed a beer using Mountain Dew as a significant percentage of the fermentables. Yes, Mountain Dew ferments. The beer is a bit champagne-like; it tastes dry with just a little sweetness. It does not taste anything like Mountain Dew, though.

Jason Pavento
Marlboro, MA

Ingredients

- 2.3 gallons Mountain Dew (24 12-oz. cans)
- 2.5 lbs. Muntons Extra Light dried malt extract
- 4.5 AAU Northern Brewer hops (0.5 oz. of 9% alpha acid)
- 2.25 AAU Northern Brewer hops (0.25 oz. of 9% alpha acid)
- 1 tsp gypsum
- 1/2 tsp. Irish moss
- 1 packet Danstar Manchester dry yeast

Step by Step

Combine one gallon of water, the Mountain Dew, the dried malt extract and gypsum and bring to boil. Boil for 60 minutes. Add Northern Brewer hops when there is 45 minutes left. Add 0.25 oz. Northern Brewer hops and Irish moss at 15 minutes left. Remove from heat, cool and pitch yeast. Ferment at about 68° F for one week. Rack to secondary for two weeks. Bottle and enjoy.



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

Chocolate Malt

A great grain for adding color and flavor

Tips from the pros

by Thomas J. Miller

Chocolate malt is a roasted brewing malt, popular with homebrewers. It is dark in color, ranging from light brown to near-black. Its color rating generally ranges from 325–375° Lovibond, though European malts are sometimes higher. Chocolate malt is used to add color and flavor to beer. When added in small quantities, it causes miniscule color adjustments in lighter beers. In larger quantities, it causes significant darkening of the beer. Chocolate malt can be used in any beer style. Generally, though, it is mostly used for color and flavor in darker beers.



PHOTO COURTESY OF BILL RIFFLE

Brewer: Bill Riffle started homebrewing in 1980 and turned professional in 1999 as the Assistant Brewer at River Rock Brewing in Little Rock, Arkansas, work-

ing under the tutelage of Head Brewer Omar Castellon. He is now the head brewer at Vino's Brewpub in Little Rock.

Over the course of the past year I made six different beers containing chocolate malt. These ranged from an Oktoberfest, to which we only added 0.3% chocolate malt for color, to our Razor Bock with two percent, to our Big House Brown with 6.25%.

The Big House Brown is the beer I would make if I could only make one beer with chocolate malt. Using 6.25%

used in small portions to change the color of your brew without adding a significant flavor impact. It is also a great secret ingredient to add subtle character to a darker beer or to smooth out the bitter coffee flavors associated with black malt.

The color associated with different chocolate malts depends on the malt type and maltster. At 325–375° Lovibond (L), chocolate malt is lighter than black malt, which comes in at approximately 475° L. The color impact on beer, however, is not just 175 color points lighter if you use the chocolate malt. The shade of color is different, too. Chocolate malt tends to add brown tones to a beer. Black malt, by contrast, adds black tones. Chocolate malt changes beer color by browning rather than by blackening, which is good if you are trying to create deep golds or dark reds.

Typical chocolate malt additions, if you're looking to add color, range up to about 0.7% of your total malt load. At this percentage you get subtle flavor

changes, increased malt richness and a slight rounding of caramel malt sweetness. Above this and you begin to get more major flavor impacts.

By itself, chocolate malt adds a dark, roasty sweetness. It is a great substitute for a portion of the black malt in recipes because it rounds off the biting coffee flavors. Sweet stouts and porters benefit from up to ten percent additions. And, as a stand-alone complement to caramel malts, chocolate malt balances the cloying sweetness with as little as a 1.5% addition.

In general, I use chocolate malt as a spice. I usually do not try to accentuate its presence. It is more of a complementary addition to my recipes. I do not think it can be added in high enough proportions to achieve a "Tootsie Roll" flavor. I imagine other ingredients in the beer, like crystal malt, and yeast interactions play a big role in achieving that. One word of caution: High roasted malts are very brittle. Large concentrations of them tend to cause lautering problems.



PHOTO COURTESY OF SCOTT ZETTERSTROM

Brewer: Scott Zetterstrom began brewing beer as a homebrewer in 1989. Along the way, Scott experienced his share of disasters and successes. He took the plunge to become a pro in 1992, when he joined the Old Dominion Brewing Company in the DC suburb of Ashburn, Virginia. He worked on the bottling line and began brewing in 1993. In 1998, he became Old Dominion's brewmaster.

Chocolate malt can be used in just about any kind of beer except low-color beers like a pilsener or helles. It can be

PHOTO COURTESY OF STEVE INDREHUS



Brewers: Steve Indrehus, on the right, became Head Brewer at Tommyknocker Brewery, in Idaho Springs, CO, in April 1996. Steve had previously worked at the Mont Elisa Winery in Oregon and the Wasatch Brewery in Park City, UT. Eric Rode, on the left, has been the Lead Brewer at Tommyknocker Brewery since 1998. Eric started as a cellarman at the New Belgium Brewing Company, in Ft. Collins, CO, and also worked at the C.B. & Potts Big Horn Brewery in Ft. Collins before joining Tommyknocker.

At Tommyknocker, our flagship product that uses a good amount of chocolate malt is the Maplenut Brown Ale. Our Rye Porter also has a nice amount of chocolate malt, as does our oatmeal stout. Chocolate malt has applications across many different beer styles.

Chocolate malt adds a character to beer best described as subtle chocolate flavors or coffee notes. Because it also adds color, it isn't a malt for light-colored beer styles.

As a general rule, you can add chocolate malt at a rate of two to four percent of the total grist in porters, brown ales and oatmeal stout. This gives both color and flavor to the finished brew. Chocolate malt's flavor, in fact, helps offset some of the bite from the black and roasted malts.

If too much chocolate malt is used, a murky color can occur. You might also get a strong coffee-like aroma and flavor, or end up with a beer that suffers from a pronounced astringency.

If too little is used, you might not have a color that is dark enough for the style (depending on the other malts used). Worse, the flavor from the chocolate malt will be too subtle to notice in the finished beer.

If you're looking to get a Tootsie Roll flavor in your beer, we think that using caramel malt in conjunction with chocolate malt will help to achieve that flavor. The caramel malt gives you sweetness while the chocolate malt adds a complex, chocolate-like flavor. Finding the right mix is really a matter of practice and experimentation and will depend greatly on the actual beer style being made.

Coffee is the other flavor you can extract from chocolate malt. This happens when you use a larger percentage of the malt in your grist. All the grain's subtlety disappears in this instance.

No special milling techniques are required when you use chocolate malt. We prefer a coarse grist for single-step infusion mashes. ■

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The Wonders of Widgets

Is it possible to bottle nitrogen-charged beer? My amber has been in the keg for two weeks pressurized with 25% CO₂ and 75% NO₂.

Karl Pergola

Albuquerque, New Mexico

Anything is possible, Karl. And yes, you can bottle beer that has been "gassed" with a blend of carbon dioxide and nitrogen. Just use your counter-pressure bottle filler as you normally would. However, when you pour your bottled, nitrogenated beer into a glass, you will not get the rich head or the profusion of fine bubbles that comes with beers from a nitrogen tap. In fact, your beer will probably seem flat. Producing bottled beer that duplicates commercial "draft style" beer requires equipment and techniques far from the reach of homebrewers. I do not intend to discourage homebrewers from innovation, but this technology has a lot more to do with the package than it does the beer.

So what is draft-style beer? Draft-style beer is beer that pours from a can or bottle as if it came straight from a nitro tap. These beers have a super-thick, very creamy head. The most well-known example of this is the cans of draft Guinness, which are now available almost everywhere. These beers start out like their draft counterparts — they are brewed, filtered and gassed with a mixture of carbon dioxide and nitrogen. This can all be accomplished at home. The next step is packaging. To the casual observer the package is either a can or

a bottle. No big deal, right? Wrong; it is a very big deal.

The package in all draft-style beers contains a device, known in the industry as a "widget," which transforms the bottle or can into a mobile dispensing system. Let's back up and look at how nitrogenated beers behave at the bar. A nitro beer will do nothing remarkable when poured from a standard beer tap except for the fact that it usually falls into the glass with absolutely no fanfare — no foam, no cascading, nothing but beer. Taste this beer and it tastes and feels really flat. Pour the same exact keg of beer through a special faucet (usually called a Guinness tap or a stout faucet) and the whole game changes. You get foam, cascading bubbles, a super-creamy head that sticks to the glass like shaving cream and a wonderfully rich mouthfeel.

The main difference between the two glasses of beer has to do with nitrogen solubility. Beers containing only dissolved carbon dioxide make a huge foamy mess when the carbon dioxide suddenly

breaks out of solution. Draft systems designed

for normal beers are specifically designed to prevent this breakout. To produce its creamy head, a nitrogenated beer is forced at a relatively high dispense pressure — usually around 30 psi — through a plate containing several small holes. Normal beer taps do not contain this orifice plate and its function is to cause gas breakout. When nitrogen breaks out of solution, millions of tiny bubbles form and these bubbles look, act and feel much

different than carbon dioxide bubbles. Any brewer, whether at home or in a brewpub, can serve nitro beers on draft as long as a stout faucet is used.

Putting the same beer in a bottle or a can requires a widget to accomplish the same effect. Widgets are arguably the most revolutionary development in beer packaging since the bottlecap. Widgets were invented in the 80's and were first on the market in the early 90's. There are several types of widgets and they all do the same thing — release small bubbles of nitrogen into the packaged beer when the container is opened. These bubbles act as nucleation sites, like salt crystals sprinkled in beer. More nitrogen bubbles form around these sites and in a very short period of time the beer has erupted into a rolling sea of tiny bubbles. Essentially, the widget starts a chain-reaction of nitrogen bubbles that cascades through the nitrogen already dissolved in the beer.

Brewers who use this fascinating technology require several pieces of specialized equipment. The first is a widget, a plastic bladder-type doo-dad with several very small holes and/or check valves. Most widgets these days look like little footballs and move freely in the package as opposed to the first model found jammed in the bottom of Guinness cans. Bottled widget beers require extra-heavy glass since the headspace has a higher pressure than carbonated beers. To start the process, an empty widget is inserted into the can. Next, they fill the bottle or can with beer and a small drop of liquid nitrogen is added immediately before it is sealed. Since liquid nitrogen has a very low boiling point, it boils in the container and creates enough pressure to partially fill the widget with beer. When the beer is opened and the headspace pressure is released, the gas in the widget rapidly expands and forces the beer in the widget through the



holes or check valves and then the magic happens. Nitrogen bubbles lead to more nitrogen bubbles and, after several seconds, the beer has a head you can cut with a knife.

So, lack of access to widgets and other draft-style beer bottling or canning equipment is why most brewers are technologically challenged when it comes to bottling or canning their favorite nitrogenated tippel!

Soft Water

Would you please enlighten me on brewing with softened water? How much salt does a softener add to five gallons of brewing water? Should I still add some amount of salt when it is called for in a recipe? I have well water and brew all-grain. I have brewed with a variety of waters, but have not found the answers I am looking for in any material that I have ever read regarding the use of water softeners.

*Robert R. Heinlein
Lake Crown Point, Indiana*

Water is said to possess "hardness" when it contains ions of calcium and/or magnesium. I have never really understood the origins of this term, since hard water feels as soft as, well, soft water. Hardness is divided into two categories: permanent and temporary hardness. The latter type can be removed when water containing calcium or magnesium ions and carbonate ions is boiled. When heated, the calcium and magnesium ions react with carbonate ions to form calcium or magnesium carbonate, also called scale. This scale is frequently seen on tea pots and water faucets in homes with hard water. Permanent hardness is the amount of calcium and magnesium that remains in water after boiling. It is possible for a water sample to contain both temporary and permanent hardness.

Water softeners work by replacing calcium and magnesium ions in water with sodium. Two atoms of sodium are added for every atom of calcium or

magnesium removed from the water. This means that if your well water has 100 ppm (mg/L) of calcium and 20 ppm of magnesium, the softened water will contain a whopping 240 ppm of sodium. As far as brewing water is concerned, sodium adds palate fullness and sweetness up to about 100 ppm. At higher concentrations, sodium gives beer a salty flavor.

The real problem with using softened water for brewing is that most homes equipped with water softeners have harder than average water. Thus, the water produced by the softener is in turn very high in sodium. For this reason, softened water is often only used for utility water — water for showers, toilets, washing machines and the like. Water piped to sink faucets bypasses the softener. The above example of 100 ppm calcium and 20 ppm magnesium would most likely not warrant a water softener.

Let's assume that you do not have abnormally hard water, but simply

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have a softener. As long as the sodium does not lend a salty flavor to your water or beer, you can use it for brewing. The "salts" listed in most recipes are calcium sulfate and/or calcium chloride. You certainly would want to add these since calcium is required for pH adjustment in the mash, is a co-factor for alpha-amylase, aids in trub formation and also helps yeast cells flocculate at the end of fermentation.

If you actually did use softened water for brewing as described above, this is what happens. 1) You remove calcium and magnesium and replace it with sodium. 2) You add calcium back to the water because calcium is important for brewing. In my opinion, this seems like a round-about way to add sodium! Most breweries were historically located near good wells and it might be your signature touch to simply use your well water as is and not to worry much about water softeners.

The more likely case is that you have a water softener because you have hard water. I would not recommend using softened water from well water that is indeed hard. Homes with hard water are easy to spot because of the white mineral deposits near water taps. Unfortunately, most hard waters in North America come from limestone aquifers, and limestone is calcium carbonate. The only beers well-suited to these waters are dark ales and lagers, for example, porter, stout and dunkel. The preferred hard water type for brewing lighter-colored beers, like pale ale, is hard water from a gypseous aquifer. Gypsum is calcium sulfate.

I am a strong advocate of the KISS (Keep It Simple, Stupid) approach when it comes to water. I prefer using the local water supply as is, with chlorine removed by charcoal filtration when applicable. Alternately, you can use de-ionized water or distilled water from the supermarket and add various salts to mold the water into the type needed for the particular task. If it is possible, get an analysis of your well water and determine what type of water you have. Based on this information you can take a more calculated approach to water treatment. Steve Parkes and Don Million offer more

information on adjusting water in the January-February 2002 issue of *BYO*.

Corn Sugar and Starters

Every time I've seen reference to a yeast starter being prepared, it calls for plain, light DME as the growing medium. Is there some reason not to use corn sugar?

*Joe Gherlone
Virginia Beach, Virginia*

There is a very good reason not to rely solely on simple sugars, like corn sugar, for yeast starters and that is nutrient content. Yeast cells require many of the same basic "building blocks" of life that we require and corn sugar is not a good source of anything other than sugar. Wort, on the other hand, is an excellent source of amino acids, nucleic acids, phosphates and carbohydrates, among many other

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organic compounds. These substances are used to synthesize proteins, DNA, RNA, cell membranes and energy.

There are some things that wort lacks or is deficient in, however. Vitamins and minerals, such as B-vitamins and zinc, are also required for cell growth and many brewers boost the content of these compounds in their starters. In fact, some brewers add these compounds to wort as part of their normal brewing practice. Oxygen is also important because of its use by growing yeast to produce unsaturated fatty acids and sterols, which yeast require for healthy cell membranes.

One of the best sources of yeast nutrients are dead yeast cells and brewers have used dead, autolysed (enzymatically self-destructed) yeast as a nutrient supplement for years. I recently began using a product marketed through White Labs called Servomyces®. This product was developed in Germany and is considered

Rheinheitsgbot (in case anyone gives a gahoot). Servomyces® is yeast that has been grown in a very nutrient-rich medium and then killed and dried. It is added toward the end of the boil at a rate of approximately one gram per 100 liters of wort and is good source of yeast nutrients.

The benefits of having a good source of yeast nutrients are healthier yeast cells, shorter lag times, faster fermentations and healthier yeast for re-use. Beer flavor is usually improved as a result of the overall improvement in yeast health. I have been using various yeast nutrients as part of my standard brewing practice for several years, with great results.

In short, yeast starters should, at minimum, be made from wort. The use of yeast nutrients, in combination with periodic aeration or oxygenation, will allow for the growth of even healthier and denser starter cultures. Happy yeast growing!

Fusel Oils and Diacetyl

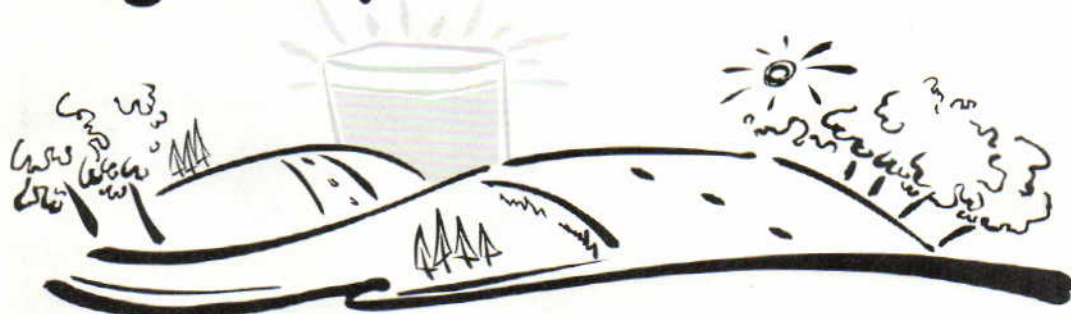
I have been brewing for about 5 years, and I brew all-grain. I have heard the terms "fusel alcohol" and "diacetyl" as they relate to taste or flavor, but don't know what they are. Are they the same? I wonder if I have these aromas in my beer. When I brew a dark beer, or a brew with an OG over about 1.080, I get an alcohol taste in the finished product. After the first few drinks the taste goes away, I assume because the taste buds are soundly asleep. Can you give me a clue? How do I brew around this problem?

Mike Shearer
Eagle River, Alaska

Diacetyl and fusel alcohols, which are also called higher alcohols, are not the same compound. However, they are both related to how yeast metabolize amino acids.

Diacetyl is a common molecule found in beers that have either had

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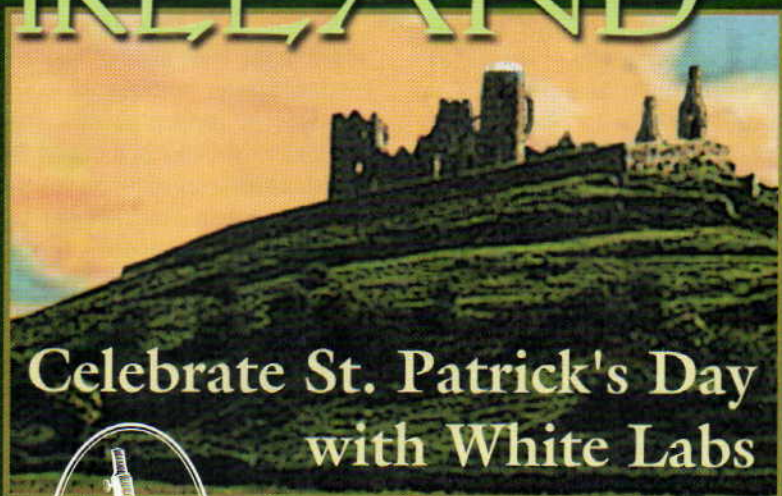
insufficient aging after fermentation or are contaminated with lactic acid bacteria. These bacteria (from the genera *Pediococcus* or *Lactobacillus*) usually come from poor sanitation or are introduced with the pitching yeast. Diacetyl is usually described as a butter- or butterscotch-like aroma and can be found in all types of beer, regardless of original gravity. If you have diacetyl in your beer, either step up your cleaning and sanitation practices, or wait until the beer has aged sufficiently for the yeast to absorb the diacetyl. Some yeast strains are better than others at absorbing diacetyl.

Higher alcohols, on the other hand, are typically associated with higher gravity beers. (Higher alcohols have a greater molecular weight than ethanol, hence the name "higher.") Descriptive terms such as alcoholic, vinous, spicy and fruity are used to describe the aromas of higher alcohols. Some beers gain a lot of complexity from higher alcohols, but excessively high levels can be unpleasant and tend to make for aching heads the next day. Three main factors can lead to higher alcohols: wort amino acid concentration, yeast-pitching rate and fermentation temperature. The good news is that proper manipulation of one or all of these factors can be used to regulate higher alcohols in your finished beer.

Wort amino acid level is directly related to higher alcohol concentration because when amino acids are metabolized by yeast, one of the byproducts is a higher alcohol. Higher gravity beers typically contain more amino acids than their lower gravity cousins, and higher alcohols are a signature of these big brews. The level of wort amino acids can be reduced in high gravity worts by the use of adjuncts, like rice or corn, which contain only a very small amount of amino acids.

The yeast pitching rate is extremely important when it comes to influencing the level of higher alcohols in big beers, and cell growth and higher alcohol production go hand-in-hand. While wort amino acid concentrations invariably increase with higher gravity worts and can be slightly changed, yeast pitching rate is something the brewer

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can really do to influence the outcome of fermentation. The rule of thumb used by many brewers for pitching rate is one million yeast cells per milliliter of wort per degree Plato. This means that if wort gravity is increased from 12° Plato (1.048) to 18° Plato (1.072), the yeast pitching rate needs to increase by fifty percent.

The importance of yeast health and pitching rate really cannot be

stressed enough. Brewers make wort and the yeast convert the wort to beer. I mention pitching rate as an important factor, yet more importantly the cells added to the wort need to be alive and kicking. Starter cultures are an effective way of increasing cell numbers and ensuring a vital population. This is one step that can really make the difference between a mediocre and excellent beer. (In this month's Techniques

column, on page 47, Chris Colby discusses pitching rates and how to make a yeast starter for your homebrew.)

The final thing you can do is to control your fermentation temperature. This variable is easy to control and has a dramatic affect on higher alcohol formation (as well as ester formation). Ale fermentations should ideally be in the range of 65–70° F. Lager fermentations should be kept between 50–55° F. Excellent beers are made using temperatures that fall out these ranges. However, in general, if the fermentation is warmer than 70° F for most ale strains, or 55° F for most lager strains, the chances of increasing the higher alcohol level in the finished beer rise.

In short, if you have problems with fusel oils in your beer, there are three steps you should take. Make sure you supply your yeast with sufficient yeast nutrients, pitch an adequate amount of healthy yeast and control your fermentation temperature.

By the way, the palate is easily attenuated to flavors. This means that after exposure to a particular stimulus, your impression of its intensity is reduced. This is probably why you do not taste alcohol after your first few sips of beer. Palate attenuation is one reason that it is difficult to effectively evaluate more than a few beer samples in a session. The human ear, really the brain, is likewise amazing with respect to attenuation. Next time you're in a crowded bar, stop a moment and listen to all the noise you're tuning out. ■



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Beers Cloned

Old Rasputin and Mac and Jack's Amber

The Repl*ic*ator

by Steve Bader



Dear Replicator,

I used to live in Virginia and could always purchase North Coast Brewing's Old Rasputin. Since then I have moved to southwest Florida and I cannot get this beer. I am an all-grain brewer and would love to try your all-grain recipe for this great beer.

George Hutton
via email

Old Rasputin, which is brewed by the North Coast Brewing Company in Fort Bragg, California, is a Russian Imperial Stout. This award-winning beer was the Gold Medal winner at the World Beer Championships from 1996 to 1998. Old Rasputin will keep you warm on the coldest winter nights, with an alcohol content of nine percent by volume. A beer this big is difficult to brew, so I went directly to the source at North Coast and talked to the founder and head brewer, Mark Ruedrich, about making this high-gravity beer.

Mark started North Coast Brewing Company in 1988. Old Rasputin was added to the lineup in 1995 and has been a big hit ever since.

Old Rasputin is a giant beer, true to style, with a beginning specific gravity of 1.090 and a huge hop bitterness of about 85 to 95 IBUs. Old Rasputin also has a big, aromatic hop profile. Mark has developed Old Rasputin to have a balanced malt profile, minimizing the harsh flavors by limiting the black malts to only 0.25 pounds per 5 gallons, and using other medium-dark malts, such as chocolate and brown malt, to obtain the dark color.

As with any high-gravity beer, it is critical that you pitch enough yeast, so make a yeast starter.

You can get more information about North Coast Brewing on the Web at <http://www.ncoast-brewing.com>, or call them at (707) 964-2739.

Old Rasputin Imperial Stout (5 gallons, extract with grains) OG = 1.090 FG = 1.022 IBUs = 85-95 ABV = 9%



Ingredients

- 9.9 lbs. Coopers Light malt extract syrup
- 1.0 lb. Hugh Baird Carastan malt
- 0.5 lb. Hugh Baird Brown malt
- 0.5 lb. chocolate malt
- 1.0 lb. crystal malt (120° L)
- 0.25 lb. roasted black barley
- 22.7 AAU Cluster hops (bittering) (3.25 oz. of 7% alpha acid)
- 9.0 AAU Northern Brewer hops (aroma hops) (1 oz. of 9% alpha acid)

- 8.8 AAU Centennial hops (aroma) (1 oz. of 8.8% alpha acid)
- 1 tsp Irish moss
- White Labs WLP001 (California Ale) yeast or Wyeast 1056 (American Ale) yeast
- 0.75 cup of corn sugar for priming

Step by Step

Steep the crushed malts in three gallons of water at 150° F for 30 minutes. Remove the grains from the wort, add malt syrup and bring to a boil. Add the Cluster (bittering) hops and Irish moss and boil for 60 minutes. Add the aroma hops (Northern Brewer and Centennial) for the last two minutes of the boil.

When you are done boiling, strain out the hops and add the wort to two gallons cool water in a sanitary fermenter. Top the fermenter off

with cool water to 5.5 gallons. Cool the wort to 80° F, aerate the beer and pitch your yeast. Allow the beer to cool over the next few hours to 68-70° F, and ferment for 10 to 14 days. Bottle your beer, age for two to three weeks and enjoy! (Yes, that's right, this beer so well-balanced that North Coast releases it to the public in less than a month.)

All-grain option

Replace the light syrup with 14 lbs. of pale malt. Mash all your grains at 152° for 45 minutes. Collect enough wort to boil for 90 minutes and have a 5.5 gallon yield.

Decrease the amount of bittering hops to 2.75 oz. of Cluster to account for the increased hop extraction efficiency in a full boil. The rest of the directions are the same.



Dear Replicator,

I travel around the country three to four days a week and get to sample some great (and some not-so-great) brews. Last week, while on a business trip to Seattle, I happened across a wonderful nectar called "Mac and Jack's African Amber Ale." This beer is excellent, but apparently it's only available in kegs. I would be forever grateful if you could help me clone this fine amber ale, since buying a six-pack isn't an option.

Craig Henrichsen
Houston, Texas

Living in Washington state, I am fortunate to have access to this beer in many of the local pubs, and I love it. This is a beer generously blessed with the flavor of the hop flower. The Yakima Valley in Washington is one of the largest hop-growing regions in the entire world, accounting for about 70 percent of total hop production in the USA. As a consequence, many brewers from the Northwest really focus on the hop flavor in their beer. The citrusy hop aroma, from hops such as Cascade, have become the signature of the West Coast pale ale style that was pioneered in this region.

I spoke to Ken Nabors, the operations manager and head brewer for Mac and Jack's. Ken says this beer is a "big, full-bodied amber beer" that does not readily fit into any traditional beer style. Ken was a bit shy when it came to giving out details about the ingredients and other brewing specifics, but he did say Mac and Jack's has a citrus hop flavor up front, followed by a floral

hoppy finish, which they achieve by dry-hopping in each individual keg. Ken also suggested using a yeast that produces a malty flavor in the beer. Clean yeasts are another feature of West Coast pale ales.

Mac and Jack's ages the beer for a few weeks before sending kegs out to the local pubs. They keep a close watch on the kegs they have out, making sure that pub patrons are always served this beer in its prime.

You can get more information about Mac and Jack's by calling them at (425) 558-9697. ■

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Mac & Jack's African Amber (5 gallons, extract with grains) OG = 1.060 FG = 1.018 IBUs = 38 ABV = 5.5%

Ingredients

- 6.6 lbs. Muntons Light malt extract syrup
- 0.5 lbs. Muntons Light dry malt extract
- 1.0 lb. Munich malt
- 0.5 lb. crystal malt (80° L)
- 0.5 lb. Carapils (dextrin) malt
- 9.3 AAU Centennial hops (bittering) (1 oz. of 9.3% alpha acid)
- 6.2 AAU Cascade hops (aroma) (0.75 oz. of 8.3% alpha acid)
- 4.2 AAU Cascade hops (dry hop) (0.5 oz. of 8.3% alpha acid)
- 1 tsp Irish moss
- White Labs WLP005 (British Ale) yeast or Wyeast 1098 (British Ale) yeast
- 0.75 cup of corn sugar for priming

Step by Step

Steep the crushed malts in three gallons of water at 150° F for 30 minutes. Remove the grains from the wort. Add the malt syrup and malt powder and bring to a boil. Add the Centennial (bittering) hops and Irish moss and boil for 60 minutes. Add the aroma hops (Cascade) for the last two minutes of the boil.

When done boiling, strain out hops, add the wort to two gallons of cool water in a sanitary fermenter, and top off with cool water to 5.5 gallons. Cool the wort to 80° F, aerate the beer and pitch your yeast. Allow the beer to cool over the next few hours to 68-70° F and ferment for 10-14 days. Add the 0.5 oz. of

Cascade pellets to dry-hop your beer for five to seven days, then bottle your beer. Pellet hops work well when dry-hopping this beer.

All-grain option

Replace the light malt syrup and powder with nine pounds of British pale malt. Mash all your grains at 155° F for 45 minutes. Collect enough wort to boil for 90 minutes and have a 5.5 gallon yield.

Decrease the amount of bittering hops to 0.75 oz. of Centennial to account for the increased hop extraction efficiency in a full boil. The remainder of the recipe is the same as the extract. Don't forget to add the dry hops!

Dunkel: the Dark Lager

Styl^e profile

The world's first legally recognized beer style

by Horst D. Dornbusch

DUNKEL by the numbers

OG11.5–13.3 °P (1.046–1.055 SG)
FG2.9–3.3 °P (1.012–1.013 SG)
Attenuation	...68–75% (apparent)
SRM18–28 (usually about 20)
IBU20–26 (usually about 22)
ABV4.8–5.6%

The Bavarian dunkel lager — as well as its darker siblings, the schwarzbier and the rauchbier — is the historical precursor of all modern lagers. These include the Bavarian helles, Märzen and Oktoberfest, bock beers, the Vienna lager, the Bohemian pilsner, the Dortmunder export, the German pils, and even the North American pilsners.

Dunkel is the German word for “dark.” It refers to the deep brown, mahogany or sepia color of this opaque, all-barley lager. From the early sixteenth to the late nineteenth century, dark lagers were the most common beers in Bavaria. Initially called red beers, they came to be called by their modern name only in the 1840s, probably to distinguish them from the growing variety of paler lagers that were being introduced at that time.

The First Beer Style . . . By Law!

Before the introduction of the indirect-heat kiln in the early nineteenth century, which allowed maltsters to make pale malt, all beers were more or less dark. Depending on the climate and the season, the beers were either ales or lagers. Most beer became ales. Worts were inoculated with airborne, top-fermenting yeasts and underwent uncontrolled fermentation in unrefrigerated, open vats. In 16th century Bavaria, yeast was not even considered a necessary ingredient of beer making. Instead, it was regarded as byproduct of putrefaction and discarded. Beers

would be lagers only in the winter in colder regions, such as Bavaria, when ale yeasts would be dormant and only bottom-fermenting yeasts were still active. These medieval beers often tasted sour and medicinal, especially in the summer when the chance of infection from wild yeasts and bacteria was greatest. Brewers would use any number of strong herbs and seeds to cover up the bad flavors.

The famous Bavarian Beer Purity Law of 1516, the Reinheitsgebot, began a momentous process that would change beer-making not just in Bavaria, but the entire world. After 1516, Bavarian beer could be made only from water, malted barley and hops. The importance of yeast in beer making had not yet been discovered, which is why the decree did not mention yeast as a beer ingredient.

In spite of the Reinheitsgebot, however, summer beers remained of poor quality. In 1553, therefore, the Bavarian ruler simply forbade all brewing between April 23rd and September 29th. As a result of these two regulations, a new beer evolved. Initially called red beer, it was always a dark lager, barley-based and flavored with hops. Fixed by government decree, it became the staple beer of Bavaria — this was the world's first legally recognized beer style.

During the early decades of the nineteenth century, the new lager beer style spread from Bavaria to neighboring Austria and Bohemia. As pale malt became available around that time, brewers started to create blond lagers as well. After the invention of refrigeration near the end of the century, cold-fermenting lagers replaced ales as the favorite beers in all parts of Europe except for the lower Rhineland of Germany, Holland, Belgium, Britain, Scotland and Ireland.

Five-grain Dunkel

(5 gallon, all-grain)

OG = 1.048 FG = 1.012

IBU = 22 ABV = 4.6%

Ingredients

3.6 lbs. two-row lager malt

2.7 lbs. Munich malt (10° L)

1.4 lbs. Munich malt (20° L)

0.9 lb. caramel malt (60° L)

0.5 lb. CaraPils malt

5 AAU Hallertauer Mittelfrüh

(1.25 oz. of 4% alpha acid)

0.5 oz. Tettnanger hops (flavor)

1 oz. Tettnanger hops (aroma)

2 packs of one of the following:

Bavarian Lager (Wyeast 2206),

Munich Lager (Wyeast 2308),

Southern German Lager

(White Labs WLP838) or

Old Bavarian Lager

(White Labs WLP920)

1/2 cup corn sugar (for bottling)

Step By Step

Step mash with 30-minute rests at 122° F, 146° F and 156° F. Alternatively, do a single-infusion mash at 154° F for an hour. Heat mash to 170° F prior to recirculation and sparging. Collect 6.5 gallons of wort. Boil for 90 minutes. Add bittering hops after the first 15 minutes of boil. Add flavor hops with 15 left in boil and aroma hops at the end of the boil. Cool wort. Aerate and pitch yeast. Ferment one week at 55° F, then rack to secondary and ferment an additional two weeks. Lager for 4–6 weeks at 28° F. Bottle and serve. See article for details.

Extract with grains option

Substitute 3.75 lbs. Bierkeller Plain Dark malt extract and 2.75 lbs. of either Bierkeller Plain Light or Irek's Munich Light malt extract for the 2-row and Munich malts. Steep the caramel and CaraPils malts in 150° F water for 15 minutes. Remove grains, add malt extract and bring wort to a boil. Follow all-grain instructions from this point forward.

All-Munich Dunkel

(5 gallon, all-grain)

OG = 1.048 FG = 1.012 IBU = 22

ABV = 4.6%

Ingredients:

8 lbs. Munich malt (10° L)
 1 lb. Munich malt (20° L)
 5 AAU Hallertauer Mittelfrüh
 (1.25 oz. of 4% alpha acid)
 0.5 oz. Tettnanger hops (flavor)
 1 oz. Tettnanger hops (aroma)
 2 packs of one of the following:
 Bavarian Lager (Wyeast 2206),
 Munich Lager (Wyeast 2308),
 Southern German Lager
 (White Labs WLP838), or
 Old Bavarian Lager
 (White Labs WLP920)
 1/2 cup corn sugar (for bottling)

Step by Step

Step mash with 30-minute rests at 122° F, 146° F and 156° F. Alternatively, do a single-infusion mash at 154° F for an hour. Heat mash to 170° F prior to recirculation and sparging. Collect 6.5 gallons of wort. Boil for 90 minutes. Add bittering hops after first 15 minutes of boil. Add flavor hops with 15 left in boil and aroma hops at the end of the boil. Cool wort. Aerate and pitch yeast. Ferment for one week at 55° F, then rack to secondary and ferment an additional two weeks. Lager for four to six weeks at 28° F. Bottle and serve. See article for further details.

All-extract option

Use 7 lbs. Bierkeller Plain Dark malt extract, or a combination of 6.2 lbs. Bierkeller Plain Dark and 0.8 lb. Irek's Munich Amber malt extract. Do not use any of the Munich malts listed in the all-grain recipe.

Bring 6 gallons of water to a boil. Shut off heat and stir in extract. Boil the wort for 60 minutes. Add bittering hops after the first 15 minutes. Add flavor and aroma hops toward the end of the boil. Cool the wort to at least 65° F. Siphon the wort to your fermenter and aerate thoroughly. Pitch yeast, ferment and lager as instructed in the article.

Dunkel Profile

The dunkel, like all Bavarian-style beers, tends to be low in hop bitterness. Brewed with a large portion of Munich malt, dunkels are soft, elegant and well-attenuated with almost no nose. They have a rich, malty, mildly vanilla, nutty-sweet palate and a dry, rounded finish that is never harsh, toasty or acrid. The diacetyl level must be well below the taste threshold, and thus notes of butterscotch — typical of many British dark beers — must be totally absent.

Ingredients

The foundation grain of a typical dunkel is Munich malt, which is also called dunkel malz or Münchener malz in Germany. Dunkels are often made from about 30% Munich malt with a color rating of 10° Lovibond (L) and about 15% Munich malt with a color rating of 20° L. For extra color, flavor and body, you can also add up to 15% caramel malt (60° L) and about 5% dextrin malt, such as CaraPils. Perhaps surprisingly, the rest of the grain bill — about 35% — is made up of pale pils malt (helles malz) with high enzymatic strength, a color rating below 2° L, and a protein content between 11 and 12%. (See the five-grain dunkel recipe on page 19 for instructions on how to brew this type of dunkel lager beer.)

It is also possible to make a dunkel entirely from a nine-to-one mixture of 10° L and 20° L Munich malts, but such a grain bill tends to produce a much lighter-colored, almost amber brew. (See the all-Munich dunkel recipe on this page, to the left, for instructions on how to brew this dunkel variation.)

Munich malts are produced from the same grains as pils malt, but are kilned longer and at slightly higher temperatures. Some are lightly roasted, but never burned. They add body, and some sweetness, to the beer. Never use black or severely roasted malts, therefore, as you would for color in a porter or stout, not even in tiny quantities! They would add roasted notes to the beer and make it non-authentic.

North-American-grown grains are perfectly acceptable for brewing Bavarian lagers, because the protein

levels tend to be comparable to those of continental-European grains. Avoid barley varieties grown for ales in the maritime climate of the British Isles, such as pale ale malts. Their protein levels can be as low as 9%, which tend to be insufficient for the full-bodied texture, rich mouthfeel and creamy, long-lasting head of a properly made dunkel lager.

When brewing with extract, choose a pale German-style lager malt extract as a substitute for the pale grain. Choose a dark lager malt extract as a substitute either for all the other malts (see the extract version of the second recipe), or for just the Munich malts, if you are planning a partial mash (see the extract version of the first recipe).

Because the ratio between "specialty" (non-pale) and foundation (pale) malts is essentially reversed in a dunkel, a partial mash that would include the Munich malts would be impractical. If you choose just straight dark lager malt extracts, you still have the option of steeping the specialty grains for extra flavor. Alternately, you can make a mini-mash of the Munich and specialty malts and add light malt extract for the remainder of the fermentables for the beer.

Because malt, not hop, flavors dominate in a dunkel, use only German-type noble varieties for bittering, flavor and aroma. Hallertauer Mittelfrüh, Hersbrucker, Tettnanger, Spalt, Perle, Northern Brewer and Mount Hood are the best choices.

Ferment your dunkel with any of the standard Bavarian-style lager yeasts — such as Wyeast 2206 (Bavarian Lager) or White Labs WLP830 (German Lager) — but note that dark lagers tend to be fermented at a slightly higher temperature than blonde lagers. Whichever yeast you pick, it must be slow acting and capable of fermenting at an optimum temperature of 50-59° F (10-15° C).

Step Infusion Dunkel Mashing

In the old days, dunkels — like all Bavarian lagers — were made from decoction mashes. But with modern grains, infusion mashing is replacing decoction mashing even in German

breweries. For authenticity, though, you should definitely use a multi-step mash schedule. To raise the temperature from one step to the next, use hot water. There is no general rule for the temperature of your infusion water, because it depends largely on the thermal absorption characteristics of your equipment; in other words, how much heat your brewing equipment absorbs (and radiates) while you brew. Use boiling hot water, if necessary. You can also apply direct heat to your mash tun. When directly heating the mash, you should stir the mash slowly but steadily. Strring slowly minimizes aeration. Stirring steadily helps avoid scorching.

The entire mash cycle may take anywhere between 90-150 minutes for a step-infusion mash, depending on your choice of starting temperature and on the number of rests. Below is an outline of a complete mash schedule for a typical dunkel mash. If you are in a hurry, feel free to skip the lower-temperature rests, but be aware that you will sacrifice authenticity.

If your equipment allows you nothing but a single-step infusion mash, ignore the schedule below and aim for a compromise temperature of about 154° F (68° C) for about one hour, but your beer will likely lack the richness and creaminess that you would expect in a dunkel!

Protein-converting enzymes work best in thick mashes, while starch-converting enzymes work best in thin mashes. In a multi-step mash, therefore, it is always best to "dough in" as thick as possible rather than to "mash in." This is good for enzymatic action, and it leaves enough room in the mash tun for plenty of hot-water additions to raise the mash temperature. The precise ratio of grain to water at the dough-in stage is not relevant, as long as the grain is at the right temperature and there are no dry pockets.

As an optional step, you can start out with an acid rest for 15-30 minutes at 100 ± 5 °F (38 ± 2 °C). Many German brewers believe that an acid rest improves extract efficiency if you hydrolyze enzymes, starches and proteins at this temperature.

If you skip the acid rest, dough in

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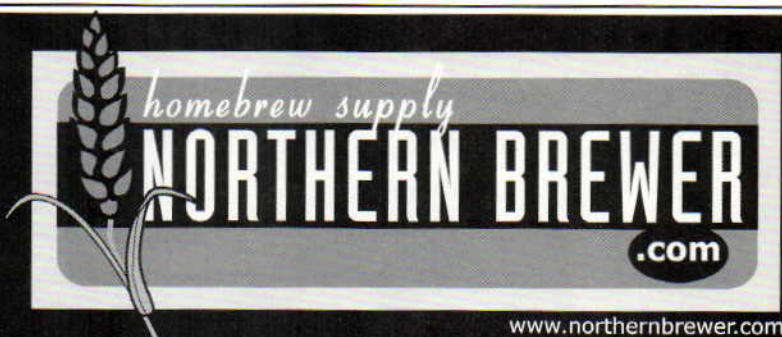


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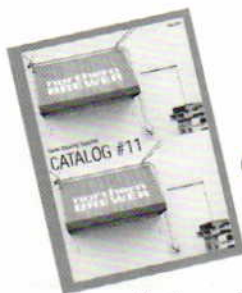
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directly at about 122 °F (50 °C) for a protein rest of about 30 minutes. Otherwise, raise the temperature using a small quantity of hot water and external heat, if necessary. Mash temperatures in the range of 113-122 °F (45-50 °C) also yield the largest amount of free amino nitrogen (FAN), simple amino acids that are essential for healthy yeast growth and yeast metabolism later on in the fermenter.

Next, increase the temperature to 146 ± 2° F (63 ± 1° C) for a beta saccharification rest of about 30 minutes, then to 156 ± 2° F (69 ± 1° C) for an alpha saccharification rest of about 30 minutes. Now you can use plenty of hot water for the temperature increase, because thinner mashes favor diastatic conversion. Also, because a dunkel is a relatively dry beer, it is essential that you give the diastatic conversion a full one-hour rest.

Finally, raise the temperature to 170° F (77° C) for the mash out and start sparging. For less trub in the kettle and a crisper, haze-free final beer, recirculate your wort. Immerse a pitcher in hot water (to keep it from acting as a heat sink), collect the first runnings and pour them back on top of the grain bed. After recirculation, sparging should take about 90-120 minutes.

From Boil To Bottle

All-grain brewers should boil their dunkel wort for 90-120 minutes. Extract brewers may employ a shorter boil, from 45 minutes to an hour. Add the bittering hops 15 minutes into the boil — never earlier! German wort has plenty of proteins, and because uncoagulated proteins envelop unisomerized alpha acids, you get less hops utilization out of your bittering hops. German brewers prefer to wait 15 minutes to let the proteins coagulate. Add the flavor hops 10-20 minutes before the end of the boil (or as late as at shut-down). Add the aroma hops near, at, or shortly after the end of the boil.

Chill the wort to at least 55-65° F (13-18° C). The optimum primary fermentation temperature is 50-59° F (10-15° C). Use two packages, containers, or pouches of yeast, or make a yeast starter to increase the yeast count.

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Decoction Tips

At mash-in, infuse your grain with up to 70% of your brewing liquor and reserve the remaining 30% for sparging. To raise the temperature of the main mash from one level to the next, draw one-third of the main mash into a separate cooker for a decoction boil of 10-20 minutes. Some German breweries boil about one-half of the mash during the final decoction and boil this for almost one hour. During the decoction, raise the temperature slowly at a rate of about 2 °F (1 °C) per minute. For improved saccharification, you can give the separate decoction mash an optional 15-minute rest at a temperature of 152-154 °F (67-68 °C). Then reintroduce the decoction mash into the main mash. Do this once for each step.

Vigorous primary fermentation usually takes about seven days. At a gravity of about 4-5° P (1.016-1.020 SG), rack the brew into a secondary fermenter and leave it there for another two weeks.

Then transfer the beer for lagering. Lager your dunkel as close to the freezing point as is possible for about four to six weeks. You can lager at temperatures as low as -2° C (almost 28° F). During lagering, the remaining yeast in suspension reabsorbs or reduces a good portion of its less desirable metabolic byproducts, such as esters, aldehydes, fusel alcohols and diacetyl. This makes the beer taste clean and crisp. The yeast also scavenges oxygen, which increases beer's shelf life. After lagering, rack off the debris one more time and prime with about 1/2 cup of corn sugar or dried malt extract. Alternatively, add about half a teaspoon of your priming agent into each 12-ounce bottle and siphon carefully out of the lagering container. ■

Horst Dornbusch is the author of "Prost! The Story of German Beer." Starting with this issue, he'll write "Style Profile" in every edition of BYO.



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W

hen Art Beall decides it's time to work on his next batch of beer, the first thing he fires up is his Dell PC. Before he pulls out his propane burner and other brewing equipment, even before he purchases his ingredients, he spends a few minutes in front of his computer.

Beall uses a software program called ProMash to simplify the more tedious tasks involved in brewing a good batch, particularly when it comes to crunching numbers. He has the computer figure out expected original and final gravities from a given set of ingredients, calculate the bitterness contributed by his hops, and determine how much water he needs to use to get the right amount of finished beer. The program can help specify what he may need to add to create a water profile appropriate for the style he's brewing. He also uses the software to tell him what amount of grains, malt extract or

hops to use if he wants to brew a larger or smaller batch than the original recipe makes. The computer does the figuring and allows Beall to spend more of his time on the actual brewing. "A lot of people just want to make good beer," says Beall, who lives in Hudson, Ohio. "If you rely on a software program like this, you don't have to spend time with your calculator."

The idea of using a computer as a brewing tool isn't a new one. Computers are perfect for two of the tasks that every good brewer must perform with each batch — calculating things like specific gravities, hop bitterness, and dilutions; and keeping detailed notes in a standard way. Rather than scribbling out formulas for bittering, for example, a brewer using a software program can just key in the alpha-acid content and amount of the hops involved. The computer does the numbers work. And the results are always consistent ... and legible!

Pennsylvania brewer and software developer Michael Taylor says he wrote his first brewing software for DOS in the early 1990s, in the days before Windows took over the world of personal computers, to help him with his brewing. Today, Taylor's latest program, Suds 6.1, includes a number of utilities that can help with brewing chores. Other notable software programs include ProMash, developed by brewer and software engineer Jeffrey Donovan in California, and a relatively new program called StrangeBrew, developed by Drew Avis, a technical writer based in Ontario, Canada.

These aren't the only software programs available for brewing. Almost any Internet search engine will reveal other options. Brewery.org (www.brewery.org/brewery/Software.html), a Website sponsored by the Home Brew Digest, has a page listing several dozen pieces of software for Windows, Mac, Unix and DOS machines. A number of



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BEFORE YOU FIRE UP THE KETTLE, flip on your computer! These three easy-to-use software programs help homebrewers hit target gravities, calculate hop additions, keep track of recipes and more.

by **PATRICK TWOHY**

those seem outdated or otherwise less useful than the trio reviewed here. And many brewers settle for various online calculators or simple spreadsheets that they write themselves. (BYO offers a free spreadsheet at its Website: www.byo.com).

The three software programs reviewed in this article — ProMash, StrangeBrew and Suds — were the ones mentioned most often in an informal survey of homebrewers who use computers, and in results of Internet searches. All three are designed for PCs, but they can be used on Macs and Linux machines with intermediary software you would use to run other Windows-based programs. ProMash, for example, tells Mac users they can run the software through Virtual PC. And Linux users can run it through Wine. All come with databases of ingredients, which the user can add to or change. The grain databases include the color and gravity that a given amount that each grain would contribute to a brew. The hop databases include a typical alpha acid percentage for each variety of hops, which the brewer adjusts as necessary.

PROMASH

ProMash is both more detailed and more flexible than the other programs reviewed here in just about every detail. It's also a little more difficult to learn, admits creator Jeffrey Donovan. But to be fair, each brew program described here requires a new user to spend some time learning its ropes.

ProMash is the most widely used of these programs. Donovan says he has more than 4,000 registered users; about 3,700 of those are homebrewers. About 300 professional brewers use ProMash, Donovan says.

One of those is Jim Wagner, head brewer at DuClaw Brewing Company, a brewpub in Bel Air, Maryland. He started out brewing at home in 1991. He turned professional after winning a number of brewing awards, including one that allowed him to brew his winning recipe at the brewery he now runs. They must've been impressed!

Not surprisingly, the program contains a number of tools and concepts that a homebrewer may not be familiar with. "The biggest thing about this pro-

gram is it will grow with the brewer," says Wagner, who sits on a review board for new features in the program. "You can take it as far as you want. Or you can just use the basics. Six months to a year to two years down the line, it will help you do things like infusion mashing. The program has many features that someone new to brewing might not need. But that's not a problem. Just don't use them."

This is the mother of homebrewing programs. The wealth of detail might seem overwhelming, but there's very little that a brewer could want that's not in there somewhere. For example, since I treat the water I use for mashing and sparging, it's handy to know beforehand exactly how much water I'm going to need. One of the 12 tools available through the program's main screen is a "Water Needed" calculator.

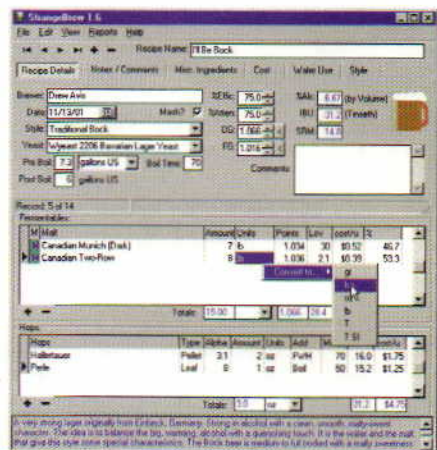
The feature takes into account parameters from your recipe, including the total weight of grain, the amount of water in the mash (which gets entered through a separate mash calculator), the length of the boil, the water absorption rate of the grain, even shrinkage due to chilling. I can also set up the program to know how much wort gets left behind in the lauter tun, deadspace in the kettle, hopback, chiller and more. All I need to do for each brew session is enter a figure for gallons of sparge water, and the program tells me how much resulting brew will result.

Or let's say you've mashed and sparged, and — oops — you extracted a lot more sugars than you expected so your wort gravity is too high. How much water should you add to get the right gravity? ProMash's dilution calculator handles that. Let's say your gravity is 1.075 and you need it to be closer to 1.066. Enter those figures and the calculator tells you to add 1 gallon of water to bring your gravity down. Or maybe you need to boost the gravity by adding some wort with higher gravity. The calculation is quite simple. And it doesn't matter what kind of measuring scales you use. ProMash reads out in specific gravity as well as Plato, and also displays in liters and gallons.

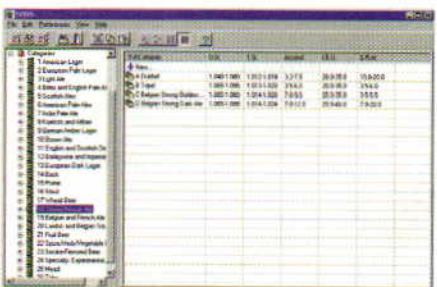
This program has lots of other little goodies. The result is a huge tool — perhaps not as "user-friendly" as other



ProMash



StrangeBrew



Suds 6.1

Computers are perfect for two of the tasks that every good brewer must perform with each batch: calculating things like specific gravities and hop bitterness; and keeping detailed notes in a standard way. Each of these notable software programs offers those features and many more.

READ YOUR PALM

Homebrew applications for hand-held computers

Only a few brew programs are available for hand-held computers, such as Palm Pilots. But partisans of palm-top computing will be glad to know that utilities do exist for these devices — and they can help on brew day.

The number of hand-held applications is small because, in most cases, the brewer doesn't really need a tool that can provide instantaneous data during the brew process. And, of course, the brewing environment can be harsh on delicate machines. (You might try my trick of slipping the hand-held into a plastic, sealable sandwich bag. It's not perfect, but at least a little splash of wort won't put it out of commission.)

Most of the programs out there address one or another specific task.

An example is PilotBrew, a suite of tools from Jeffrey Donovan of ProMash. One of the nicer items in it is a hydrometer correction calculator. It's often good brewing practice to stop all-grain runnings from the mash tun when specific gravity drops to 1.010. (If you sparge beyond that point, you risk extracting harsh tannins from the grains.) A brewer might take a sample of runnings and try to chill it to close to the calibration temperature of the hydrometer, which is usually 60° F. But that can take time, and the brewer may accidentally allow the runnings to fall under 1.010. This tool lets you determine specific gravity regardless of the temperature of the sample. Just enter the hydrometer reading, temperature of the runnings, and the hydrometer's calibration temperature and you get true gravity instantly.

Also included in PilotBrew are tools to calculate alcohol content, and a calculator to determine the strike temperature of water being used for mashing. PilotBrew isn't a critical brewing accessory. But it's handy. And best of all, it's available free at the ProMash Website

(www.promash.com/resource.html). It's available for devices that use both the Palm operating system (such as those from Palm and Handspring), and the Windows CE operating system from Microsoft.

One of the broadest brew programs available for hand-helds is Sudslite, a version of Suds that Michael Taylor wrote for Windows CE-based devices.

"I developed Sudslite primarily to address my biggest gripe with recipe software: I couldn't run the program in my brewery!" Taylor writes in the documentation that comes along with the software. "With desktop software, I would formulate the recipe, print a report and make any adjustments or guesses down in my basement. If I made any significant changes to the recipe, I was forced to either run upstairs and recalculate, or take my best guess."

Let's say you threw in a little more hops at the beginning of the boil than you intended. Just enter the real amount and the program can tell you how much you need to scale back on subsequent hop additions so you don't make the beer too bitter.

Or maybe your first mash step got a little hotter than you expected. Toss in the real temperature and you'll see immediately what temperature to heat water for your next infusion in order to hit the temperature you need for the next mash rest.

By Taylor's own admission, Sudslite can be a little clunky to use. But it can save time and complications in the brewing process. The program won't run on Palm-based systems. Sudslite is available at Taylor's Web site, <http://oldlib.com/suds>.

A quick search of Web sites that distribute software for Palm hand-held devices, such as palmgear.com, reveals a smattering of other applications that address specific brewing problems, such as record keeping or calculating bitterness. —P.T.

programs (to use a term popular in Silicon Valley), but ProMash definitely has the edge for inclusiveness over all rivals in its class.

One big advantage of ProMash is its Web site (www.promash.com), which includes, among other things, a database with nearly 100 recipes contributed by users that can be imported easily into the program.

System requirements: Windows 95, 98, ME, NT, Win 2000 and Windows XP Operating Systems. Donovan says he designed the program to work with minimal system requirements so brewers can use cheap computers for their brewing. "ProMash will run on a 486," he says. "I know a lot of people who do exactly that: They get a junky old computer that they can use out in their brew house."

STRANGEBREW

Strange name, but a good program. And it's the least expensive of the three (by a few bucks, that is).

The program has a narrow following, partly because homebrewing and writing software aren't a business for Avis, they're an avocation. He began writing StrangeBrew in 1998, but the result was too cumbersome, he says. So he rewrote it in a different computer language in 2000. The latest version came out in November 2001.

StrangeBrew can be downloaded from Avis' site and used free for 30 days. After that, some features are disabled but core tools (like the ability to create recipes) are still available. Full use of the program after the first month costs \$15, though Avis says he'd consider accepting a six-pack of Sam Smith Taddy Porter in lieu of cash.

For the cost-conscious brewer, StrangeBrew makes it easy to see how much a given recipe will cost to make, right down to the expense per bottle. The Web site (www.strangebrew.ca/) offers a good deal of help and support for software users.

One of the unusual features in StrangeBrew is a little slider bar that lets you see what other styles your recipe may match. After you've entered your recipe into the program, it compares ingredients, gravities and other

Software tools you can use

P = ProMash S = Suds SB = StrangeBrew O = Other

Feature	Program	Notes
Calculator for original and final gravities	P, SB, S	The core feature of these programs.
Style guideline database to show whether a recipe fits within description of a given style	P, SB, S	ProMash lets the user decide whether to use the American Homebrew Association guidelines or the more popular Brew Judge Certification Program standards. Strange Brew and the most recent version of Suds come with the BJCP style guidelines built in. All these programs let the user edit the style guidelines.
Inventory of ingredients on hand	P, SB, S	Handy, but not critical.
Built-in note-keeping system	P, SB, S	No calculations, so you don't really need a computer for this, but good record-keeping is the major point of using brew software.
Water usage calculator to determine how much water will be needed at each stage	P, SB, S	Very useful.
Calculator to determine temperatures for mash infusions or decoctions to yield target mash temperatures	P, SB, S	Takes away a lot of guesswork.
International Bitterness Unit calculator	P, SB, S	Calculating IBUs is the trickiest things these programs attempt. The results you get will give you a relative sense of bitterness. Don't expect the numbers to be exactly accurate. There are too many variables the programs can't account for adequately.
Grain database, with gravity attributes of each grain included	P, SB, S	ProMash comes with a larger database of grains than either of the other programs. Users can add to and edit items in the databases of all the programs.*
Hop database, with typical alpha-acid levels included	P, SB, S	ProMash comes with a larger database of hops than either of the other programs reviewed here. Users can add to and edit items in databases.*
Yeast database with yeasts available from major providers included	P, SB, S	ProMash comes with a larger database of yeasts than either of the other programs reviewed here. Users can add to and edit items in databases.*
Database of other additives	P, SB, S	Users can add to and edit items in databases.
Water profile tool that helps brewer create water similar to that in a given brewing region, including database of water profiles from major brewing centers	P, SB, S, O	BreWater and Strange Brew also include tools that suggest amounts of different water additives to mimic a selected target water profile, which is convenient, but not critical.
Tools to convert units and resize recipe	P, SB	ProMash lets users decide whether to use American or metric measurements. Strange Brew allows users to select specific units.
Carbonation calculator to determine how much sugar or dry malt extract to add to reach a target carbonation level	P, SB	Not strictly necessary, but nice to have.
Hydrometer temperature correction calculator	P, SB	Not many homebrewers would want to do this calculation, a third-order polynomial, in their heads.
Dilution calculator to determine how much water or secondary wort is needed to add to bring primary wort to a target gravity.	P	No brewing session runs exactly as planned. This tool could take the guesswork out of saving a batch.
Refractometer utilities	P	Wort gravity, gravity during fermentation and more.
Other goodies		<ul style="list-style-type: none"> Suds offers a version for hand-held computers running Window CE. ProMash offers mini-tools for both Palm and Windows CE hand-held.

* From time to time, ProMash updates its program and databases, and users can download the free updates from the Website.

Software cost comparison

Software	Website	Cost
ProMash	<ul style="list-style-type: none"> • http://www.promash.com • E-mail: jeffrey@promash.com • Telephone: 805-252-3816 	<p>\$24.95</p> <p>A free evaluation version is available to download. With the evaluation version, you may create and/or modify and save three recipes, and create and/or modify and save nine brewing sessions. Recipe and brew session printing is disabled in the evaluation version.</p> <p>The full version is available to purchase and download from the site. You may also find it on disk at your favorite brew supply store.</p>
StrangeBrew	<ul style="list-style-type: none"> • http://www.strangebrew.ca • E-mail: drew@strangebrew.ca 	<p>\$15</p> <p>Can be used free for 30 days before some features are disabled. After that, full use requires registration and the \$15 fee.</p>
Suds	<ul style="list-style-type: none"> • http://oldlib.com/suds/ • E-mail: suds@oldlib.com 	<p>\$20</p> <p>Full versions can be used for free for 30 days before registration is required.</p>
BreWater	<ul style="list-style-type: none"> • http://home.elp.rr.com/beerbrew/ • Email: kenbob@elp.rr.com 	<p>A self-extracting file with the program is at http://home.elp.rr.com/beerbrew/water/bw3setup.exe</p>

statistics and gives you lists of other styles the recipe matches.

The slider lets you specify how close you want the match to be, and the list will grow or shrink accordingly. A recipe for helles bock/maibock that comes with the program, for example, is an excellent match as a Belgian dubbel or a Scottish export 80-shilling, according to the software. For a not-as-close match, the program lists about a dozen styles the recipe could also fit. I have found this concept useful in entering contests when the beer I had on hand wasn't one that the contest was accepting.

Other features include Web-ready recipe publishing, xml import/export, inventory management and automatic shopping-list creation, and a mash profiler that allows unlimited steps. Avis is starting work on a similar program for wines, ciders and meads.

System requirements: Windows 95, 98, 2000 or NT4 running a Pentium 90 or faster with five megabytes of free disk space.

SUDS 6.1

Suds is probably the most basic of the three leading programs. The latest version, Suds 6.1, was released in

January to replace Suds 97 and the Suds 6 beta testing version.

Suds gives you a single place for all your recipes, log entries and miscellaneous brewing comments. It includes a formatted log entry system, recipe formulator, water addition calculator, and a host of other features.

The great thing about Suds is that it's simple to use and it gives you a really easy-to-read look at how well your recipe matches the style you're aiming for. For example, I used Suds to create a recipe for weizenbock, a strong, wheat-based beer. I used 8 pounds of wheat malt, 4 pounds each of pilsner and Munich light malt, 7.5 ounces of CaraMunich, and 6 ounces of flaked oats. The program's simple style comparison page showed me a very clear table that said my original gravity — 1.077 — was right in the range for the style, which is 1.066 to 1.080.

I used 1 ounce of Tettnanger hops with 4.5 percent alpha acid in the boil for 60 minutes, and a half-ounce more of the same hops for the final 15 minutes of the boil. The style comparison page shows — in bright red — that my bitterness might be a bit high: 19.8 International Bitterness Units, compared with a range of 10 to 15 IBUs.

It's worth mentioning that many of the calculations provided by these programs are "guestimations." The program can't account for all the variables involved with getting a completely accurate bitterness figure, for example. Suds gives the user a choice of four different ways to calculate bitterness.

Unlike some other brew programs, Suds does not include a water profiling tool, a convenient way to resize recipes, or a tool to convert units, which is handy if you need to know, for example, how many ounces of hops you have in a package labeled only in grams. Both other brew programs reviewed here have those features.

Suds 6.1 can be downloaded from the software's site and used for 30 days for free. To use it thereafter costs \$20. Registered users of Suds 97 can upgrade for free.

Taylor says his program is best for people who are familiar with the basics of brewing and are ready to take the next step. "My program kind of evolved to my level of expertise. I'm an intermediate to early advanced all-grain brewer," he says. About 2,300 brewers have registered as Suds users.

System requirements: Suds 6.1 runs on Windows95, 98, ME, 2000 or

XP. A Pentium processor with 133 MHz is recommended. The program needs 32 megabytes of memory.

It's the water

If you use either StrangeBrew or ProMash, you can use the program to help make your brewing water similar to the water where the style you're brewing originated. To use this tool, you will need to know some details about the water you use. Information about calcium, magnesium, sodium, sulfates, chlorides, carbonates and alkalinity are available from municipal water districts. If you use well water, you'll need to have a water analysis done to get that data.

Additives used to adjust water profile include gypsum, epsom salts, baking soda and several other items. Each of those adds a mix of chemicals. The water profiling tools calculate how much of each compound will be added by a given amount of an additive. The brewer may need to add small

amounts of several additives to approximate the water he is after.

If you use Suds, which doesn't have a water profiler, you can download a separate free program called BreWater to create a water profile appropriate for whatever beer you're brewing. StrangeBrew and BreWater each have a neat gizmo that suggests amounts of various additives to approximate your target brew. With ProMash, you're on your own for picking out which additives and how much to use. You'll need to experiment in the program, adding a bit of one or another ingredient until you find a mix that works.

How to get up and running

The simplest way to start is to select a program you'd like to try and go its Web site. Download the program and set it up on your computer. At that point, poke around and learn a little about the program's features. Try selecting a recipe and making changes in it to see how the program works.

We should mention that all three programs will not always produce the same answer for the same calculation. Why? Because each software may employ different parameters or brewing calculations. By way of easy example, the gravity value for light malt extract syrup is 1.038 in Suds, 1.035 in ProMash and 1.034 in StrangeBrew. So the programs yield slightly different results for a recipe with the same ingredients. When I entered the same recipe but set the gravity potential equal for all ingredients, the resulting OG was the same in all programs.

Using a computer can enhance your brewing at any level. The more complex your brewing regime, the more use you might get out of a software program. But even novice brewers can make use of these tools. So next time you're planning a batch, flip on your computer! ■

Patrick Twohy is a homebrewer and freelance writer in California.



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CIRCLE 13 ON READER SERVICE CARD

If you make the transition from extract to all-grain brewing, you have a lot of options to consider when building a recipe. That's not a bad thing — in fact, that's the reason some brewers make the switch. You can use different kinds of grain, different ratios of grain, different mashing temperatures and mashing methods. The possibilities are endless. And they can be bewildering.

Along with these options come a lot of new ingredients ... and new terminology to describe them. In this article, we're going to get down to basics — literally. When brewing beer from grain, most recipes start with the group of malts known as “base malts.”

Base Malt: What Is It?

Beers are differentiated from each other by their color, flavor, alcohol content, hopping and many other factors. But they all have one thing in common before they become an individual beer style — fermentable sugars that form the “base” of the beer. This base of fermentable sugars comes from the starches in the base malts. They're called base malts precisely because they form the base of the beer. They typically comprise anywhere from 60 to 100 percent of the grist.

Once you have this base, changing other things in the recipe, like hops and specialty malts (specialty malts, for the purposes of this article, I define as dark and crystal malts) make the beer what it is. For example, all cakes consist mainly of flour. That's the base. What makes it into chocolate cake is chocolate flavoring.

The base malt has several functions in a recipe. The first, as I mentioned, is to provide the base of fermentable sugars for the beer. The majority of the alcohol content of the beer is established by adjusting the amount of base malt in a recipe — the more malt, the more alcohol. The sec-

ond function is to provide the base flavor profile for the beer. This is most important in beers that don't use a lot of specialty malts in addition to the base malt. In other words, if you use a lot of flavorful specialty malts, their flavor will tend to mask the flavor of the base malt. Conversely, if there are little to no specialty malts in the recipe, the flavor of the base malt is more important. Last, the base malt provides enzymes to convert its starches into sugars. It also provides extra enzymes to convert specialty malts (like carapils) and adjuncts (like corn or flaked barley) that lack enough enzymes of their own to do the job.

Types of Base Malt

In this article, I will discuss five common kinds of barley base malt: pale, pilsen, pale ale, Vienna and Munich. There are other kinds of barley malt that can form the base of a beer, like stout malt. And some brewers might not consider Vienna and Munich to be bona-fide base malts, because they're usually used in conjunction with pale malt and rarely comprise more than 30 percent of the grist (I'll address this later). By and

Get Grain *on* YOUR BRAIN

By Mark Garetz

From two-row to pale ale and pils, a guide to FIVE COMMON BASE MALTS — how they're made, how they're used and how to brew with them.

large, however, these five malts provide the base for a wide range of beers.

Basic Pale Malt

This is the most common type of base malt, and it is used as the sole malt for 95 percent of all beers. It is very light in color — usually about 1.8 to 2.1 degrees Lovibond. If your beer was made strictly from this malt, it would be a medium yellow color. Pale malt typically has lots of enzymes — enough to convert its own starch and the starch from good deal of adjuncts, up to 50 percent of the total grist. Pale

malts are well modified, which means it's easy to convert their starches into sugars. Any type of mashing schedule can be used with them, single-step infusion being the most common.

Pale malt is sold in two forms — two-row and six-row. The most common form used by home and craft brewers is two-row, while big commercial breweries will typically use a lot of six-row. The names come from how the grain actually grows on the stalk. Two-row has two kernels that grow opposite each other on the stalk. They tend to be large and uniform in size. Six-row,

as you might guess, has six kernels that are slightly smaller than two-row kernels. Six-row has even more enzymes than two-row, which is important to megabreweries that use a high percentage of adjuncts, like rice or corn, in the beer. Six-row also yields better in the field, which tends to make it a little cheaper than two-row. Again, this is only important in megabreweries, where saving a few dollars a batch can really add up. For small-scale and homebrewers, the savings would never be enough to bother with. Six-row is also reported to have a



PHOTO BY CHARLES A. PARKER

sharper flavor by some brewers. Two-row lends a rounder flavor to your beer. So the take-home advice here is this: Always use two-row, regardless of what the recipe calls for or what someone may tell you.

Pale malt is often called other things. The most common nickname for it is two-row, but that really is a misnomer since almost all malts available to homebrewers are made from two-row barley. Still, I call it two-row myself. It's also known as "lager malt," not to be confused with pilsen malt (described later). Two-row is also sometimes referred to by the name Klages (pronounced like "claw guess"). Klages is the name of a variety (technically a "strain") of barley. Many years ago, the most common two-row available in North America was Klages, and if you bought two-row you stood a good chance of getting 100 percent Klages barley. Hence "Klages" became another nickname for two-row. But that was long ago. Klages still makes up a

tiny percentage of available two-row malts, but almost all are now blends of Klages and other malts. Harrington is common, but new varieties are being released all the time. So my advice to you is not to worry about what specific varieties of malt are in your two-row. You have to trust your maltster to give you a blend that will make good beer. (Some North American homebrew suppliers still sell their malt as 100 percent Klages or just Klages. This is either due to ignorance, being too lazy to change the catalog from a few years back, or they want you to believe you are getting something you're not.) In England you can buy unblended varieties of malt, such as Maris Otter.

Pale malt can be used to make all types of beers. In fact, it should be used to make almost all kinds of beers. It's the least expensive type of base malt and if your beer uses a lot of specialty grains to change the flavor, the base malt hardly matters. Is pale malt basically the same from supplier to suppli-

er? No, but the differences tend to be extremely subtle. Some have a more pronounced maltiness or fuller flavor profile than others. If you're making a pale beer that is essentially all two-row, these subtle differences will be apparent in the final beer. So here it may be wise to use the base malt that has a flavor that you like, or that you want in the final beer. But if you are making a stout, for example, the flavors of roasted grains in the finished beer will overpower any subtle malt effects from the two-row.

Pilsen Malt

Sometimes just called "pils," pilsen is a special kind of pale malt that is used to make — you guessed it — pilsners. Pilsen malt is typically very light in color (anywhere from 1.1 to 2 degrees Lovibond). This malt typically tastes thinner and crisper than regular two-row, which carries over into the beer. Getting this flavor is usually at the expense of maltiness and aroma.

BASE MALTS BY THE GLASS

1. Pilsen malt is used to brew traditional Czech or German pilsners. 2. Munich malt is used in Oktoberfests and many German lagers, like dunkel. It also shows up in ales, from IPA to porter. 3. Pale ale malt is like two-row, but is kilned at a higher temperature. This flavorful malt is used to make ales, especially traditional English ales. 4. Vienna has a malty flavor profile. It's used in Vienna lagers. 5. Pale malt, often called "two row," is the most common base malt. It's used as the sole base malt in 95 percent of all beers.



PHOTOS BY IAN MACKENZIE

THE BASE MALT RECIPE FILE

NOW THAT YOU UNDERSTAND base malts, how do you use the knowledge? The best advice I can give you is to brew and see what happens. Brewing is like cooking. You taste your ingredients. You think about what the ingredients taste like and what the finished beer should taste like. Then you put together a recipe and see what happens. With that in mind, I've put together a starter recipe file. These simple all-grain recipes should give you some ideas about how base malts can be used and how each malt will taste in the finished beer.

All of these recipes are for five gallon batches and all use a single-step infusion mash at about 154° Fahrenheit. Mash in all the grains together. To each recipe you can add a quarter-pound of flaked barley for head retention. I also recommend one tablespoon of Irish moss added at the beginning of the boil. (Most homebrewers add it near the end of the boil. That works as long as you rehydrate the Irish moss first, which most homebrewers don't do. Adding

it at the beginning eliminates the need for rehydration.)

Some of these recipes are ales, some are lagers. You can brew the lagers as ales if you don't have any way to control the fermentation temperature. All the ale recipes (and lager recipes made as ales) should be fermented at 70° to 72° F. If you use lager yeast for the lagers, start the fermentation at 70° to 72° F, then lower it to 54° once the fermentation has started in earnest.

I've given you the bittering hops for these recipes in IBUs, or International Bittering Units. This is a measure of how bitter the final beer should be. IBUs take into account hop utilization, which is an expression of how efficiently you use the bittering compounds during the boil. It also accounts for losses during fermentation. To calculate the weight of hops you need, use the following formula:

$$\text{hop weight in ounces} = \frac{\text{Gallons} \times \text{IBUs}}{\% \text{ Util} \times \% \text{ Alpha Acid} \times 0.749}$$

If you know your approximate utilization, great. If you don't, here are some guidelines: For the novice brewer, you'll probably get 24 to 26 percent utilization for the one-hour recommended boil. Most all-grain brewers will probably get 26 to 28 percent utilization. Advanced brewers or brewers with really great kettles and burners are more likely in the 30 to 33 percent range.

Using the Extra Pale Ale recipe as an example, I call for 30 IBUs of bitterness in a five-gallon batch. The top half of the equation looks like 5×30 , which equals 150. Assuming your utilization is 28 percent and your Galena hops are at 13 percent alpha acid, then the bottom equation looks like $28 \times 13 \times 0.749$, which equals 273 (rounded up). Now divide 150 by 273 to get about 0.55 ounces of hops. Note that these calculations only apply to the bittering hops (in the example recipes, always a single addition of a single variety). All other hop additions should not be adjusted based on alpha acid. Just use the weight listed.

Two-Row Extra Pale Ale

OG = 1.048 FG = 1.012 IBU = 30

This recipe is very simple, but it makes an excellent beer. It's a great way to evaluate two-row malt.

Ingredients:

8.5 lbs. pale malt (two-row)
30 IBUs Galena hops (bittering)
1 oz. Cascade hops
(5 minutes before the end of boil)
1 oz. Cascade
(steeped for 10 minutes after the boil or dry-hopped)
Wyeast 1056 (American Ale) or
White Labs WLP001 (California)

Step by Step:

Mash in 10.6 quarts of water to bring the mash to a temperature of 154° F. Let stand 30 minutes. Sparge

with 180° F water to collect 6 to 7 gallons of wort. (The exact amount will depend on how much you boil off. The idea is to end up with 5 gallons of wort.) Bring the wort to a boil. Add 1 tablespoon Irish moss and the bittering hops. Boil for 55 minutes, then add 1 oz. of Cascade, stirring in well. Boil another 5 minutes. Shut off the heat, stir in another ounce of Cascade and cover the kettle. Let stand 10 minutes, then cool to 72° F. Transfer to the fermenter and pitch the yeast. Ferment until done (gravity has stopped dropping). Bottle or keg.

German Pils

OG = 1.045 FG = 1.011 IBU = 25

Another simple recipe, but you will really taste the pilsen malt.

Ingredients:

8 lbs. pilsen malt
25 IBUs Tettnanger hops (bittering)
1 oz. Tettnanger hops
(5 minutes before the end of boil)
Wyeast 2278 (Czech Pils) or White Labs WLP800 (Pilsner) to make as a lager; Wyeast 1056 (American) or White Labs WLP001 (California) to make as an ale.

Step by Step:

Mash in 10 quarts of water to bring the mash to a temperature of 154° F. Let stand 30 minutes. Sparge with 180° F water to collect 6 to 7 gallons of wort. Bring the wort to a boil. Add 1 tablespoon Irish moss and the bittering hops. Boil for 55 minutes, add 1 ounce of Tettnanger, (recipes continued on page 35)

BARLEY BASICS

Barley, whether raw or malted, plays an important role in the global economy. The majority is grown in cool-climate countries, although some is grown on the hillsides of Mexico, Latin America and beyond. Most barley is used as animal feed and an ingredient in food. Malted barley, either as flour or an extract, is used in cereals, snacks, crackers, candy, health drinks and many more products.

Barley malt is the basic ingredient in beer. Why barley? For starters, it's a win-win situation for everyone. The supply and demand is fairly consistent, as is the price. The farmer gets to plant the crop early in the spring and harvest in early summer. It is an "in-between" crop: it is harvested after oats and winter wheat and before spring wheat. Yields are good, and it is friendly to the soil.

As every maltster knows, barley contains everything needed to produce a quality product for the brewer. The kernel has all the necessary enzymatic power to convert the flint-hard barley kernel to a soft, modified kernel of malt. Barley has a fairly neutral flavor and color, so the maltster can create the precise characteristics needed by the brewer. The brewer, in turn, can blend malts and adjust his procedures to develop whatever beer style he selects. Because of its husk and natural pH adjusting, barley malt is the easiest grain to brew with.

What barleys are available and which ones should be used in beer? Until recently, within the last eight to ten years, most of the barley grown in the United States was a six-row variety. The main growing area for six-row is western Minnesota, North Dakota and South Dakota, a region known as the Red River Valley. Each of the Western states also grow some six-row.

By far the largest crop of six-row is Robust. More than three-fourths of the acreage planted in the Red River Valley is Robust, because it is preferred by the big brewers. The barley has excellent enzymes and produces a clean, sweet, mild malt flavor, making it very versatile in creating beer styles. The Stander variety is rather widely grown but is not very popular with either the maltster or brewer. It is what is described as "hot," which means it has excessive levels of the alpha and beta amylase enzymes. The next most-popular strain is Excel. This tends to have a little higher protein level and a sharper, more husky flavor. If the homebrewer

buys a six-row base malt, he can expect that Robust would be the majority, if not all, of the product, with maybe a little Excel, Foster or B1602.

In the United States, two-row varieties have become very popular. Two-row is grown mostly in the Western states and much of it is on irrigated land. Irrigation allows the farmer to control nature and control the quality of the barley, at least to some extent. Moisture — or lack of it — during the development stage determines the kernel plumpness, color, starch-to-protein ratio and brewing quality.

Up until 1997, Klages was the primary two-row variety. The maltsters and brewers loved it. It was easy to work with, had good brewhouse yields, a nice color and flavor, and low protein, but the farmer was not happy with his agricultural yields. In 2001 there was very little, if any, Klages grown in this country, except under contract. It is doubtful that any Klages malt would find its way into a homebrew shop.

Harrington is the most widely grown two-row malting variety. It has many of the Klages characteristics but a big disadvantage — the husk is very loose. During malting, far too much husk is lost. We all know how important husk is for lautering during all-grain brewing!

Moravian is grown in Colorado, Idaho and Wyoming, under contract to Coors. The original Moravian variety has undergone many generations since the barley was brought over from Czechoslovakia. It is very difficult to malt and requires changes in brewhouse procedures. It has a distinctive flavor, regardless of how it is malted. If you can get some, try it. It makes an interesting brew.

Metcalf is grown in Canada. The flavor is a bit different from Harrington, and the husk stays on the kernel. A bit of Alexis also is grown in the States. This variety is popular in the UK. It tends to have low protein, usually in the 9 percent range, and low enzymes, so it takes careful time and temperature control during mashing.

Each barley will give slight flavor differences and may perform a little differently in the brewhouse. Trying new base malts can be a challenge, but that's what makes homebrewing fun!

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but that's what typifies a real pilsner. To get this flavor profile, the maltster will typically keep this malt less modified than regular two-row. Some would say it is under-modified, but that is rarely actually the case. It is modified well enough so that a single-step infusion mash presents no problems (this is the simplest kind of mashing, conducted at a constant temperature in a single vessel). Sometimes pilsner malt doesn't have a lot of enzymatic power to spare, so it can't convert itself and a load of adjuncts. But you really don't want anything else in a true pilsner anyway, so it's of little concern.

Pilsen malt is used to make one type of beer — traditional German or Czech pilsners. Those beers usually consist of 100 percent pilsen malt and nothing else but hops, yeast and water. If you have pilsen malt on hand and nothing else, you could use it to make almost any other beer style, but standard two-row would be a better choice. I can't tell you how many times I've seen a recipe call for 90 percent two-row and 10 percent pilsen as the base malts. That's a complete waste of pilsen and a complication in the recipe that makes no sense. Just use all two-row — you'd never taste the pilsen in that recipe. I've also seen pilsen malt called for in a lot of other German beers, like Munich. This is not a good choice. (It is more than likely an example of choosing a malt because it sounds right, rather than thinking about what the beer should actually taste like.) Use pilsen malt for brewing pilsners and that's it.

Pale Ale Malt

This malt is basically the same as standard two-row, but it is kilned at a slightly higher temperature. This results in a darker color (it measures about 3 to 4 degrees Lovibond) and it also changes the flavor profile. Pale ale malt can be very flavorful and malty, with a good malt aroma. It tends to be the most modified of all the base malts and it works well with any mashing schedule, from single infusion to step mashing. It has a fair amount of enzymatic power and can convert itself and some extra adjuncts, up to 50 percent

the base malt recipe file

stirring in well. Boil another 5 minutes. Cool to 72° F. Transfer to fermenter and pitch the yeast. Ferment until done (gravity has stopped dropping). Bottle or keg.

Extra Special Bitter

OG= 1.050 FG = 1.013 IBU = 25

This recipe shows a typical use for pale ale malt. The small amount of chocolate malt will give this beer a nice copper color. This is a real English ESB; don't expect it to be like a RedHook ESB, which is actually more of a light ale.

Ingredients:

8 lbs. pale ale malt
1 lb. crystal malt (15° Lovibond)
0.10 lbs. chocolate malt
25 IBUs Galena hops (bittering)
1 oz. Willamette hops
(5 minutes before end of boil)
Wyeast 1968 (Special London) or
White Labs WLP002 (English Ale)

Step by Step:

Mash in 11.4 quarts of water to bring the mash to a temperature of 154° F. Let stand 30 minutes. Sparge with 180° F water to collect 6 to 7 gallons of wort. Bring the wort to a boil. Add 1 tablespoon Irish moss and the bittering hops. Boil for 55 minutes, then add 1 ounce of Willamette, stirring in well. Boil another 5 minutes. Cool to 72° F. Transfer to the fermenter and pitch the yeast. Ferment until done (gravity has stopped dropping). Bottle or keg.

Oktoberfest

OG= 1.067 FG = 1.017 IBU = 18

This recipe makes a traditional Oktoberfest. It uses basic two-row for most of the fermentables, with Vienna and Munich for flavor, aroma and color. Carapils adds body.

Ingredients:

9 lbs. pale malt (two-row)
0.5 lbs. Vienna malt
1.5 lbs. Munich malt
1 lb. carapils
0.5 lbs. crystal malt (95° Lovibond)

18 IBUs Tettnanger or Mt. Hood
hops (bittering)

0.5 oz. Tettnanger or Mt. Hood
(5 minutes before end of boil)

Wyeast 2206 (Bavarian) or WLP820
(Oktoberfest) to make as a true
lager; Wyeast 1056 (American) or
White Labs WLP001 (California) to
make as an ale

Step by Step:

Mash in 15.6 quarts of water to bring the mash to a temperature of 154° F. Let stand 30 minutes. Sparge with 180° F water to collect 6 to 7 gallons of wort. Bring the wort to a boil. Add 1 tablespoon Irish moss and the bittering hops. Boil for 55 minutes, then add 0.5 oz. of Tettnanger or Mt. Hood, stirring in well. Cool to 72° F. Transfer to the fermenter and pitch the yeast. Ferment until done (gravity has stopped dropping). Bottle or keg.

India Pale Ale

OG = 1.063 FG = 1.016 IBU = 35

This is definitely a West Coast, hophead IPA. It uses Munich malt for body, color, flavor and aroma (something has to compete with those hops to balance the beer!). I included this recipe so you could see a non-traditional use of Munich. Try it, you'll like it!

Ingredients:

8.5 lbs. pale malt (two-row)
1.5 lbs. Munich malt
1 lb. carapils
0.5 lbs. crystal malt (15° Lovibond)
0.25 lbs. crystal malt (95° Lovibond)
35 IBUs Galena hops (bittering)
1.5 oz. Cascade hops
(5 minutes before end of boil)
1 oz. Cascade (dry hop)
0.5 oz. Columbus (dry hop)
Wyeast 1056 (American) or
White Labs WLP001 (California)

Step by Step:

Mash in 14.7 quarts of water to bring the mash to a temperature of 154° F. Let stand 30 minutes. Sparge with 180° F water to collect 6 to 7

gallons of wort. (The exact amount will depend on how much you boil off. The idea is to end up with 5 gallons of wort when you pitch the yeast.) Bring the wort to a boil. Add 1 tablespoon Irish moss and the bittering hops. Boil for 55 minutes, then add 1.5 oz. of Cascade, stirring in well. Boil another 5 minutes. Cool to 72° F. Transfer to the fermenter and pitch the yeast. When fermentation starts to slow down (characterized by the vigorous activity starting to subside) add 1 oz. of Cascade hops and 0.5 oz. of Columbus. Stir in well with a sterile spoon. Ferment until done (gravity has stopped dropping). Bottle or keg.

Super Smooth Porter

OG = 1.049 FG = 1.012 IBU = 25

This will give you a nice, smooth porter with a good deal of flavor and body. Both light and dark Munich are used in this recipe. Normally I'd use more chocolate malt, but I've cut it down to allow for the use of the dark Munich, which will add a lot of toasty flavor on its own.

5 lbs. pale malt (two-row)
1 lb. light Munich malt
1.5 lbs. dark Munich malt
1 lb. carapils
0.5 lbs. chocolate malt
0.25 lbs. black patent malt
25 IBUs Willamette hops (bittering)
Wyeast 1056 (American) or White
Labs WLP001 (California)

Step by Step:

Mash in 11.6 quarts of water to bring the mash to a temperature of 154° F. Let stand 30 minutes. Sparge with 180° F water to collect 6 to 7 gallons of wort. (The exact amount will depend on how much you boil off. The idea is to end up with 5 gallons of wort.) Bring the wort to a boil. Add 1 tablespoon Irish moss and the bittering hops. Boil for 60 minutes. Cool to 72° F. Transfer to the fermenter and pitch the yeast. Ferment until done (gravity has stopped dropping). Bottle or keg. Enjoy! —M.G.

BASE MALT EXTRACT ESSENTIALS

PHOTO BY CHARLES A. PARKER



Let's see a show of hands. Everyone who was brewing when Blue Ribbon malt extract was the only "beermaking" extract you could find, raise your hand. OK. Now let's see how many of you know what base malt was used to make Blue Ribbon. No hands? I didn't think so. It's only been within the last 20 years that most homebrewers developed a desire to know not just whether their products would make beer, but exactly how those products are derived. In his article on base malts, Mark Garetz walks you through five malts that are used as a base in all-grain brewing. Which begs the questions — what are the base malts used to make malt extract, and if you want to work with one of the malts Mark mentioned, which extract do you use?

By starting with an unhopped, 100 percent malt extract, a skilled homebrewer can create almost any beer style in existence. Today's high-quality malt extracts — the well-known "name brands" that are formulated specifically for brewing — have a high degree of fermentability, sufficient FAN (free amino nitrogen) for yeast nutrition and mid-sized proteins for a creamy, long-lasting head. These top-of-the-line extracts are made with choice base malt, usually from the barley variety that's dominant in the country where the extract is produced. In the United States, for example, that would be Harrington two-row pale malt.

Depending on the extract type, specialty malts also may be included. No manufacturer is going to release their recipe, but with careful tasting and experience, it's possible to make an educated guess about what malts your favorite brand includes.

The most important thing to remember when selecting an unhopped malt extract is this: If you are not working with a high-quality extract, it does not matter what base malt produced it. Stick with extract producers who have been recognized as making high-quality extracts intended primarily for beer making. Next, seek out technical information on the malt extract you're considering. This will tell you if the base malt used in producing the extract is the same as, or similar to, the base malt you would use in all-grain brew. All the better producers include this information on their Websites, so read the spec sheet carefully.

The age of the malt extract is also important. It doesn't matter if the base grain used in producing a malt extract was a lightly kilned pilsner malt if the extract in the can is two years old. It will be dark. Look for the "use by" date or the production date on the bottom of the can. If there is no date, either try a different brand, or look for a brand that seems to be selling through well at your local shop. And always purchase a malt extract that specifically says "100 percent malt extract." If it doesn't specify that, the extract could be cut with cheap corn syrup.

Let's run down each of the five base malts in the article and see how they translate to unhopped malt extracts. I mention a few brand names by way of example, but this list is not meant to be comprehensive. If you have a favorite extract brand, simply do a little research

and learn about the base malts that are used to produce it.

Two-Row Pale & Pale Ale Malt

Two-row pale malt is the base for almost all ales, and is also the base grain used in almost all malt extract production. As long as the malt extract is from a quality producer, you can substitute "Light" or "Extra-Light" malt extract for just about any recipe that calls for two-row or pale ale malt. This includes liquid or dry malt extract.

Pilsen Malt

Coopers uses two-row Schooner, an Australian pilsner barley, in the production of its extracts. To my knowledge, Coopers is the only company that uses pilsner barley in the production of malt extract. Many producers offer an "Extra-Light" malt extract in both liquid and dry form that will work well also.

Vienna Malt

Vienna malt is rarely used by commercial brewers these days and is not used at all in malt extract production. You can best simulate the body and color of Vienna malt by combining in equal quantities a relatively light Amber DME, like Muntons Amber, with a Light DME.

Munich Malt

Briess Amber contains between 15 to 50 percent Munich malt. You can substitute it for Munich, but you'll be guessing a bit on the ratios. St. Patrick's of Texas has a proprietary product, Maries malt extract, that is 50 percent Munich. If your Oktoberfest recipe calls for up to 25 percent Munich malt, then a 50-50 mix of either of these two extracts with a good Light malt extract will put you in the right ballpark.

Mark Henry imports Coopers beer and winemaking products into North America. He lives in California.

of the total grist. As the name implies, this malt is primarily intended to make ales, especially traditional English ales. It's too dark for a pilsner. It can also be an excellent choice for Belgian-style amber ales.

It's common for this malt to be made by specialty maltsters in the United Kingdom. It's also common for the specific barley variety to be featured. Maris Otter is a British variety of barley commonly associated with this type of malt. (Maris is the name of the company that markets the barley seeds to growers, while Otter is the variety. Yes, there is a barley called Maris Beaver, and other varieties named after small furry creatures, but they aren't used in brewing.) This malt is also sometimes sold as ESB (Extra Special Bitter) malt. Darker versions are known as Amber and Mild malts.

Vienna Malt

This is a very special kind of base malt. It is more highly kilned than two-row and is typically around 4 degrees Lovibond. Vienna's flavor profile is very malty but can have some grassiness to it. Most Vienna has just enough enzymatic power to convert itself, but some strains may have as much enzymatic power as two-row. Vienna is well-modified and can work with any kind of mash schedule.

The primary purpose of Vienna is to make Vienna-style lagers. These beers are similar to Oktoberfests (also known as Märzen) but have a lower alcohol content. Trying to find a true "Vienna" these days is hard. Samuel Adams Lager is actually a good representation of a Vienna-style lager (it's probably a tad too hoppy to be a real Vienna), but they don't market it as such. Even if you don't want to brew a Vienna, Vienna malt has other uses. It's typically used as part of the grain bill in Oktoberfests and other German lagers (but not pilsners). You can also use it in any other recipe in which you want the flavor of Vienna malt. You also could make a beer out of 100 percent Vienna (some brewers use this to make an amber beer), but I wouldn't recommend it. Five to ten percent Vienna is a good starting place when

used as a specialty malt for flavoring. A Vienna lager, on the other hand, might use 30 to 40 percent Vienna as one of its base malts, with regular two-row comprising the rest of the grist.

Munich Malt

Munich is a very useful malt for the all-grain brewer. It is more highly kilned than Vienna malt and runs the gamut from 6 to 30 degrees Lovibond. The most typical range, however, is 8 to 9 degrees Lovibond. When someone refers to Munich malt, they usually mean the lighter versions that measure 9 degrees Lovibond or less.

The flavor of lower color or "standard" Munich malt is malty with a slight toasty edge. This toasty edge increases with color, becoming the dominant flavor in the high-color Munichs. The low-color Munichs have enough enzymatic power to convert themselves, but above 15° Lovibond, Munich starts to lose enzymes at a rapid pace, so it must be used in conjunction with two-row (which you'd usually do anyway). Munich malts are well modified and require no special attention during the mash.

Traditionally Munich was used to make Munich-style lagers, which hardly exist commercially today. The closest you'll find in modern times is an Oktoberfest. (A historical perspective: These lagers were common centuries ago because Munich malt was one of the lightest malts that was available. It's not until relatively recently that maltsters have been able to make malts much lighter in color. It's reported that the "death" of the Vienna and Munich styles can be attributed to the introduction of pale malts and the resulting pilsner style.)

All that aside, Munich remains a very popular malt with brewers. It's always part of every Oktoberfest recipe, often in conjunction with some Vienna. A typical Oktoberfest grain bill might be 75 percent two-row malt, 15 percent Munich, 5 percent Vienna and 5 percent crystal malt (ranging from 60 to 90 degrees Lovibond). You should consider Munich for any German lager that's not a pilsner. The classic Munich lager is dunkel, and 100 percent medi-

um-color Munich malt can be used to brew this style. It's also a common ingredient in many ales. My IPA recipes will typically call for 5 to 10 percent Munich. I also use it in bock, doppelbock, porter and many other styles. It adds a nice maltiness to the beer, but be careful not to overdo it, or the toastiness will start to become apparent.

Dark Munichs really shouldn't be classified as a base malt, but we'll cover them anyway to show you how they differ from the lighter Munichs. The dark Munichs can be used anywhere you want their flavor. It's used by one famous brewery, for example, in their porter (I'd name the brewery, but I'm sworn to secrecy). The really dark Munichs have a very pronounced toasty flavor and can be used as a substitute in recipes that call for toasted malt. DeWolf-Cosyns produced a malt called Biscuit, which is similar to the high-color Munichs, but the company is supposed to be closing its operations in 2002. Should Biscuit disappear from the market, a high-color Munich would be a reasonable, but not an exact, substitute for that malt.

Why Are Vienna and Munich Base Malts?

Good question, since they rarely make up more than 30 percent of the malt bill. Part of the answer is historical — Vienna and Munich used to be the only base malts! But part of the answer lies in how much fermentability they contribute to wort. For all practical purposes, Vienna and the light Munichs contribute the same amount of fermentables per pound as the other base malts (as opposed to specialty malts, which contribute less). So, at least for purposes of this article, we can still consider them base malts.

Other Base Malts

The focus of this article has been base malts that are made from barley, but we should mention that other grains would qualify. Wheat malt would be the most common alternative. Spelt, millet, sorghum and other grains are used in parts of the world where barley is scarce.

Evaluating Malt

If you buy your supplies from the local homebrew shop, you may not have much choice when it comes to base malts. They may carry only one two-row and one Munich, and might not carry pale ale, Vienna or pilsen malts at all. But if you're lucky, your local shop will have a good selection. I used to own a homebrew shop in California, and at one point we carried three different two-rows, two pale ales, two pilsens, two Viennas and six Munich malts! On the Internet and by mail-order, you can find a similar range of selections at some of the better sites, and you can certainly get a wider range if you don't mind buying from a few sites.

So how do you evaluate the malts? Ideally it would be nice to brew a batch of beer with every grain type. (Check out the recipes on pages 33 and 35; each recipe is designed to highlight the flavor of one of the five base malts we've covered in this article.) Besides

brewing with each base malt, the simplest way I know to evaluate grain is simply to chew some and taste it. The enzymes in your saliva will "mash" the grains for you, so after chewing, let the grains sit a while. The enzymes will work on the grains, and starchiness will be replaced with sweetness. Pay attention to the flavors. Then choose what you like. Sometimes it's hard to project those flavors into the finished beer, but with practice, you will be able to do that. If you record your perceptions of the malt, then compare them to your perceptions of the finished beer, it will help you put the two together.

If your local store has a selection, chances are they'll let you graze in the grain bins for a while. If you are ordering online, then order a pound or the minimum of several different types. This will be a little expensive for a test, but it will be worth it.

Once you have picked the grain that tastes the best to you (ignore the marketing hype; your taste buds are

the ultimate judge), then order enough to do a batch and brew with it.

Caring For Base Malt

Base malts require more care in storage than specialty malts. Specialty malts can be stored for long periods of time, because in most cases they are kilned to such a high degree that there is no longer any starch or enzymes left. The starches have been converted to sugars or burned to a crisp. It makes little difference if specialty grains are stored cracked or whole, as long as they are kept cool and dry. (Some specialty malts have some starch and enzymes left, so find out about your malt when considering storage options.) But base malts are a different story. They contain lots of starch, and starch absorbs moisture much more readily than the sugars in the kilned malts. And the enzymes need protection. So it is crucial to store base malts in their whole, uncracked state for as long as possible. Ideally, you should



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crack the grain just prior to mashing. If kept cool and dry, cracked base malts are good for at least a month, sometimes three or four. Uncracked base malts can be stored for at least a year or more, if stored cool, dry and sealed so pests can't infiltrate.

Again, you can use your taste buds (and eyes and touch) to check your base malt for freshness. If the malt is crushed, it should still be dry and powdery. Any sign of gumminess is a sure sign of trouble. Taste the malt, too. It should be dry and, again, not at all gummy. You should be able to detect any stale or moldy flavors. If you taste any of these, toss the grain. It has gone "slack" and you can't brew with it.

One thing to be especially careful of is pests. All grain is susceptible to grain moths, grain weevils and rodents. But they particularly love starchy base malts. Rodents don't care if your grain is crushed or not, but weevils and moths just love crushed grain. Keep it in a tight container.

Crushed or Whole?

Many homebrewers wonder whether they should buy malt that's already been crushed, or invest in a grain mill. Ideally you should get a mill and crush your grain just before you use it. But that can be expensive and time consuming — not to mention a lot of work and mess. So a smart way to go is to buy your malt by the batch and have the shop crush it for you. You just have to be ready to brew soon after you get the grain. Unless you can pick up a bag of grain from your local shop, my experience is that you won't save a lot of money by buying your base malt by the bag. One thing I do not recommend is buying base malt by the bag pre-crushed, unless you intend to use it all right away.

Summary

Now we've covered all the bases! What are the important points? Pale malt (two-row) is used for just about every beer you brew. It's the primary

base malt. When selecting your pale malt, use two-row. There's no reason a homebrewer will need six-row. When you want to brew a pilsner, use pilsner malt exclusively. Don't muck it up with anything else. And don't bother with it anywhere else. Pale ale malt is useful if you want to brew traditional English ales. You can use it in other recipes, but be prepared for the extra color it will add. Vienna has a limited range, but experiment. Watch out for its grassy flavors. Munich has a lot of uses. Consider it for all German lagers (except pilsners) but don't try to use it for the sole malt. Use it in amounts of up to 30 percent in conjunction with two-row. It's a good all-around malt for adding malty flavors and aroma. But be mindful of its toasty edge. Play with the darker Munichs, especially in dark beers. The best way to understand base malts is to brew with them! ■

Mark Garetz is author of "Using Hops" and a frequent contributor to BYO.

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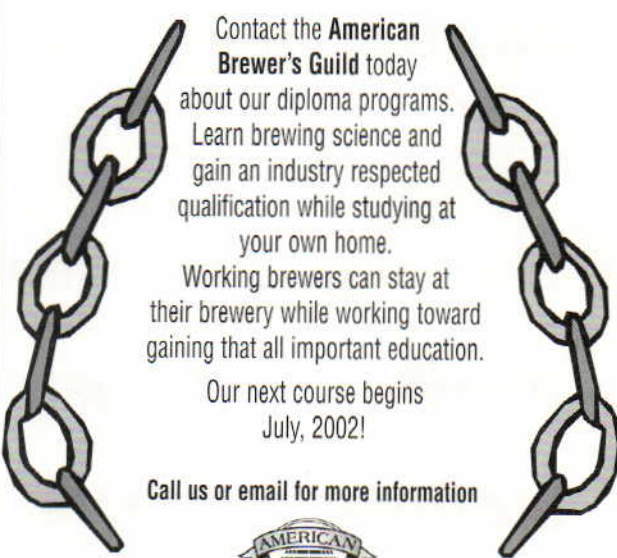
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MEAD IS A CLASSIC FERMENTED BEVERAGE

with a long history. Ancient text and drawings, some dating back as far as 4000 BC, mention both wine and mead. Several Biblical writings describe this wonderful drink, as do many Roman and Egyptian texts. The first detailed mead recipes began appearing in the early 1500s and make reference to these ancient texts.

Originally mead was made by fermenting honey and water with wild yeasts. Over time, many variations were invented. Some recipes add spices and some add fruit, while other recipes even call for adding grape juice! Each of these variations have taken on different names over the years — such as melomel, metheglin, pyment and cyser — but the foundation of these fermented beverages still remains sweet honey. Mead-making offers endless possibilities, giving the intrepid brewer a new arsenal of tools to use in the quest for making wonderful fermented beverages at home.

Mead can be fermented as either wine or beer. Some brewers ferment it with malt, and at a lower

HONEY

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original gravity, with the final beverage resembling and tasting much like ale. Others increase the starting sugars and ferment it so the resulting beverage has alcohol levels that resemble wine. Malt will be the primary determining factor in the final flavor; by adding it to your mead, the finished drink will resemble beer more than wine.

Where does honey come from?

As everyone knows, honey is produced by bees. The Latin name for honey bees is *Apis mellifera*, which means "honey carrier." The various flavors of honey, which include orange blossom, wildflower and clover, are the result of the different nectars collected by a hive of bees in a particular year.

The nectar collected by bees from various sources is primarily a complex combination of sucrose (cane sugar), dextrose (grape sugar or glucose) and fructose (fruit sugar). The nectar is stored in the bee's "honey sac" and transported to the hive. Enzymes are added

By Joe O'Neal

to the nectar inside the sac. The nectar is then delivered to the honeycomb, where the bees evaporate its moisture by fanning their wings. The nectar has now become honey, and the bees seal it into the comb with wax.

The composition of honey

The average composition of honey is water, amino acids and enzymes, dextrose, sucrose and fructose, minerals and organic acids. (Raw honey also contains pollen, wax and propolis, a gummy substance that bees use to seal the honeycomb. Commercial honey producers remove this waxy stuff by straining and filtering.)

Under most circumstances the amounts or percentage of each of these compounds can vary substantially. The sugars tend to have the most consistent levels; they average 80 percent of total composition, with water content averaging 17 percent. The remaining three percent is comprised of minerals, vitamins, proteins and enzymes.

The amount of water contained in honey is critical to its quality and to its stability. Honey with lower moisture levels contains more sugar, and is much less likely to begin fermentation during storage. This is because osmosis draws moisture from any wild yeast cells that may be present and helps to keep the yeast in a dormant state. Conversely, honey with higher moisture levels can become unstable if wild yeast are present, and spontaneous fermentation can begin. Honey will also draw moisture from the air so proper storage should always be an important consideration.

Average sugar content of honey

Fructose (d-fructose)	38.5%
Dextrose (d-glucose)	31.0%
Sucrose (table sugar)	1.5%
Maltose	7.2%
Other higher carbohydrates	4.2%

Storing Honey

Honey is a fairly stable product, especially high-quality honey (commercial "Grade A" honey has a maximum moisture content of 18.6 percent). Keep honey in airtight containers if possible and store at room tem-

peratures (70° F). Over time honey will darken with age and its flavor will change, due to contact with air and oxygen, but this does not denote spoilage. Honey that will be stored for extended periods can be kept at cooler temperatures (around 50° F), or even refrigerated if desired. Honey that has been diluted with water, or that contains higher moisture levels, should be stored very cold or used immediately, as fermentation by wild yeast will likely begin at room temperatures. Crystallization of honey is also common as it ages or if it is stored at cold temperatures. This is a natural process and gentle heating of the honey will return the honey to its liquid form.

Acidity and pH

Honey contains many different acids, including amino acids and other organic acids. Gluconic acid is the dominant acid in honey and is one of the primary factors in honey's flavor profile. The acid range in honey is generally between 0.17 to 1.15 percent. Total acids in honey are generally expressed as "meq/kg" (millequivalent/kilogram). pH values in honey range from 3.4 to 6.1. Most honey will average around 4.0 pH. It is important to note, however, that the PH does not always reflect the acidity values, but rather reflects a buffering action between organic and inorganic acids. When making mead in the style of wine, acidity and pH should be measured and adjusted with a titration kit. (More on adjusting acidity later.) If you're making mead in the style of ale, using pH papers should suffice. Keep pH levels in the 5.0 range (see "The pH pHiles" in the May 2001 issue for more on measuring and adjusting pH).

Different types of honey

Honey gets its flavor and consistency from the floral nectars on which the bees are foraging. North America has more than 300 floral sources for honey, and each nectar varies in the type of sugars, proteins, minerals and trace elements present. The small quantities of aromatic oils also differ between flowering plants.

Honey falls into one of two cate-

gories, "monofloral" and "polyfloral." The difference is whether the bees collected nectar from a single source or from different sources.

Another consideration in choosing a type of honey for mead-making is color. Color designations for honey range from "water white" to "dark amber." The color relates to the mineral content and is characteristic of the floral source. In general, the darker honeys will have stronger flavors than the lighter honeys. Not every kind of honey is good for making mead, so let's look at some that are excellent:

Tupelo: This light, golden-amber table honey is prized because it does not crystallize. It has a very high fructose-to-glucose ratio of 44:30. It is made from the nectar of the greenish-white flowers of the Ogeechee lime tupelo trees, which grow only in the swamps of northern Florida and southern Georgia. Tupelo honey is rare and the most expensive in America. Average price is \$4.50 to \$5 per pound.

Orange Blossom: This is the most aromatic of all honeys; it smells like an orange grove in full bloom. This honey comes from the citrus groves of southern California, and the 2001 orange blossom honey is exceptional. Other citrus honeys are often given this same name, though they may have come from a different citrus flower source. Average price is \$3.50 per pound.

Wild Buckwheat: This is a relatively dark honey, and the flavor is strong. Its flavor is often described as resembling malt, which explains its popularity with brewers. It is usually made from the wild buckwheat of Washington state, not the commercial buckwheat grown in the Northeast. Average price is \$3 per pound.

Clover: This is a light honey. The moisture levels tend to run on the high side, at about 18 percent, making clover honey a candidate for quick use. As with most of the lighter-flavored honeys, the ash content is low, as is the total acid content, which would contribute to a softer flavor profile. It's a

Many Meads to Make

Braggot (5 gallons)

Ingredients:

9 lbs. of honey (any kind)
4 lbs. pale malt extract (unhopped)
1 tbsp yeast nutrient
4 tsp acid blend
Wyeast 3632 (Dry Mead) or your favorite ale yeast
1 cup corn sugar (for priming)

Step-by-step

Boil 4.5 gallons of water for 4-5 minutes. Cool slightly and add all ingredients except yeast and corn sugar. Cool to room temperature and add the yeast. Ferment until dry, then rack. A small amount of gelatin can be added to aid in clarification. After 14 days, rack your braggot back to the primary, add the corn sugar for priming, and bottle. Age for several months.

Basic dry mead (1 gallon)

Ingredients:

2.5 lbs. honey (any kind)
2 tsp acid blend
0.25 tbsp gypsum
0.15 tsp Irish moss powder
1 Campden tablet
or 0.15 tsp sulfite powder
1-2 tsp yeast nutrient
Wine yeast of choice

Step-by-step

Dissolve honey in enough warm water to bring the volume to just over one gallon. Add rest of ingredients except sulfite and yeast. Remove 1 cup of must and heat to 80° F, pitch yeast into the warm must. Add sulfite to the 1 gallon of must and cover. After 12-24 hours add fermenting mead starter to 1 gallon of must. Attach a bung and airlock and ferment to dryness. Rack to secondary container. Keep secondary container full and rack every 4-6 weeks until clear. Bottle at several months of age.

Basic sweet mead (1 gallon)

Ingredients:

3.5 lbs. honey (any kind)
5 tsp of acid blend
0.25 tbsp gypsum
0.15 tsp Irish moss powder
1 Campden tablet
or 0.15 tsp sulfite powder
1-2 tsp of nutrient
Sweet mead yeast (Wyeast 3184 or White Labs WLP720)

Step-by-step

Dissolve honey in enough warm water to bring volume to just over one gallon. Add rest of ingredients except sulfite and yeast. Remove 1 cup of must and heat it to 80° F, pitch yeast into arm must. Add sulfite to 1 gallon of must and cover. After 12-24 hours add the fermenting mead starter to 1 gallon of must. Ferment mead to dryness, add 0.5 tsp potassium sorbate to prevent re-fermentation in the bottle, and then sweeten with sugar or honey. Rack to secondary. Keep secondary container full (top up with water if necessary) and rack every 4-6 weeks until clear. Bottle at several months of age.

Pyment (5 gallons)

Ingredients:

6 lbs. orange blossom honey
1 96-oz. can Chenin Blanc grape juice concentrate (or your choice of other wine-grape juice)
4 large pomegranates
10 kiwi fruit
Juice of 2 oranges
8 tsp acid blend
0.25 teaspoon sulfite
1.5 tsp tannin
2 tsp pectic enzyme
2.5 teaspoons potassium sorbate
7.5 to 9 ounces of sugar for final sweetening
Wine yeast of choice

Step-by-step

Dissolve honey in enough warm water to bring volume to just over six gallons. Add rest of ingredients except sulfite, pectic enzyme, fruit and yeast. Remove 1 cup of must and heat it to 80° F, pitch yeast into cup of warm must. Add sulfite to the 6 gallons of must and cover. After 12-24 hours add the cup of fermenting mead starter to the 6 gallons of must and stir well. Cover and fit airlock. Check must in 24 hours and stir, then add fruit and pectic enzyme to must. Ferment mead to dryness or near dryness and rack to secondary container. You may add a common fining agent if mead is dry at this racking, or allow the mead to clear naturally. Rack mead again in 3-4 weeks, and then again in 4-6 weeks (add a pinch of sulfite at each racking). Allow mead to clear and age for 4-6 months. For final sweetening 2 to 2.5% residual sugar is suggested. Dissolve 2.5 teaspoons of potassium sorbate in a small bit of water, and stir into the mead. Add the sweetening sugar. If mead is at room temperatures, you can stir the sugar right into the mead. If mead is at cooler temperatures, remove 2-3 cups of the mead and heat it to 80° F in a sanitized pan, and dissolve your sugar in this. Add to mead and stir. Wait several days before bottling.

My Bravura Mead Recipe (5 gallons)

Ingredients:

4 lbs. orange blossom honey
4 lbs. Texas mesquite honey
6 lbs. amber agave nectar
2 dried vanilla beans
0.25 cups dried orange rinds
5 oz. dried ginger
2 cinnamon sticks
5-6 oz. dried mango
14.5 grams acid blend
(TA to 0.75 for a sweet mead of 2% residual sugar)
5 tsp of yeast nutrient or DAP
(a blend of both is best)
1 tsp pectic enzyme

2 tsp of grape tannin
0.25 tsp sulfite
Claro KC or bentonite fining agents
2.5 tsp potassium sorbate
(before final sweetening)
Lalvin 71-B wine yeast

Step-by-step

Warm some of the water and dissolve the honey in enough warm water to make up just over six gallons. Once dissolved add this to your fermenter. (I use a conical fermenter with a racking port for this mead; it makes it much easier to rack off the dead yeast cells and other adjuncts.) Add the agave nectar to the warm honey-water mixture and stir. Add the rest of the water to cool your must. Add the acid blend. Remove a cup or two of the must for your yeast starter. Re-hydrate your yeast in 1 cup of 100° F water and let sit for 15 minutes. Pour the re-hydrated yeast into the 1-2 cups of must that you removed. Add a pinch of nutrient to this, cover and let sit. Add 0.25 tsp of sulfite or 2-3 Campden tablets to your primary must. Add pectic enzyme (to combat haze) and tannin. Cover and wait for your starter to get going, approximately 12-24 hours. After starter is foaming nicely, add it to the primary fermenter and stir well to aerate. Cover and fit airlock. Check fermenter after another 24 hours; activity should be quite evident by now. Add all the other ingredients to the fermenter and stir. Ferment at very cool temperatures if you can, and let it finish (it will take 4-5 weeks to ferment). Add fining agent at second racking if needed. Allow your mead to age in bulk containers for 3-4 months, racking every 6 weeks as needed. Add the potassium sorbate and then sweeten the mead with sugar or honey a week or two before bottling. The potassium sorbate will keep the mead from re-fermenting in the bottle. Filter your mead if you can for a brilliant shine. Bottle, age several months before trying. —Joe O'Neal

great choice for flavored meads, in which you may want less of the honey flavor and more of the fruit or spice in the upfront profile. Average price is \$2.50 per pound.

Mesquite: Mesquite honey is produced in the desert areas of Texas during the dry spring and summer months. Mesquite trees are ubiquitous in areas of Texas stretching from Austin southwest toward the Mexican border. The white flowers produce a light honey of delicate flavor. Average price is \$3.25 per pound.

Wildflower: Wildflower honey can be very unique, with special flavors. This depends mostly on the kind of flower the nectar was collected from. It can be notably different from region to region, because of the different plants and flowers that are indigenous to each area. Plants such as wild thyme, bramble and hawthorne are often sources of nectar for this honey. Average price is \$3 per pound.

Huajillo: This honey comes from the white flower of a native bush that grows in the south Texas chaparral or brush country. Huajillo has long been regarded as an exceptional honey and more than 100 years ago it was shipped in huge quantities to Europe. The color can be very light but it varies more year to year than other honeys. Average price is \$2.50 to \$3 per pound.

Sage: This is a light-flavored honey with good aromatic qualities. Sage shrubs usually grow along the California coast and in the Sierra Nevada mountains. The color of sage honey is usually white or water-white. Like tupelo, sage has a higher fructose-to-glucose ratio and is extremely slow to crystallize. Average price is \$2.50 per pound.

Other types of honey that are well worth trying for mead-making would be fireweed, blackberry blossom and raspberry blossom. The names alone have a strong lure. I have made mead from orange blossom honey and mesquite honey (among other types),

and highly recommend both of these for their aromatics and flavor (especially the orange blossom).

In addition, a mead-maker need not limit his batch to just one kind of honey. Blending several kinds of honey before fermentation can open up a lot of potential and give you a chance to add color, flavor, aroma, complexity, and structure to a finished mead.

One thing worth noting is that the very best honey will be fresh and right out of the beehive with minimal filtering. Keep in mind that honey such as this often contains pollen and bee parts. Most honey you can purchase through a supplier will have been processed in some manner. Honey with the very least amount of processing will retain more of its flavors and aromatics. If you are a homebrewer that has a beehive or beekeeper nearby, consider yourself lucky. Get to know your local beekeeper and see about acquiring some of his delicious nectar. If you don't have a local beekeeper, a good place to find some fresh honey is a farmers' market. Your local agricultural agency may have information on local beekeepers or honey suppliers as well. There are several bulk honey suppliers that are good sources of honey; the National Honey Board keeps a list of these suppliers. (Go to www.honeylocator.com to search the NHB database. The site also lists beekeeping associations by state.) Another source are homebrewing and home winemaking supply shops that purchase from bulk suppliers and then sell smaller amounts to homebrewers.

Variations in mead

Just as there are variations and different type of honeys, there are different types of meads as well. Mead is pure honey and water fermented to create an alcoholic beverage. When you add other components, either for added sweetness, flavoring or aromatics, the mead takes on a different name. Here's a guide to types of mead.

Braggot: Mead with flavoring derived from malted grain.

Capsicumel: Honey with chili pepper.

Cyser: A sweet mead to which apple juice has been added.

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

Hippocras: Mead to which grape juice and spices have been added.

Melomel: Also called mulsum; mead to which fruit juices other than apple or grape have been added.

Metheglin: Mead to which herbs and spices have been added.

Morat: Mead to which mulberries have been added.

Pyment: Mead to which grape juice has been added.

Rhodamel: Mead with rose petals.

Sack: A name given to stronger meads, generally made with more honey to increase alcohol content or sweetness. Sack meads usually use about 4 pounds of honey per gallon of mead.

Small: Small meads contain less honey (1.5 pounds per gallon) and ferment faster than regular meads. Ale yeast starts the fermentation, which takes about a week. These meads are more like ale than wine.

A common question that always comes up in winemaking and brewing conversations is, which type of mead should I make? Or, which type of mead is the best? The answer depends mostly on what characteristics you want in your mead. In the past I have made braggot, hippocras, melomel, pyment and methglin in one form or another. Meads with fruit or grape juice are quite nice indeed; the added flavor and dimension often lend the first impression, with the wonderful aroma and flavor of honey lingering just behind. But the mead I make most often has grape juice, fruit, spices and other flavorings added to the honey! It doesn't fit into any of the categories above, so I have decided to call this idiosyncratic

drink "Bravura." The results can be quite exceptional.

The mead-making process

Making mead is easy. The process will generally take a little longer than your average batch of beer, since honey tends to ferment slower than malt and dextrose.

The process of mead-making starts with the pasteurization and sterilization of the honey. I have read countless mead recipes that start out by telling you to heat or boil the honey. There are several schools of thought on this, and several options as well.

Keep in mind that sanitation and the prevention of bacterial and microbial infection are just as important in mead-making as they are in home brewing or winemaking. So in addition to sanitizing your must, remember to keep your work surface and every piece of equipment sanitary.

One aspect of honey worth mentioning is its antibacterial activity, which is attributed to a substance or effect called "inhibin." Research has shown this to be a byproduct of gluconic acid, and it is now known to be hydrogen peroxide. In diluted honey solutions that have correct pH values this antibacterial activity has a significant presence. With that in mind, I don't believe bacterial infection from within honey is of major concern.

To boil or not to boil

In mead-making, just as in winemaking, the unfermented honey, water and other ingredients, once combined, is called "must." This is the equivalent of the unfermented wort that homebrewers create in the kettle.

Your aim in preparing the must and in the fermentation of honey should be to retain as much of the natural flavor and aroma of the honey as possible. Honey is a dense and sticky product, which makes it quite difficult to work with. You will need to dissolve the honey in water so the must is easy to pour and stir. There are several options that a mead-maker can employ that will dissolve the honey and sterilize the must at the same time. Each of these methods have pros and cons.

Boiling: This process involves heating some water in a stainless-steel pot. Once the water is at a very warm temperature, just below the boiling point, it is removed from the heat and the honey is added. The mixture is stirred to dissolve the honey and then placed back over the heat. The must is brought to a boil and the scum that forms on top is scooped off. This scum consists of coagulated protein and beeswax. After a brief period the must is removed from the heat and allowed to cool, or more water is added to bring the temperature down more rapidly.

Advantages: The must is sterilized and any bacteria or wild yeast present will be killed. In addition, protein compounds are boiled out of the honey mixture, leaving less chance of a protein haze in the finished mead.

Disadvantages: The flavor and fragrances of the honey will most often be cooked out of the must, leaving your finished product with very little of either. Possible color change.

Heating: In this method, water is heated to 180° or to just below boiling, and the honey is diluted in the hot water. This method is similar to pasteurization. The temperature is held at this temperature for 20 to 30 minutes.

Advantages: As with boiling, the must is sterilized and any bacteria or wild yeast present will be killed. Some of the protein compounds will also be removed, although some may remain.

Disadvantages: As with boiling, some of the honey characteristics can be lost, as well as some of the subtle aromas. The color of the honey may change. Some of the protein compounds are heated out of the must, but not all of them, so fining may be needed to clarify.

Sulfite: This method simply dilutes the honey in warm water so that it is dissolved. Once dissolved, the rest of the water is added and the must is sulfited to around 65 to 70 parts per million (ppm). Sulfite additions are common in winemaking to sanitize the must, and this is becoming the preferred method among mead-makers, as well.

Advantages: The must is sterilized.

The must will retain all of the delicate flavors and aromas contained in the honey. No change in color to the honey.

Disadvantages: Possible protein haze in your finished must, requiring extended aging in bulk or the use of a fining agent to remove the haze and clarify the mead.

Sulfite comes in several easy-to-use forms for homebrewers and wine-makers. One of the most common forms is Campden tablets. The tablets are crushed and then added to the must. Each tablet contains 0.44 grams of sodium metabisulfite and adding one crushed tablet per gallon of must is just about right (the amount of sodium metabisulfite in tablets can vary; check the label and adjust the amount if you need to.) Since these tablets contain sodium, I would err on the side of caution when using them, since you can end up with a salty flavor in your mead. An easier and much better product to use is potassium metabisulfite, which comes in powder form and is ready to measure out and use. Here's a quick guide that tells you how much potassium metabisulfite to add to various batch sizes of mead.

Sulfite Additions (potassium metabisulfite)

Amount of must	1 gallon
Amount of sulfite	0.33 gram
Result	0.05 tsp
	50 ppm
Amount of must	1 gallon
Amount of sulfite	0.46 gram
Result	0.07 tsp
	70 ppm
Amount of must	5 gallons
Amount of sulfite	1.64 gram
Result	0.26 tsp
	50 ppm
Amount of must	5 gallons
Amount of sulfite	2.3 gram
Result	0.37 tsp
	70 ppm

Which of the above sterilizing methods to use will depend mostly on

your style and how quickly you want the mead to clear. Personally, I prefer to sulfite the must, preserving as much of the natural honey aroma and flavor as possible. When using this method to make a pyment (honey and grape juice) or a braggot (honey and malt) I have not noticed any significant haze, and a common fining agent such as Claro-KC clears the mead within a week. With a pure honey mead, I have experienced some residual protein hazes after fermentation when using only sulfite to sanitize, and I had to use bentonite to clear it. In addition to the methods mentioned here for sanitizing a mead must, other processes — from no sanitizing at all, to sterile filtration — are used by some mead-makers.

Nutrients

Honey contains small amounts of vitamins, minerals and amino acids, as well as anti-oxidants. That said, honey is not abundant in available nutrients, and it is recommended that nutrients be added to the must before fermentation. The known lag time in getting yeast activity started in a mead must is partially due to the lack of available nitrogen and nutrient compounds. Mead adjuncts, such as fruit, malt, grape juice or other spices, can be used as a source of nutrition for yeasts, but yeast nutrients should be added to the must to supply adequate compounds. DAP (Diammonium Phosphate), yeast hulls, Fermaid or a combination should be added at the rate of one-half teaspoon per gallon. Additional DAP can also be added partway through the fermentation process, at about day six, to keep the yeast active.

Acid

A well-balanced mead should have just enough acid to offset the sweetness. Mead has low acid levels because the honey is diluted with so much water. So I recommend that you measure and adjust the acid.

Once your must is diluted with water, take an acid reading. You can take your total acidity reading with a simple acid-testing kit, available at most homebrew or winemaking supply shops. Purchase a testing kit that con-

tains a one-percent solution of sodium hydroxide, as opposed to another strength. Measure out 7.5 milliliters (mL) of your mead must with the supplied syringe and add this to a test tube or small container. Add 3 to 4 drops of the supplied indicator solution (phenolphthalein) and stir or swirl to mix. Rinse your syringe and draw up 10 mL of the one-percent sodium hydroxide solution and begin slowly adding it to the mead must. After each few drops you add, swirl the container and look for a color change over the entire sample. When you see the entire sample change color, record how much of the sodium hydroxide you used. This will be your total acidity in grams per liter. If you used 5.6 mL of sodium hydroxide to see an entire color change in the solution then your acidity will be 5.6 grams per liter.

Adding acid to the must is controversial among some mead-makers, and some favor adding the acid after fermentation to adjust for acid-sweetness balance. Your primary concern will be pH levels in the must, because adding acid will lower pH levels. But proper acid levels promote a healthy fermentation and adjustments should, in my opinion, be made before fermentation. After adding water to your must the acid levels are going to fall dramatically, and pH levels will be approaching between 5 and 6, so I recommend that you add at least enough acid to the must to bring the pH down into the 3.5 range. After fermentation and after sweetening the finished mead, additional acid can be added if needed to balance your mead. A general rule of thumb is that if you intend a dry mead the natural organic acids formed during fermentation may be sufficient. Some mead makers, including myself, do adjust acidity before fermentation, taking into account desired residual sugar levels, with no apparent ill effects. A common acidity range to target when making a mead with 2 percent residual sugar is 6.5 g/L (0.65 percent total acidity). For a braggot style of mead to which malt is added, and procedures are followed for a lower-alcohol brew, use simple pH papers and shoot for a range of about 5.0 pH.

To add acid, simply buy a powdered acid blend at your supply shop. Most of these blends contain three natural acids — citric, malic and tartaric — that are found in a wide variety of fruits. The amount to add varies (see page 42). Some mead-makers substitute fresh citrus juice for an acid blend.

Yeast

Most yeasts that are available for making beer or wine will also work quite well for fermenting a honey mead. Mead musts can be started with a wide range of Brix or specific gravity levels, resulting in alcohol percentages from six to 20 percent. For an ale style of mead, the starting specific gravity should be in the range of 1.050. If you're making a wine style of mead, the specific gravity should be in the 1.080 range. As with any homebrew, the final alcohol levels, nutrient needs, oxygen consumption and sugar levels should be taken into account when selecting a yeast culture. Sweet and dry mead yeast are now available specifically for fermenting meads. Dry granulated wine yeasts seem to work very well for meads as well. Most mead-makers will recommend the following yeasts for either their clean ester properties or for the favorable qualities they lend to the mead, without the inherent harshness other yeasts might contribute.

Danstar Nottingham

Nicely balanced, strong fermentation.

Lalvin 71-B

Fruity characteristics; perhaps my favorite mead yeast.

Lalvin K1V-1116

Harsh at first, but ages wonderfully.

Red Star Cote Des Blanc

Smooth, good flavor.

Red Star Pasteur Champagne

Clean, neutral, vigorous.

White Labs WLP720 (Sweet Mead) or WLP715 (Champagne)

Tolerant to 15 percent alcohol and accentuates the fruity characteristics

of meads. Use the Champagne strain for dry meads.

Wyeast 3184 (Sweet Mead) or 3632 (Dry Mead)

Harder to get started, but shows good qualities in a finished mead.

Fermentation

Honey is known for its slow fermentation times; mead will take much longer to ferment than beer. However, providing that you supply a nutrient-rich environment and higher temperatures for the yeast to thrive in, fermentation times can be shortened quite a bit. Is this desirable? Well, most white wines are fermented at very cool temperatures, resulting in a long and slow fermentation. This tends to preserve fruit flavors and subtle aromas in the finished product. This type of fermentation can be applied to meads as well. Meads that are slow to ferment may show more of the flavor and aroma of the honey, as well as subtle hints of toasty or yeasty flavors. Finding a happy medium may be the best approach, such as a moderate fermentation that takes only two to three weeks, or slightly longer, at about 68 to 70° F.

If you are using a dry wine yeast, re-hydrate the yeast in a cup of water that has been heated to around 100 to 105° F, and stir lightly. Allow this to sit for 15 minutes and then stir once more. To the cup of warm yeast water, add 1 to 2 cups of your mead must and stir. Allow this to sit, slightly covered, for 20 to 30 minutes. Stir your must thoroughly to aerate it and then stir your yeast starter into your must. If you used sulfite to sterilize your must, wait at least 12 hours before adding your yeast starter. Otherwise the sulfite will inhibit the yeast.

After 24 hours you should see signs of activity. Give the fermenting must a good stir to supply oxygen to the growing yeast colony. Stir the must once more on day two of active fermentation, then attach a bung and airlock. Partway through fermentation, on or about day four to six, depending on how fast your gravity levels are falling, give the mead a gentle stir to bring settled yeast up from the bottom of the

fermenter. Monitor your airlock for bubbles and use your hydrometer to occasionally check the remaining sugar levels.

When activity seems to have stopped and your hydrometer reads below 1.000 specific gravity, or 0° Brix, add potassium metabisulfite to 50 ppm and allow the yeast to flocculate for a couple of days. Once the yeast has settled, rack your mead off the yeast sediment to a secondary container. Keep racking the mead every four to six weeks until it is clear. This may take as long as six months. Once the mead is clear, bottle it. I like to age my mead six months in the bottle, which means a year may elapse between making the batch and popping the first cork. With a drink this tasty, waiting is harder than it sounds! ■

Joe O'Neal is an avid homebrewer and home winemaker in Bay Saint Louis, Mississippi.

RESOURCES & REFERENCES

A number of experts helped me with this article. Special thanks to Jami Yanoski and Marcia Cardetti at the National Honey Board, who offered scientific insight into the composition and chemistry of honey; Pat Vargas and Rich Gulling, authors of "Making Wild Wines and Meads," who read an early draft of the article; Lynne O'Connor of St. Patrick's of Texas, who offered excellent information about various types of honey; and the friendly and knowledgeable folks at www.gotmead.com. I also referred to several other articles and publications, including:

"An Analysis of Mead, Mead Making, and the Role of its Primary Constituents" by Daniel McConnell and Kenneth Schramm (<http://www.solorb.com/mead/danspaper.html>).

"Making Mead: The Art and the Science" by the National Honey Board (www.nhb.org).

"Making Wild Wines and Meads" by Pat Vargas and Rich Gulling (Storey Books; www.storey.com).

"The Mead-Lovers README file, Version 14" by John Dilley, Dick Dunn, Thomas Manteufel and Michael Tighe (<http://hbd.org/brewery/library/meadfaq.html>).

—Joe O'Neal

Multiply Your Yeast

Grow a load of healthy yeast with a starter

Techniques

by Chris Colby

RECOMMENDED STARTER SIZE FOR VARIOUS BEERS

°Plato (SG)	5 gallons (19 L)	10 gallons (38 L)	15 gallons (57 L)
24 (1.096)	4.6 L	9.1 L	13.9 L
22 (1.088)	4.2 L	8.4 L	12.8 L
20 (1.080)	3.8 L	7.6 L	11.6 L
18 (1.072)	3.4 L	6.9 L	10.4 L
16 (1.064)	3.0 L	6.1 L	9.3 L
14 (1.056)	2.7 L	5.3 L	8.1 L
13 (1.052)	2.5 L	4.9 L	7.5 L
12 (1.048)	2.3 L	4.6 L	7.0 L
11 (1.044)	2.1 L	4.2 L	6.4 L
10 (1.040)	1.9 L	3.8 L	5.8 L
9 (1.036)	1.7 L	3.4 L	5.2 L

This assumes a starter of specific gravity 1.048. When pitching to higher-gravity beers, pour off the starter liquid and pitch the yeast sediment only.

What's the simplest way to improve your homebrew? Well, for most homebrewers, it's increasing their yeast pitching rate. Pitching a single packet of yeast into a five-gallon batch does not give your beer enough yeast cells to efficiently ferment the wort. Beers made from underpitched worts start slower, and this slow start can leave the wort open to the growth of microorganisms such as bacteria or wild yeast. Underpitched beers also stop fermenting at higher final gravities, resulting in a beer that may be too sweet. Finally, an underpitched wort may lead to high concentrations of esters and fusel oils, which can yield off-flavors and smells. If everything else has gone right, these flaws may not be overpowering — and thousands of homebrewers brew decent beer this way — but pitching the correct amount of yeast can turn a so-so beer into a suh-weet one. The first step towards pitching the right amount of yeast is to know how much yeast you need.

How Much Yeast?

A general rule of thumb for pitching ale yeast is that you need one mil-

lion (1.0×10^6) cells per milliliter of wort per degree Plato. An average-strength ale weighs in at 12° Plato (1.048 SG). So, for 5 gallons (~19 L) of this beer, you would need to pitch about 228 billion (2.28×10^{11}) yeast cells. I calculated that number like this: (1.0×10^6 cells/mL° Plato) \times (12° Plato) \times (19,000 mL) = 2.28×10^{11} cells. You would need more cells for higher gravity beers for larger volumes of beer. See the table above for recommended starter sizes for a variety of worts.

Wyeast says its XL packs contain 40–60 billion cells and White Labs says its tubes contain 30–60 billion cells. Using the pitching rule above, 60 billion cells is only enough to pitch to 1.3 gallons of wort. You would need almost four packages of yeast to pitch to a standard five-gallon batch of homebrew. (This number assumes your yeast package isn't more than a couple weeks old and hasn't been mishandled at any point. Cell counts decrease with time and mishandling. Not refrigerating the yeast will result in low cell counts.) Fortunately, there's an easy way to get from 60 billion (or fewer) cells to 228 billion (or more) — making a yeast starter.

A yeast starter is simply a small batch of beer. The yeast from this small batch is used to inoculate your main wort. In addition to raising the correct amount of yeast cells, a starter also ensures that your yeast cells are healthy. If you pitch the yeast around the peak of fermentation, also called high krausen, they will be in good shape. Some quick back-of-the-envelope calculations can show you how large a starter you need to raise the required 228 billion yeast cells.

At high krausen, yeast density reaches about 100 million cells/mL in a normal-strength beer. So, to raise 228 billion cells, you'd need 2,280 mL — just over two liters — of starter wort. To calculate the starter volume needed for any number of cells, just divide the number of cells required by 100 million (1.0×10^8) cells/mL. For example, five gallons of barleywine at 24° Plato (1.096 SG) would require 456 billion cells. For this you'd need $(4.56 \times 10^{11}) \div (1.0 \times 10^8) = 4,560$ mL (about four and half liters).

Another rule of thumb relating to pitching is that the size of the starter should be at least $\frac{1}{10}$ the volume of the wort. Using this rule, a five-gallon (~19 L) batch of beer would need a 1.9 L starter. As you can see, our two estimates of starter volume are pretty close. When I brew a five-gallon batch, I split the difference and make a two-liter starter.

You should take the above numbers with a grain of salt, perhaps even an entire salt lick. As the car commercials say, your mileage may vary. These numbers assume your starter wort is of average strength, around 12° Plato (1.048 SG). They also assume your wort is well-aerated and has all the proper nutrients. And they assume that your wort is at high krausen and that your yeast strain of choice actually has a maximum density of 100 million cells/mL at high krausen. Any devia-

tion from these things, or a host of other things, may alter your cell count.

Without actually counting yeast cells — a procedure that requires a microscope, a special dye (methylene blue) and a piece of equipment called a hemacytometer — you'll never know your exact cell count. You will also never know what percentage of your cells are alive and what percentage are dead. However, the calculations above are a rough guideline for making an adequate starter. Even if your actual cell counts are off by as much as 20%, which is unlikely, you'll be fine.

Materials Needed

Making a yeast starter for five gallons of ale requires only the following materials: a two liter (or larger) container with cap, a fermentation lock for the container, dried malt extract (light, unhopped), a pot and your yeast package. The new three liter soda bottles, made of PET plastic, work well as a yeast starter container. A #6.5 stopper

— the stopper that fits a standard carboy — also fits the three liter bottle. Glass gallon jugs can also be used, although for most you'll need a smaller size stopper.

Making a Yeast Starter

Measure out enough dried malt extract (DME) to make a wort with a specific gravity of 1.048. Dried malt extract yields 45 gravity points per pound per gallon; in other words, one pound of DME in a one gallon of water makes a wort with a specific gravity of 1.045. So, to calculate the amount of DME you need, take your target gravity (in "gravity points") times the volume of your yeast starter (in gallons) and divide this number by 45. A beer with a specific gravity of 1.048 has 48 gravity points, and two liters equals 0.52 gallons, so we need $[(48 \text{ points} \times 0.52 \text{ gallons}) \div 45 \text{ points/lb./gallon} =]$ 0.55 lb. DME. So you will need about a half a pound of DME to make a yeast starter for an average-strength ale.

Bring two liters of water to a boil on your stovetop, then turn off the heat. Add the malt extract and stir until completely dissolved. Expect some foaming when you add the extract. Turn the heat back on and boil the starter wort for 15 minutes. If you'd like your starter to have hops in it, just like your beer will, add a few hop pellets. Keep the pot partially covered with a lid during the boil. When the boil is over, put the lid on and cool the starter wort in your sink.

Cool the wort until it is at room temperature or below. This may take 15 minutes or so. Don't cut corners on this step or you may negate all your efforts by killing your yeast. To cool the wort as quickly as possible, fill the sink with ice water and place the pot in it. Every minute or so, lift the pot out of the water and swirl the wort gently by moving the pot in a circular motion. Keep the lid on to keep out microorganisms. Swirl the ice water in the sink around with your hand and return the

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pot to the water. If the water is getting warm, replace it with cold water. At room temperature the side of the pot will feel cool to the touch. You can also use a sterilized thermometer to measure the temperature of the wort. The wort should ideally be under 80° F, but over 65° F, before pitching.

During the boil and cooling, clean and sanitize your starter container and fermentation lock. Remember that this "little batch of beer" is going into your big batch of beer, so pay close attention to cleaning and sanitation. Any contamination of your yeast starter will be magnified in your main batch of beer.

Once the wort is cool, quickly pour the wort into the container. A sterilized funnel can be used if you have troubles pouring. Quickly cap the starter. Shake the starter vigorously to aerate the starter wort. Once the foam has subsided, pitch the yeast into the starter. If you keep the starter between 72–80° F, it should be ready to use in two days.

The yeast starter's fermentation

may not be as vigorous as a normal beer fermentation. Remember that a fresh package of commercial yeast has enough cells to ferment 1.3 gallons of beer, over twice the volume of a two-liter starter. To reach high kraeusen, the yeast will only have to replicate roughly two times. In a normal batch of beer, the yeast must divide three or more times to reach high kraeusen. Thus, the vigor of your starter fermentation may be less than you expect given your previous experience with beer fermentations. This is especially true of smaller yeast starters.

Some optional things to do when making a yeast starter are adding yeast nutrients or aerating with pure oxygen. If done properly, either will increase your cell counts. There are many different yeast nutrients available (White Labs and Wyeast have their own kinds, for example). Follow the manufacturer's directions and don't overdose your yeast on nutrients. Likewise, if you aerate with oxygen, be

careful not to overdo it. An easy way to aerate effectively without using pure oxygen is to refrigerate your yeast starter overnight, then shake vigorously when it's cold. More oxygen will dissolve in cold liquids than warm, so you'll get a little benefit from the refrigeration. When you're ready to pitch to your starter, place the starter up in a sink full of warm water to quickly heat it to room temperature.

Fermenting the Yeast Starter

Treat your yeast starter like you would a batch of beer. Keep it away from bright light, even if you didn't add hops. Avoiding skunking isn't the reason for shielding a yeast starter from light. Ultraviolet radiation from sunlight causes mutations in laboratory yeast, and this affects their growth. Keep the starter between 72–80° F while it's growing, slightly higher than normal ale temperatures. The yeast will grow quickly and happily in this temperature range.

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On brewing day, you can pitch your entire yeast starter or pour off the liquid and only pitch the yeast sediment. Pitching the entire yeast starter ensures that the yeast are active when they enter your wort. Pitching the sediment only is preferred when pitching the whole starter would dilute the color or strength of your beer. (For more on this, see "The Great Homebrew Debates" in the January 2001 issue.) For high-gravity beers, pitch only the yeast sediment from the starter.

Once you've pitched your yeast starter, your fermentation should start in 6-24 hours. Variation in start times depends on the number of healthy yeast cells in the wort, the level of wort aeration, yeast strain and wort temperature. Once I began making yeast starters, I never had any more problems with fermentations that wouldn't start or "stuck" fermentations. ■

Chris Colby is the managing editor of Brew Your Own. He writes the "Techniques" column in every issue.

DO YOU NEED A STARTER?

I contacted Dr. Chris White of White Labs and Dave Logsdon of Wyeast for their input on whether making a yeast starter was really necessary.

Chris White replied that the million cell per mL per degree Plato rule originated from experience with repitching yeast in commercial breweries. He stressed that there are critical differences between yeast harvested from a fermenter and lab-grown yeast, like the kind he produces. Lab-raised yeast is grown under aerobic conditions. In other words, the yeast is grown in the presence of oxygen. In contrast, yeast from a fermenter has had no access to oxygen since early in the fermentation. Since oxygen is a major contributor to yeast cell health — particularly to the health of the cell wall — fresh lab-raised yeast will be in better health than yeast from a prior beer fermentation. Another difference between the two sources of yeast is biological purity. Lab-grown yeast is free of


other organisms; yeast from a fermenter is not. One of the reasons for high pitching rates is so your yeast can outcompete any other microorganisms in your wort.

Given the differences between lab-grown yeast and yeast harvested from a fermenter, you'll probably need fewer lab-raised yeast cells to ferment your beer, compared to yeast harvested from the bottom of a fermenter.

Dave Logsdon confirmed that Wyeast also raises their yeast aerobically. He suggested that healthy lab-raised yeast can be pitched at a rate that is 1/2 to 1/10 below the standard rate. This would mean that a healthy package of commercial yeast would be enough for a five-gallon batch of wort.

In the end, the decision is yours. If you've never made a yeast starter before, try it and see if it improves your beer. Then you can decide if the improvement is worth the time and energy it takes to make a yeast starter. —C.C.

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CIRCLE 31 ON READER SERVICE CARD

What's in a Hop?

Where bitterness, flavor and aroma come from

Homebrew
science

by Steve Parkes

I recently heard an advertisement for a famous non-alcoholic beer. The actor insisted this beer was made from only the finest water, yeast and hops. I doubt many of you had trouble spotting that malt is the missing ingredient in that statement. But like the copy writer at the ad agency, many in the general public seem to believe that beer is made only from hops.

Historically speaking, hops are a fairly recent innovation in the brewing world. Although evidence exists of their cultivation as early as 200 AD in Babylon, and 700 AD in Germany, they were not widely used in brewing until the 11th century in Bavaria. They didn't gain wide acceptance until the 15th or 16th century in the rest of Europe. In England they were not highly thought of initially, and their use was banned by King Henry VIII. This was only a short time before brewers began emigrating to the United States, so American brewers have been using hops for about as long as their European counterparts.

It is impossible to think of a beer today that does not include hops, despite what some critics of American pilsener-style beers may think! In fact, it is a legal requirement in the United States and the UK that beer includes hops in the formulation. The Bavarian purity law, the *Rheinheitsgebot*, written in 1516, also legislates the use of hops for German brewers.

Hops provide a bitter flavor, a nice flavor, and a pleasant aroma to beer. They enhance the foam on beer, and the way the foam clings to the side of the glass. They also provide protection against beer spoilage from certain microorganisms. Over the centuries of hop use, microorganisms have evolved that are resistant to hops, but most of these are found only in breweries. This was once an important factor in the evolution of the beer style known as India Pale Ale. This beer was designed

to survive a long sea voyage and hence was heavily hopped. As brewers' understanding of microbiology and sanitary brewing practices have grown, hopping levels and alcohol content have dramatically decreased in this famous beer style.

Hop cones used for brewing are the dried seed cases of the plant *Humulus lupulus*. The hop cones consist of a central string or stalk, and between 20 and 50 petals. At the base of the petals, the resin (known as lupulin) is produced as a sticky yellow powder exuded from the surface of the leafy petals. The hop plant is a perennial with separate male and female plants. All commercial hops, used for flavoring beers of all sorts, grow on the female plants and will contain seeds if male plants are allowed to produce pollen near them. To prevent seeds from developing in the hops, most countries do not permit male plants to be grown anywhere. In England male hops are permitted (except in Hampshire) and most English hops contain seeds. The plants grow up strings or trellis wires during the summer and the hops are harvested and dried in September. In England, the USA, Canada and Australia, hops are packed into the final package on the farm where they were grown. In European countries, the individual farmer's hops are blended, re-dried and packed into bales in large lots or processed directly from the farmer's lots. There is a great deal of variation between hops from the different countries, as well as different growing regions within a country and even from farm to farm. Typically a hop cone consists of the following components:

10% water
15% total resins
0.5% essential oil
4% tannins
2% monosaccharides

2% pectins
0.1% amino acid
3% lipids and wax
15% proteins
8% ash
40.4% residual carbohydrate
(cellulose, lignin)

Brewers are largely interested in the total resins and the essential oils, which represent the brewing value of the hop. Both are contained in the yellow lupulin dust that is found around the base of each petal on the hop flower. This material is essentially the only portion of the hop a brewer need be concerned with. The rest of the hop's leafy matter may perform an important role in the brewery as a separation aid. The leafy material acts as a filter screen which aids in clarifying the wort after it has been boiled. The other components, particularly proteins and polyphenols, are soluble in boiling wort, although it should be remembered that greater quantities of protein and polyphenols are derived from malt.

The total resins are further subdivided into hard resins, soft resins and uncharacterized soft resins. Soft resins consist of alpha- and beta-acids and it is those compounds that the brewer is most interested in.

Alpha-Acids

Alpha-acids consist of more than 50% of the soft resins and are largely thought of as the primary source of bitterness in beer. Not directly, though, as they are insoluble in wort and must first be isomerized by heat to become soluble. It requires around 45 minutes of boiling to isomerize and solubilize 30% of the potential alpha-acids from the hops. This amount drops dramatically as the boiling time diminishes. A number of factors influence the degree of hop utilization; these will be discussed in an article on wort boiling in

the May-June issue of BYO. The isomerization reaction results in a change in the chemical structure of the alpha-acid molecule.

Basically, alpha-acids are a class of compounds known as humulones. They consist of a complex hexagonal molecule with several side chains, including ketone and alcohol groups. Examples of humulones include humulone, cohumulone, adhumulone, posthumulone and prehumulone. Each different humulone differs in the make-up of the side chain. For instance, humulone has a side chain of isovalerate attached, while cohumulone has isobutyrate as its side chain. These side chains can become detached during extended storage under poor conditions and result in the cheesy flavors sometimes associated with old hops. It has become accepted dogma among brewers to think of each of these humulones as having different bittering characteristics. There are some that swear that the bitterness associated with cohumu-

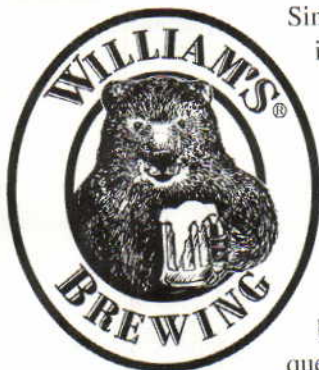
lone is "harsher" than that from humulone. Other studies have shown no difference in sensory impact when each of the different humulones are compared. Nevertheless, the humulone to cohumulone ratio is now quoted in hop analyses and new varieties are being bred with low cohumulone levels in mind. Historically, the most highly prized hop varieties — including noble hops such as Hallertau, Tettnang and Saaz — also happen to be those that have low cohumulone levels.

The alpha-acid levels in hops begin to tail off immediately after harvesting, and continue to decline in storage. The number quoted to you on a packet of hops was the alpha-acid content when the hops were tested immediately after harvest. Despite the best intentions of the retailer, the hops have been subjected to conditions that cause their alpha-acid levels to be lower. High temperature and exposure to air will speed up the losses of alpha-acids. In hop varieties with poor storage charac-

teristics, up to 50% of the total harvest alpha-acids may be lost in six months when hops are stored at 70° F. A good hop will still lose 20% of its total acids under the same storage conditions. Hops should be stored in a fridge, or preferably a freezer, and air must be excluded from the package. This will more than half the deterioration rate of your hops. Since you have no way of knowing what the hops experienced before you bought them — remember, the inside of a UPS truck can get up to 140° F in the summer in Arizona — it is always better to buy your hops from a reputable hop supplier.

Additional benefits of alpha-acids are seen from their role in foam formation and head retention. They cross link chemically with certain specific proteins in an extremely complex manner to support foam. If you sip the thick foam on a pint of nitrogen-poured Guinness, you will notice a distinctly more bitter taste than that found in the beer beneath.

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Beta-acids

These compounds are not actually bitter, but will turn bitter when they oxidize during storage. The alpha to beta ratio is considered important in gauging how a hop will provide bitterness as the hops age. The bittering potential from alpha-acids declines with time but the bittering potential from oxidized beta-acids increases. In a hop with a 2:1 ratio of alpha to beta acids, the bittering potential may remain fairly constant. The oxidation reaction will take place to an even greater extent during kettle boiling.

Beta-acids consist of lupulone, colupulone, adlupulone and other substances and, like alpha-acids, differ in the structure of the side chains. Again there is a difference of opinion in the brewing world as to the character of bitterness derived from beta-acids compared to that of alpha-acids. In Germany oxidized beta-acid bitterness is preferred while in Japan it is considered too harsh.

Uncategorized soft resins

Dr. David Ryder gave a talk at the National Craft Brewers Conference in Milwaukee on April 28th, 2000, entitled "Hopping to Perfection." Ryder is Vice President of Brewing, Research and Quality Assurance at Miller Brewing Company. In his lecture, Dr. Ryder introduced the idea that perhaps uncategorized soft resins may have some brewing value. In his talk — which was slightly better attended than my own talk on beer costs and quality — Ryder announced that Miller researchers have discovered that this fraction contains a portion of hop aroma compounds chemically bound to sugars. The upshot of the research suggested that maybe these compounds find their way into beer where yeast may transform them into beer flavor compounds. However, until the research is published in a journal and is evaluated by brewing scientists, the uncategorized compounds will remain just that, uncategorized.

Oils

The total oils, formed in the lupulin glands, represent the general aroma characteristics of the hop. It varies in concentration depending on hop variety and from season to season. It may be as low as 0.5% or as high as 2%. The oils are soluble in boiling wort but are extremely volatile and are largely lost during the wort-boiling phase of brewing. A full boil of an hour to an hour and a half, needed to volatalize most of the unfavorable aroma characteristics from the malt and precipitate enough of the denatured protein and polyphenols, results in the complete loss of any of the aroma components from the hops. Brewers get around this issue by adding a portion of the hop charge to the boiling wort 5-10 minutes from the end of the boil. Alternatively, brewers add hops immediately after boiling, but before chilling, to attempt to extract the aromas and avoid the losses due to volatilization. The action of yeast fermenting

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sugar and causing vast amounts of CO₂ to rise through the wort has the effect of carrying hop aroma away with it. While this may produce a wonderful hop aroma in your fermentation area, it will cause a decrease of hop aroma in the beer. Remember that intense hop aromas are not always pleasant, so losing some may be a good idea. Hop aroma may also be added to the finished beer by a process known as dry hopping, in which whole hops are added to the beer in a maturation vessel. Oils dissolve slowly into the beer, probably into the alcohol fraction, while there is no increase in bitterness in the beer.

There may be up to 300 different compounds in hop oil and much of the chemistry associated with their role in beer flavor is yet to be unraveled. Three classes of compounds exist within the hop oil fraction. Hydrocarbons, oxygenated compounds and sulfur containing compounds. The majority of the compounds in fresh hops are hydrocarbons (75%) and oxygenated compounds account for most of the balance. Sulfur compounds represent only around one percent of the hop oils, but are potent flavor compounds with low taste thresholds.

Hydrocarbons

Principally, hydrocarbons consist of a class of essential oils known chemically as terpenes. These include monoterpenes such as myrcene, diterpenes such as dimyrcene, and sesquiterpenes such as farnescene, humulene, caryophyllene, selenine and limonene. Each of these essential oils can be isolated and their individual aroma contributions identified. Some are floral, others spicy, some are simply described as "hoppy."

Myrcene, humulene, caryophyllene, and farnescene are the four major components of hop oil, accounting for up to 80% of the total essential oils. They are, however, extremely volatile and are only found in large quantities in beer that has been dry hopped. The amount of these constituents, and particularly the ratios between them, can be used as clear varietal indicators. Myrcene particu-

larly is a major oil and is characterized as having an unpleasant, aggressively hoppy aroma, with a harsh grassy character. It is very volatile and hence not found in beer in large quantities unless the beer has been heavily dry hopped. Humulene is the hop aroma that is perhaps the most prized. So hops with a lot of this compound are well thought of, largely because it oxidizes readily and it's oxidized form is pleasantly hoppy. Saaz contains as much as 45% humulene. Some hop merchants quote the humulene to caryophyllene ratio as an indicator of hop aroma quality.

Oxygen-containing compounds

This class of compound grows with time as hops are stored and their components oxidize. Poor storage of hops will result in hops that may contain up to 50% of these compounds. Since they may represent powerful flavoring agents that find their way into beer through late kettle additions of hops, some brewers deliberately age their hops to enhance these qualities. Oxygen-containing compounds consist of oxidized terpenes, higher alcohols, aldehydes, ketones and esters. Linalool and geraniol are higher alcohols and provide a floral character to beers, while geranyl acetate is an ester and provides a fruity character.

Sulfur-containing compounds

Sulfur-containing compounds are found in trace amounts, but may be potent flavoring agents. Hops in the field are treated with sulfur to control mildew, and in Europe some sulfur may have been added to the warm air in the hop kiln. This causes several highly volatile compounds, including dimethyl sulfide (DMS), to be produced and are responsible for cooked vegetable, onion and garlic flavors. Late kettle additions may slightly increase the levels of these compounds.

Tannins or Polyphenols

Hops also contribute additional polyphenolic compounds to wort, and these compounds are known to contribute significantly to beer haze. Luckily, boiling will cause them to com-

bine with proteins and precipitate out of solution, avoiding additional haze problems with the finished beer. However, beers that are dry hopped often are seen to exhibit hazes that are difficult to remove.

Noble Hops

Certain hops are prized for their special characteristics. In Europe these varieties are known as noble hops. The origins of this term are unknown but it is likely that through their long history of use they became prized because beer made from them was favored by drinkers. There are only four true noble hops: Hallertau Mittelfrüh, Tettnang Tettnanger, Czech Saaz, and Spalt Spalter.

Some consider the English varieties Fuggle and East Kent Golding to be noble. They are characterized through analysis as having an alpha to beta ratio of 1:1, low alpha-acid levels (2-5%) with a low cohumulone content, low myrcene in the hop oil, high humulene in the oil, a ratio of humulene to caryophyllene above three, and poor storability resulting in them being more prone to oxidation. In reality this means that they have a relatively consistent bittering potential as they age due to beta-acid oxidation. Their flavor improves as they age during periods of poor storage.

While it would appear that researchers have managed to unravel the exact nature of hop aroma, the sheer number of compounds present, the levels at which they are present, the degree to which they become modified during aging and storage, and the multitude of ways they can be used by brewers, make truly accurate use difficult. Likewise, control of the actual bittering potential of hops is difficult to predict. This is why some of the larger brewers use extracts, emulsions or oils added directly to finished beer as a way of controlling the character of a beer's bitterness, hop aroma and flavor. This is also why brewers are justified in insisting they are "artists." ■

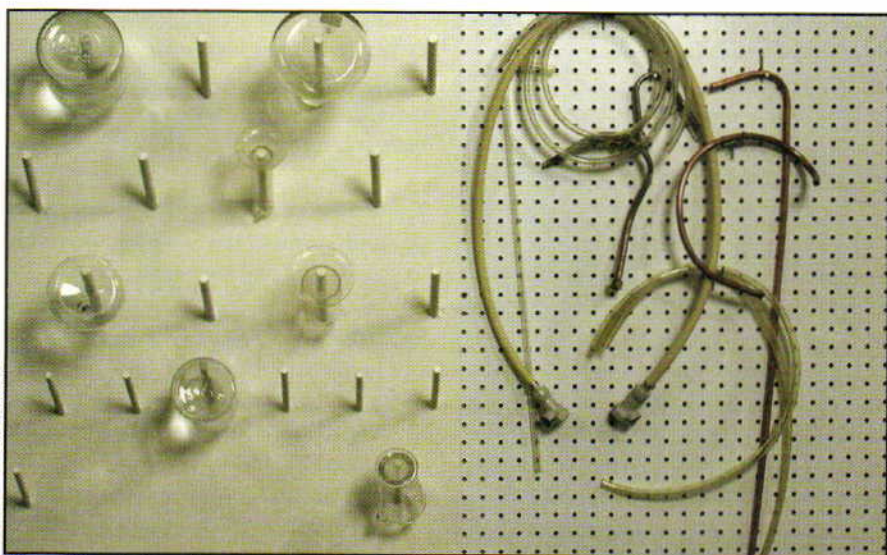
Steve Parkes' next "Homebrew Science" article will examine hop chemistry during the wort boil.

The Ultimate Rack

An easy way to organize your equipment

Projects

by Thom Cannell



PHOTOS BY THOM CANNELL

The ultimate brewing rack includes a laboratory-style rack with dowels (left) to hold glassware and a pegboard with hooks (right) for storing the voluminous amount of brewing miscellany that every homebrewer seems to accumulate.

My first beer was a wheat beer that I brewed on the kitchen stove. I brewed my next 25 or so batches on the stove as well. Later, I purchased a propane burner and moved from the kitchen to the back porch. Both of these brewing situations had one thing in common. Whatever I needed — hose, spoon, valve, filtered water, racking tube — was always downstairs above the large laundry room cleanup sink. On most brew days I climbed so many flights of stairs that I didn't need to go to the gym.

Now that I am planning a new indoor brew house, creating a central repository for every bit of brewing paraphernalia — the Ultimate Equipment Rack — became a must-do. So I sat with pencil and paper, sketching what a great rack system should encompass.

For glass objects — like Erlenmeyer flasks, graduates, test tubes and bottles — a regular laboratory drying rack would be great. Long hoses need to hang high enough so their ends don't touch the floor or

counter, and other odd bits — like spoons, clamps, quick disconnects, wire and filters — would best have individual hooks. For these items, a pegboard needs to be incorporated. Large vessels — like gallon-sized yeast starter bottles — should have a shelf, one that permits rapid air drying when wet. An ordinary coated wire laundry or kitchen shelf will work well and is inexpensive. So here is our wish-list of items: a pegboard, a wire shelf and a laboratory drying rack. Some of these items can simply be purchased at the home improvement store, while others will have to be built.

There is a fundamental problem with building the Ultimate Equipment Rack. While the wire shelves are relatively impervious to water, any wood other than marine-grade plywood is likely to swell and disintegrate. This is particularly true of the pressed paper pegboard and the easy-to-work medium density fiberboard (MDF) used for our lab drying rack. Sealing the surfaces and painting or varnishing is absolutely imperative (unless you've invented a water-free brewing system).

Of course, you can buy water-resistant pegboards, but then you don't get the fun of building a board that's custom-designed for your own brewing gear.

The tools you need

Most of our materials can be purchased pre-cut or cut to size at the store. What remains — cutting dowels and battens — can be accomplished with a hand saw or saber saw, and a drill. For mounting the complete system you might need a masonry drill bit and anchors.

Step by step

Will you follow my dimensions? Not unless your brewhouse is identical to mine. But the dimensions will be similar and construction should proceed along the same lines. Take a look at what I've done and modify all the dimensions given to fit your own brewing storage situation.

Laboratory drying rack

A lab drying rack is simply an assembly of wooden dowels stuck into a wooden sheet at an angle. The angle should be consistent and is typically 60°. The rack hangs so the dowels point upward at an angle. Glassware can be placed upside-down on the pegs and any water inside the container will run out as it dries.

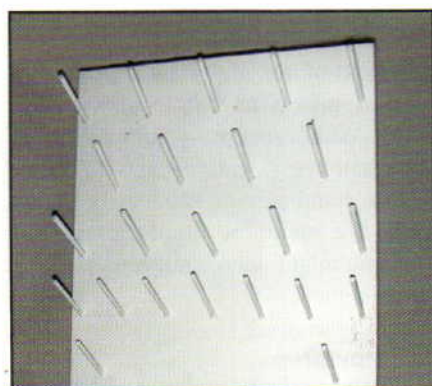
Start by selecting the correct size of 3/4" MDF or plywood. Both are easy to drill, but both need extensive sealing. I used MDF as it drills and works the easiest. I don't have a commercial drill press with a 24" throat and angled

PARTS LIST

2' x 4' white pegboard	\$4.50
4' wire shelf	\$9.00
3/4" dowels (3),	
1/2" dowels (4)	\$5.50
sanding sealer	\$9.00
paint	\$8.00



Drilling holes at a consistent angle can be done with a homemade angle-guide made from a cardboard box.



The finished drying rack is ready to hold glasses, bottles or containers of all kinds for drying and storage.

table, so I had to use a hand drill. But how could I drill at the correct angle? Actually, it was simple. I traced a 60° angle onto a spare cardboard box and cut it to size. That gave me a 60° slope long enough to rest my drill against.

1. Cut your MDF or plywood (marine-grade preferred) to 36" x 42".

2. With a framing square, mark several lines across the board and mark positions for insertions of wooden dowels. I made six rows.

3. Mark locations for dowels. Dowels should be made of hard wood and cut to 6" lengths. When locating dowels, stagger each succeeding row. Staggering allows yourself room to place larger flasks or bottles on the rack. For my rack, I marked off places for five dowels of the top row, four dowels on the row below it and then back to five. On the fourth row, it switches to having seven smaller pegs.

4. Drill appropriately-sized holes using your homemade angle guide. I used 3/4" dowels for the top three rows and 1/2" dowels for the lower three rows.

5. Glue or use silicon seal to secure all dowels in their holes.

6. Seal with sanding sealer. Two coats are better than one. Scuff with steel wool, green scrubbers, or sandpaper between coats.

7. Give all surfaces a final scuff, then paint or varnish. Use a high-gloss paint or varnish to seal the surface.

Pegboard

Pegboard is made of pressed, adhesive-impregnated paper. Moisture quickly makes it delaminate and each hole provides plenty of additional vulnerable surfaces. You must seal those surfaces exposed by drilling with a penetrating sealer.

Pegboard is available in precut

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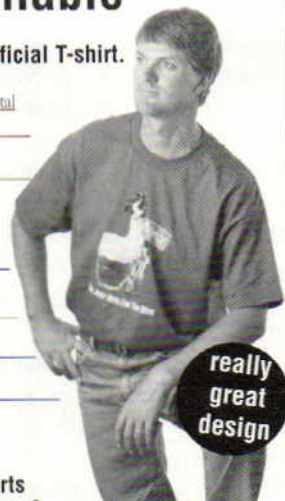
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sizes, including 4' x 8', 4' x 4', and 2' x 4'. If you have a choice, purchase 3/8" thick pegboard for its strength. But beware, most pegboard hooks are meant for 1/4" thick pegboard.

1. Cut a 2' x 4' section of thick pegboard to 24" x 42".
2. Cut several 3/4" x 1-1/2" x 42" battens to add stiffness and enough stand-off so your hooks will insert easily.
3. Scuff the finish of every surface and seal generously with sanding sealer.
4. Glue and screw the battens to the back of your pegboard in an "H" or rectangle. Use stainless steel screws (#8 x 3/4").
5. Apply a second or third coat of sealer. Dry, scuff and paint.

Wire shelving

Wire shelving is available in sever-

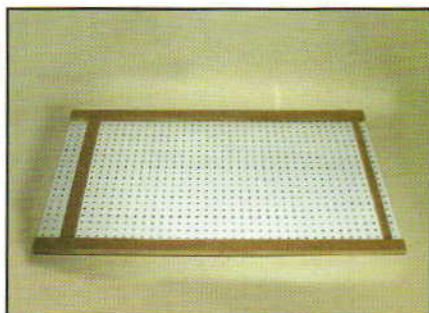
al widths and lengths and may be cut to size. They have the welcome attribute of providing open drain space and plenty of weight-holding capacity.

Shelving is available in packaged units that include hangers, end caps and supports. The supplied fasteners are meant for wooden studs and dry wall, but will work in cement if you drill a hole. This requires the use of a special carbide-tipped drill.

Final assembly

Attach your drying rack and pegboard to the wall using appropriate fasteners. In my case that will be two-inch galvanized or stainless steel deck screws. My brewhouse, now under construction, has studded walls.

Decide on an appropriate height for your shelf, perhaps allowing enough room for glass fermenters. If you'll be putting fermenters on your shelf you'll want one that's 18" deep and "pantry" rated. And for luck add an extra support and hanger. ■



The battens on the back of this pegboard help keep the board flat. They also move the board away from the wall slightly.



Wire racks can be purchased at any home-improvement store. They are great for storing, and draining, carboys.

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The Red Queen

(And why Alice doesn't homebrew)

Chris Colby
Bastrop, Texas



The Red Queen offers Alice a mug of homebrew and tells her to watch out for Tom Petty.

In Lewis Carroll's "Through the Looking Glass (And What Alice Found There)," Alice encounters the Red Queen in the Garden of Live Flowers. The two go to the top of the hill to look at the garden, with its chessboard, below. Suddenly, and for no apparent reason, the Red Queen and Alice take off running. Soon, however, Alice notices that although they are running, they aren't getting anywhere. When she mentions this, the Red Queen says, "Now, here, you see, it takes all the running you can do to keep in the same place. If you want to get somewhere else, you must run at least twice as fast as that."

We all encounter the Red Queen in our everyday lives. I just bought a computer with a clock speed 87.5 times faster than that of the computer I had in college. The hard drive has a capacity 300 times that of my college computer. How long does it take to boot up the machine and start Microsoft Word? About the same amount of time.

I recently recognized the Red Queen intruding into my homebrewing world. I was reaching for the last porter of a batch that I liked particularly and thought, "Gee, I wish I'd been able to drink more of these." Between

friends, family and special occasions, I was only left with about a six-pack to myself.

Just then a thought struck me. I've been brewing for about 11 years now. I started out brewing five-gallon batches of beer, but gradually increased the batch size over the years. Now I brew 12 and 18 gallon batches. But, no matter how much beer I brew, I have only ever ended up with a six-pack to myself. It has been taking all the brewing I can do just to get a six-pack of my own beer for myself!

Where does all the beer go? When I started the hobby, I remember thinking, "This is great, but how am I going to drink all this beer?" (I remember my liver saying, "Have you considered badminton?") The two and a half cases of beer per batch looked like they would last quite awhile. It wasn't until much later that I realized that I wasn't going to be drinking all of those beers, the rest of the world would be.

I'm sure my progression through the hobby is not unusual. My first batch of beer was a five-gallon batch of bucket-brau. This beer went to a variety of places. I gave some to the person who taught me how to brew. Most of the rest were sampled before the batch was ready. By the time the beer from my first batch was properly conditioned, I was left with six beers. Of course, at that point I had not yet been trained on how to appreciate homebrew. Instead of noting that the diacetyl level was above threshold and head retention was low, I simply enjoyed the beer. What an idiot!

Soon after the first few batches, I bought a seven gallon carboy, learned to multiply the amounts on an ingredient list by 1.2 and began brewing six gallon batches. Some of the beer from these batches went to a group of friends on my "distribution list," which seemed to grow with each batch. I quit sampling the beer before it was ready, but this beer simply started showing

up at poker nights instead. In the end, I'd end up with six beers. By this time, of course, I didn't fall into the trap of actually enjoying my beer, because somewhere out there — in never-kissed-a-girl beer-geek land — somebody might detect that the trans-3-nonenol levels were too high.

Then I discovered high-gravity brewing. In high-gravity brewing, you ferment a concentrated beer in your fermenter, and then dilute it to working strength with de-aerated water. Using this method, you can brew more beer with your existing equipment. So, my six gallon batches suddenly became 7.2 gallon batches. More beer for me? Nah, now my family found out about my brewing and wanted to sample the fruits of my brewing endeavors.

Recently, I bought a 20-gallon brewpot. So now I brew 12 (and sometimes 18) gallons of beer at a time, fermenting them in multiple carboys.

Some of the beer still goes to friends, but where the hell did all these new friends come from? Some goes to family, but I never knew I had so many relatives. (Uncle Bob? I don't remember an Uncle Bob.) The rest of the beer ends up at "special" occasions, such as Al Haig-a-thons or Yak Day. I'm beginning to think that finishing a batch of beer can actually cause someone to have a birthday.

I've recently taken a series of steps to bring the Red Queen into check. I've seriously considered what is and isn't a homebrew-worthy event. I've also gone through a harsh, but fair, culling of some of my extraneous friends. I've even implemented DNA testing to determine who is and isn't actually related to me. How many beers do I get for myself now? Well, only about six, but I have a plan. Next time I'm going to brew more. ■

Chris Colby lives in Bastrop, Texas. He is, uh, temporarily out of homebrew. Those kegs? Empty. Now go away.

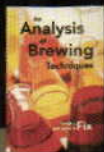
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