Home brew your own beer

By Richard Blunt

The major beer brewers in America have gotten a painful lesson in recent years. After an endless ad campaign to increase the sale of tasteless "light beers," they have finally begun to realize that their bland, flavorless excuses for beer are being rejected, and an increasing number of their former customers are seeking—and finding—alternatives.

"Quality, not quantity," is the message from beer lovers in the 90s and a growing crop of microbrewers are providing those alternatives by offering a wide variety of rich, robust brews. These specialty ales, lagers, wheat beers, barley wines, and stouts make any of the popular "light" beers seem flat and tepid by comparison, like spoiled ginger ale. This is all good news for the beer drinker because the beer industry is returning to the golden days before Prohibition when microbrewing and home brewing were the standard rather then the exception. Success in the 90s will go to those who have the talent to brew good beer. So, if you made one of those fine brews I described in the last issue, grab one, sit back, and relax; we're going to continue our trip into the world of home brewing and bring you one step closer to mastering this fine and exciting craft.

Now, assuming you've read my previous column (Issue No. 32), purchased the necessary equipment and supplies, and successfully formulated one or more of the suggested recipes, you can consider yourself an intermediate brewer.

In this issue, I'm going to reveal the basic elements of brewing in more detail. This information will make it possible for you to start brewing beers using whole grain recipes and to refine these recipes to suit your personal tastes. You'll approach this with confidence because you'll have a better understanding of how brewing chemistry works.

In my last column, we discussed how to brew good tasting ales using malt extract syrups and powders. This is an easy and time-saving way to brew and it'll consistently produce excellent beer. If you want, you can continue to brew using this method until the end of time and, if you use your imagination and talent, you'll be able to brew a wide variety of custom-blended beers and ales.

But if you're daring, you can further tease your sense of creativity and become more intimately involved in the entire brewing process. You can learn to brew using the all-grain method of brewing. Insiders like you and I call this "brewing from scratch." Depending on how much time, patience, and effort you're willing to invest, scratch brewing can reward you with some sophisticated and exciting brews that can't be duplicated using the malt syrups and powders.

How do you get started brewing from scratch and what special equipment do you need? Before we get into that, a brief overview of all-grain brewing is in order. The next four pages will be technical, possibly confusing, and even boring (what an admission) to many of you, but read it anyway and digest it over the next several months. It's necessary that the good home brewer understand this stuff. The recipes begin with Duffy's stout on page 44.

Malted barley (see previous issue for how malted barley is made) is crushed and mixed with hot water to form what brew masters call a **mash**. This temperature-controlled mixture activates enzymes in the malted barley that break down soluble starches and proteins to sugars and amino acids. This sweet extract, called **sweet wort**, is rinsed from the grain husks by a process called **sparging**. The sweet wort is boiled with **hop flowers** which add bitterness and flavor to create a **bitter wort**. The bitter wort is cooled quickly and active **brewers yeast** is added to start **fermentation**. The yeast converts the extracted sugars into alcohol and carbon dioxide. As the fermentation progresses, the brew is moved from one vessel to another to prevent it from absorbing flavors from the yeast sediment and the hop and malt residues. The beer is then bottled and aged. Aging allows the beer to become clear and naturally carbonated. That's it in a nutshell. Now, let's examine the process in more detail.

Equipment you'll need

Crushing the barley requires using a **grain mill** to get the job done properly. (Using a coffee grinder or a blender is a definite no-no; they grind the grain husks into fine particles, which impedes starch conversion in the mash and makes it impossible to filter the mash properly while sparging.) A good home brew shop will offer you several options to help you with this task. Many shops will also crush the grain for you. If they can't, they'll have a variety of grain mills for sale. I've been using a Corona brand grain mill for 12 years. It's the lowest priced of the quality grain mills, and it gets the job done properly.

To hold the mash and maintain its temperature until the mash reaches **starch end point** (that's when all the glucose starch molecules are reduced to fermentable sugar), you'll need an insulated **mash tun**. A mash tun may be no more than a 5 or 6-gallon insulated picnic cooler. If that's what you decide to use, get a good one. It should be a good brand and capable of standing up to water temperatures as high as 175º F.

Washing the grain husks and filtering the sweet wort requires a **sparging system** (Figure 1). Your system will

include a **lauter tun**—which is a fancy name for a 5-gallon bucket with a false bottom fitted inside and a spigot at the bottom (Figure 2). The false bottom fits several inches above the real bottom to serve as a filter and suspend the grains above the outlet. The system also requires a grain bag that is fitted inside the tun. This bag holds the grain and works just like the paper filter in a drip coffee maker. To wash the grain efficiently, the system has a sparging arm, which is simply a specialized shower head attached to another bucket that is filled with brewing water.

When I first started all-grain brewing, I used a 3-gallon plastic watering can with a large spray head for sparging. Much to my surprise, it worked. It's possible for you to fashion a system in your work shop or, for about $50, you can buy a professionally made system. (As you've probably guessed, I prefer brewing beer to building brewing machinery.)

Since you'll be cooking a larger volume of liquid (about 6.5 gallons), it's time for you to buy the **8-gallon stainless steel or enamelware pot** we talked about in the last column. This will be your boiler. You're going to need a pot this large for scratch brewing.

After boiling, the wort must be cooled as quickly as possible to prevent contamination from unfriendly yeasts and bacteria. Wild yeasts make wonderful sourdough starter but they make lousy beer. So, to minimize the threat of contamination, I strongly suggest you invest in a **wort chiller**.

There are two types of wort chillers and both are constructed from about 20 feet of ¼" outside diameter copper tubing. One is constructed to allow the hot wort to flow through the tubing (about 18 feet of which is packed in ice) and into the primary fermenter. The other is made of the same type of copper tubing, but the tubing is coiled so it can be set directly into the wort kettle and cold water run through it. Both these systems quickly cool the hot wort from boiling to about 90º F. I prefer the one that sits in the wort kettle and runs cold water through it because I don't feel comfortable trying to clean and sanitize the inside of 20 feet of copper tubing that has been used to siphon 5 gallons of hot wort. There are special cleaners sold for this purpose, but I'm not convinced. I've encountered many such specialty cleaners that are sold to the food service industry. The results always fall short of the stated claims.

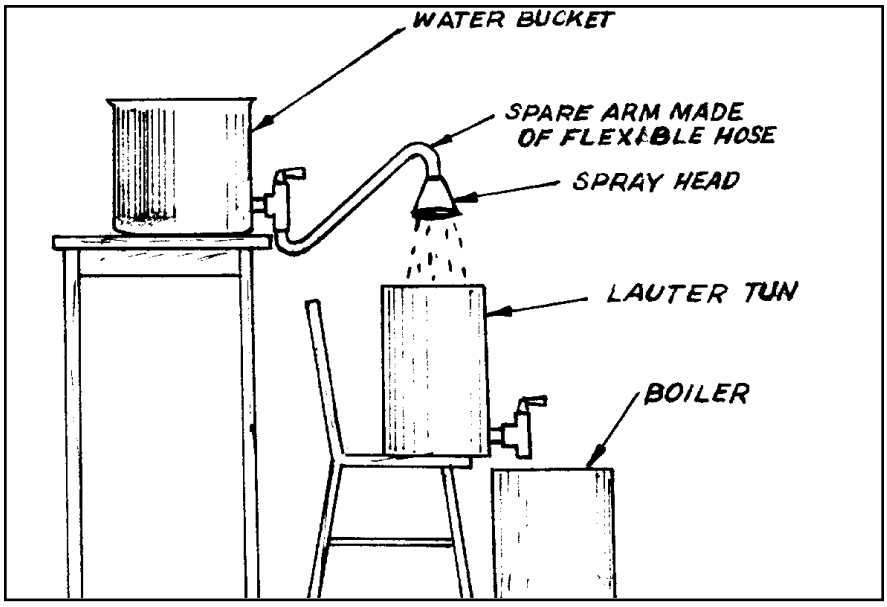

Figure 1. The sparging system.

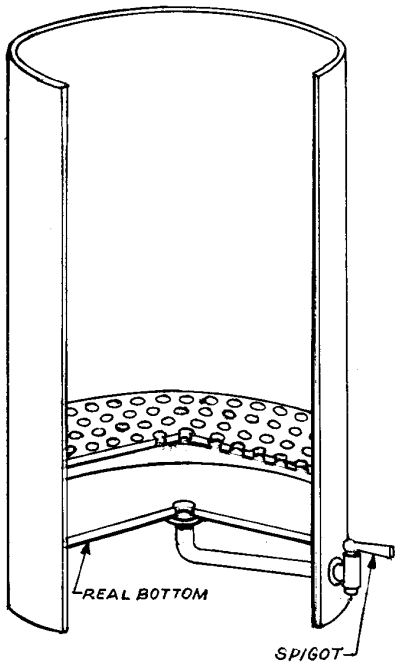

Figure 2. Cutaway of the lauter tun.

Chemicals and test equipment

Last column I made an error when I suggested that **magnesium sulfate**, which is epsom salt, could be used independently to increase the acidity of brewing water. *This was a mistake*. Magnesium sulfate should be used in small amounts along with **calcium sulfate** (gypsum) to condition water used to brew certain ales. Please pardon my error; it was my first in 1995.

Common **iodine** is used to test for the presence of unconverted starch in the mash. The iodine will turn black if any starch is present and this will mean the conversion is not complete.

Brewers pH papers are innocent looking little papers that will change color when dipped into a liquid containing water. (In high school chemistry we called it litmus paper.) The color represents the relative molar concentration of hydrogen and hydroxide ions present in the solution. For nonscientific types like me it's easier to say that it tells you how acid

or alkaline the solution is. You match the paper to the closest color on a chart, and right above that matching color is a number. This number is the pH and is represented on a logarithmic scale ranging from 0 to 14. 7.0 is neutral, below 7.0 is acid, above 7.0 is alkaline. This is a valuable tool for testing your brewing water after it has been treated.

To weigh hops a small **diet scale** is enough. Calibrate it with something of known weight. It is not necessary to weigh malted barley; assume that 4¼ cups of barley is equal to one pound.

There is a science to brewing but I'm going to skip it here because I don't want to put you to sleep or give you a migraine. However, there are other things you must pay attention to because the way you control them will determine the quality of your beer. First and foremost among them is the water.

Water is key

I grew up in Boston, Massachusetts, a part of the country where good water is taken for granted. Most of the municipal water supply comes from Quabin Reservoir which is one of the purest sources of soft neutral water in the country. Even when I started brewing, the complexity of water chemistry did not ring home to me. It wasn't until I had my first opportunity to brew a batch of Oktoberfest Lager that it struck home.

I was living in a small farming town in upstate New York, well known for manufacturing wonderful sauerkraut. After four disastrous brewing failures, it finally occurred to me that my problem was with the water. So I embarked on a three week water chemistry home study project, surviving several outbreaks of rage spurred by frustration as I tried to understand the difference between an alkaline salt and an acid salt, between a bicarbonate and a sulfate of magnesium or calcium, or even worse trying to imagine why a positive ion is called a cation and negative ion is called an anion, and when they get together they are collectively called ionic compounds. I am still not sure what a free hydronium ion is.

But this I do know: Beer is about 90% water, so it is easy to say that the mineral content and the pH of the water used will have a noticeable effect on the flavor and appearance of the finished brew. Water that is too hard (acid) will produce a beer with a harsh thin flavor and will inhibit the solubility of hop bittering resins. Water that is too soft (alkaline) will create even more problems. It inhibits coagulation of proteins during the boil and produces cloudy beer that is very prone to contamination during fermentation. It also contributes to a harsh, bitter taste. This harshness will destroy most lagers. So if your water supply is clear, not contaminated, and has an agreeable taste and smell, it will probably be suitable for brewing. I suggest you call your local water company and ask them for a printout of the latest water analysis for your area. Don't be afraid to tell them what you're doing. My experience with the water company, and even private water testing labs, has been quite positive when I tell them I'm a home brewer.

To make things simple, ask the following questions.

- What is the temporary hardness of my water?
- What is the permanent hardness of my water?

When you get the answers, here's what you do: Add the two numbers that represent the temporary and permanent hardness. If the sum is less than 100, you have soft water. Consider yourself in business and ready to brew. If the sum is higher than 100, compare the two numbers and if the permanent hardness number is less than 100, this means the water can be treated. Determine how much of this water you will need for brewing and bring it to a boil in your brew pot. The temporary hardness will precipitate out of solution and settle on the bottom when the water cools. You're now ready to brew. If the permanent hardness number alone is higher than 100, or if your water is iron contaminated, treatment is more difficult—though you can make some interesting pale ales with hard water—so I'm going to suggest you use bottled water for now.

Water chemistry is as complex as any subject could be, so if you're new to the art of home brewing don't work yourself into a frenzy over perfecting your water. After you've made a few batches you can check the books in the brewing section of your favorite book store or home brew shop. Trust me, you'll find enough brewing chemistry to keep you reading for many moons. But the reading will be easier and more enjoyable because of your hands-on experience.

Malted barley

Barley is one of the hardiest of all cereal grains. It has a short growing season and is grown from the Arctic Circle to the tropical plains of northern India. It serves as a staple food in the Middle East, but in the West 50% of the barley grown is used for animal feed and about 30% is used for the production of beers and distilled liquors. Many other grains can be used in the brewing process but barley has always been the preferred source of fermentable extract.

Barley is the seed of a grass type plant. The seeds grow in two, four, or six heads along a central stem. When fully ripe it is harvested, dried, then stored for a few weeks in preparation for malting. It is then graded. Only fully matured barley is considered suitable for malting. (In the last issue I gave an overview of the malting process.)

European brewers prefer 2-row barley because it has a thin husk and a large plump seed that offers a high yield of convertible starch. It also

malts better than the 6-row variety and imparts a smooth mellow flavor to the finished brew. 6-row barley is preferred by commercial breweries in the United States because it is rich in enzymes. These enzymes are necessary to convert the high percentage of adjuncts (other grains like wheat, rice, oats, or corn) that these large breweries use to produce their beers. But 6-row barley is also high in proteins that can cause problems with clarity in the finished brew. We're not going to use any grains other than barley here, so English 2-row malt will suit our needs.

How will you know if the malt you buy is high quality? Here is a simple way to evaluate it.

- The grains should be plump, firm, and of even size and shape.
- The color should be a light straw.
- A grain squeezed between the thumb nail and finger should crush easily.
- A grain broken in half should write like a piece of chalk.
- Float a few grains in some water. They should float horizontally. Vertical floating means air pockets in the grains and that's a sign of poor malting.
- If the grains sink, the malt is probably very old or it is barley that has not been malted.

Specialty malts

There are specialty malts which can be added during the brewing process that impart unique flavors, color, and body to create different brews.

Crystal malt is green barley that is malted in the conventional manner to convert barley starch to malt flour. The grain is then roasted at mashing temperature to convert the starch to fermentable sugars and to crystallize the sugar inside the husks. This malt can be purchased in both light and dark colors.

Black malt is malted barley that has been roasted at high temperatures slightly below that which carbonizes the grain. This procedure drives off all the malt flavor and deactivates all enzymes. I use it in small quantities to color brown ales, porters, and stouts.

Chocolate malt is malted barley that is roasted to a dark brown color, but not as long as black malt. It is lighter in color than black malt and the reduced roasting time preserves some of the malt flavor.

Roasted barley is an unmalted grain that is roasted to a reddish brown color. This wonderful grain imparts an assertive roasted flavor to dark ales and stouts that is similar to fresh roasted coffee beans.

Adjuncts

As I said, other starches can be used as a source of fermentable sugars in combination with barley malt. These starches must be gelatinized (cooked) before being added to the mash. Properly prepared, adjuncts will contribute natural flavor and a lighter body to the finished beer or ale. Since we are brewing ales that derive flavor and body from the various forms of barley malt, I won't go into detail on this subject. But as you gain brewing experience you'll find adjuncts a source of character and flavor that shouldn't be ignored. There is a wide variety to choose from. The most commonly used and available are unmalted barley, corn, oats, potato, rice, rye, sorghum, tapioca, and wheat.

Sugars

In the last column I talked about the value of corn sugar in the brewing process, but there are other sugars that can be introduced into the wort with interesting results. Some sugars are sweeter than others, some are more fermentable, and some are not fermentable at all. Sugars for brewing are available in both crystal and syrup form and type of sugar contributes its own unique character to your beer. Here are a few I've used over the years with good results.

Lactose is a sugar that will not ferment. I use it to add sweetness and body to dark ales and stouts. Since it is not easily dissolved in beer, it must be boiled in a small amount of water before being incorporated.

Molasses is a syrup composed of sugar cane juice that is left over after the available sucrose is crystallized. This juice is processed three times to remove as much sucrose as possible. Each processing results in a different grade of molasses; first (light molasses), second (medium molasses), and third (blackstrap molasses). To maintain quality and lighten flavor, clarified cane syrup is added to the best molasses sold today.

I use molasses to do flavor experiments with dark ales. Use molasses in moderation; excessive amounts will make your beer very hard to drink.

Maple syrup can be used in home brew. I've used it in place of brown sugar to flavor full bodied English bitters. The flavor is rich and buttery. I hope you'll give it a try some time. But beware as this is an expensive addition, requiring at least a half gallon to sweeten and flavor five gallons of ale. Some folks say a full gallon but let your own taste decide.

Honey stands in a class by itself. How much character and flavor it adds to beer is debatable. Some say it does, some say it doesn't, some say maybe; I say, you decide. But before you do, buy a copy of Carlie Papazian's book The New Complete Joy of Home Brewing and read the Chapter on *Making Honey Mead*. Make a batch of this legendary drink, and let your imagination be your guide.

This list is only an introduction to the vast list of sugars that can be incorporated into your brew and help you create the beer that best expresses your personal talent, and creativity.

Yeast

The final flavor of your brew will be determined by **yeast**. So understanding a little about how these little critters work is important.

Yeast is a single cell fungus that cannot manufacture its own food as plants do. There are three types of fungi that are of interest to the home brewer: budding fungi (yeast), fission fungi (bacteria), and mold fungi. We're interested in the budding yeasts because we use them in fermentation. We're interested in the others simply because we're trying to avoid them.

Chemically, yeasts are constructed of proteins, glycogen, minerals, enzymes, and vitamins. For yeasts to remain healthy and active, these elements must be replenished with nutrients, which are extracted from the mash in the sweet wort. The yeasts absorb simple proteins from the wort and refine them into high quality amino acids. If a wort solution lacks proper nutrients to keep the cultured yeasts healthy, or the pH is not suitable, wild yeasts or mutations of the cultured yeast may find this environment to their liking and take over. This will spoil your beer.

Brewing beer of consistent high quality requires fermenting with as pure a strain of cultured yeast as time and budget will allow, and by ensuring its proper nutrition and controlling its chemical environment by carefully manipulating the pH and temperature of the ferment.

Culturing your own pure strain of yeast can be tricky for a new home brewer, so don't bother—at least for now. Your home brew shop has the answer to this problem.

A well stocked home brew shop will have yeast in two forms: liquid and dry granulated. Of the two types, liquid is the purest and can be purchased to match the type of beer or ale you are brewing. Dry granulated is an all purpose yeast and more prone to be contaminated with bacteria or mutant yeast cells, although I must say I used Red Star and Edme dry yeast for years and had no problems.

Dry yeast can be added directly to wort that has been boiled and cooled, while liquid yeast must be cultured in a yeast starter for at least two to three days before you start to brew.

But the biggest problem with liquid yeast is the cost—about $4 for 1.4 fl. oz, which is enough to make only one batch of brew.

Hydrometer

A **hydrometer** is an elongated glass tube weighted at the bottom and calibrated along the stem. It is designed to measure, by weight, the amount of sugar that is in a solution. This measure is termed specific gravity. My hydrometer has two other scales, one to measure potential alcohol and the other to measure how much sugar per U.S. gallon is in your beer. For now we will only discuss specific gravity. Here's how it works: If a hydrometer is placed in water that is 60º F, it will sink until the water surface is at the point on the specific gravity scale marked 1.000.

Because wort has sugar in it it'll be heavier than water, so a hydrometer placed in wort will float higher than if placed in pure water until it reaches a number that represents this added weight. Example: A sample of extra special bitter at 60º F, before fermentation, will read about 1.045 on the specific gravity scale. This means the sample is .045 heavier than water at the same temperature. The reading is termed as the starting gravity (SG). A sample of this ale at 60º F taken after fermentation is completed will read about 1.012. This is termed the finished gravity (FG). In this example I would write this as SG 45 and FG 12.

To use the hydrometer, put a sample of brew in the test vial and lower the hydrometer into the liquid until it's floating. Gently spin the unit to release all air bubbles. At eye level, take the reading in accordance with the directions that came with your hydrometer. Record this reading in your journal. Most beer recipes will indicate the starting and finished gravities of the brew. Compare your readings to these numbers and you'll get a good idea if things are going as planned.

Now to some recipes.

Duffy's stout

We're going to work with a recipe while discussing the mashing process. Duffy's Stout is a strong Irish stout with lots of character.

SG after boil: 43-45

FG after fermentation: 7-8

8¼ gals. soft water (9 qts. for mash and 6 gals to sparge)
7 lbs. malted barley (English 2-row pale malt)
1 lb. flaked barley
1 lb. roasted barley
1 tsp. gypsum
1 oz. bullion hops
1 oz. cascade hops
1 pkt. Irish Ale liquid yeast (or 1 pkt. Red Star dry ale yeast)
¼ tsp. Irish moss powder
½ tsp. ascorbic acid (antioxidant to remove destructive oxygen)
¾ cup pure corn sugar (for bottling)

Brewing procedure

1. If you're using liquid yeast, prepare this starter three days before you start brewing. With dry yeast prepare the starter one day before brewing.

Mix 6 ounces of munton and fison dark dried malt extract with three quarts of soft brewing water. Bring this mixture to a boil and add ¼ oz. of hops and boil for 15 minutes. Remove mixture from the heat, strain to remove hops, and quickly cool to 90º F. Pour the mixture into a sanitized one gallon jug, add the yeast, attach a fermentation lock, and set aside in a cool spot. Remember that everything that touches your beer from now on must be sanitized.

When preparing the yeast starter, it's important you work in a clean dust-free area. Don't even sneeze. Bacterial contamination is a real hazard when working with any yeast culture.

2. Grind the grain and prepare the mash. Proper grinding or crushing will prevent many problems later on in the brewing process. A grain mill is the best answer to these problems. There are two types of grain mills available to the home brewer. The most common is the type that employs grooved opposing face grinding plates that are adjustable. An example of this is the Corona Grain Mill (about $50). A more expensive type is the two-roller grain mill sold at any well stocked home brew shop (about $140). I have not used the two-roller mill but those who have tell me it's worth the money for the dedicated all grain brewer. The grinding plates on the Corona mill are a trick to adjust but even the best adjustment yields a grind that is a little too fine by professional standards. But hey, I don't brew beer to pay the rent, and it's better than a rolling pin.

When grinding the grain, your objective is to separate the starch from the grain while leaving the husk as intact as possible. Before grinding the malt, practice with a few ounces to get the blades to the setting that produces the best results.

Grind the grains the day before brewing. Specialty grains should be crushed separately. A note on sanitation: Grinding grain creates a dust that is rich in beer-killing bacteria, so do your grinding far away from your brewing area. Once again, if grinding grains is not your cup of tea, check with your favorite home brew shop. For a small charge they'll do the grinding for you. You don't know what progress this is. In the old days if you asked a question like that, the phone went dead.

3. There are three mashing procedures used by home brewers. The procedure you use depends on the type of beer you're brewing, the type of malt that you intend to mash, and your level of experience.

Infusion mashing is the easiest and most practical procedure for the newcomer to all grain brewing. It works best when using fully modified English 2-row malt to brew full bodied ales. This is because the malt and water are maintained at one temperature until conversion is complete. The one temperature conversion favors the production of dextrin sugars which are not as fermentable as maltose and they produce a full bodied brew with a slight sweetness.

Step mashing (or modified infusion) calls for holding grain and water at various temperatures for specified periods of time. The temperature is raised by applying direct heat to the mash until the desired temperature is reached and the mash is removed from the heat to maintain this temperature. This procedure is mostly used to convert under-modified 6-row malt that is high in enzymes and can be incorporated with a high percentage of adjuncts. This produces a brew that is drier, with less body, and a higher alcohol content.

Decoction mash is similar to the modified infusion mash, with some distinctions. To raise the mash to a higher temperature, a portion of the mash is removed and brought to a controlled boil and incorporated back into the mash. This process of controlling two mashes and maintaining very exact temperatures in the main mash can become very complicated and is not recommended for the newcomer. If you ever become interested in the vast world of lager beers, where the differences in types is very subtle, decoction mashing is a must.

Duffy's Stout calls for English 2-row malt and an infusion mash as do the other two recipes in this article.

Attempting to grind malt, mash, sparge, boil, strain, cool, and start ferment in one day can be tear jerking, especially with three children asking endless questions. So, to avoid this headache, I start the process the night before, after my children go to bed.

I grind the malt. (This job is not fun for me and I confess to requesting that my grain be crushed at the shop, more than once.) Next, I condition my brewing water and start my mash. Then I go to bed. I get up the next morning and proceed. Once I add the hops to the boiling wort, my children leave the house. So my brewing day is usually a peaceful experience.

Let's mash

Since we are this close to our first all grain brew, I'm not going to hammer you with anymore boring science while detailing this procedure. After you've experienced a couple of successful all grain brews, you can dig into the hard chemistry.

Infusion mash:

1. Bring 9 qts. of soft brewing water to a boil, add the gypsum, and turn off the heat.

2. In another pot bring two gallons of tap water to a boil and pour it into the insulated picnic cooler. This is to preheat the cooler so it will keep the mash at the right temperature longer.

3. Allow the brewing water to cool to 168º F. **This is an exact temperature**. If it cools to a lower temperature, apply heat to bring it back to 168º F.

4. Discard the water used to heat the mash tun. Add about 1/3 of the crushed grains to the chest. Slowly add 1/3 of the mash water (3 qts.) while stirring with a plastic spoon to ensure an even mix. Continue this until the 9 lbs. of grain and the 9 qts. of mash water are incorporated. To ensure that there will be no dry pockets of grain in the mash, mix the grain by lifting from the bottom. After the mash is mixed, the temperature should be between 150º F and 152º F. If the temperature is lower or higher adjust with hot or cooled brewing water. Check the pH; it should be between 5.0 and 5.5. Now put the lid on the cooler, cover the cooler with a heavy

blanket, sit back, crack a home brew, and relax for an hour.

5. Remove 1 Tbsp. of mash and place it on a white saucer. Add a drop of iodine to the sample and observe. If there's a change in the color of the iodine to black or purple, conversion is not complete. Continue the mash until there is no change in color. **Important**: Iodine is a poison, if ingested. Discard all test samples and wash all utensils.

When starch conversion has been verified, turn out the lights and go to bed.

6. It is now 7 a.m.; I'm up at least five minutes before my kids and ready to start brewing again. I turn the heat on under the brew pot to start heating the remaining 5¾ gallons of brewing water.

7. Next I set up my sparging system.

7a. Assemble the lauter tun by putting the false bottom in place and fitting the grain bag inside; then check the spigot to be sure it's turned off.

7b. If you're using a separate water bucket with an attached sparge arm, set the water bucket on a counter or a sturdy table. Set the lauter tun on a chair below the sparge bucket. The boiler will be set on the floor below the lauter tun. The heated sparge water will be transferred into the water bucket. The water will flow from the water bucket by way of the sparge arm into the lauter tun to wash the sugar from the grains, and then back into the boiler (Figure 1).

8. Heat the sparge water to 180º F and transfer it to the water bucket. Add enough water to the lauter tun to bring it about 3 inches above the false bottom.

9. Gently scoop the converted mash into the lauter tun. Add enough sparge water to bring the water level just above the grains and let the whole business settle for a minute.

10. Open the spigot at the bottom of the lauter tun to start the flow of sweet wort into the boiler. The first quart or so will be cloudy. Catch this before it goes into the boiler and pour it back over the grains. In fact, repeat this process until the wort runs clear. Continue to sparge, keeping the water level just above the grains until all the water is used. Let all of the water seep through the grains. Under no circumstances should you attempt to squeeze the grains to extract any water that does not flow through the grain bed. If all goes well you will collect about 6¼ gallons of water in the boiler.

11. Bring wort to a boil, add bullion hops in a hop bag, and boil for about an hour. Remove these hops and add the cascade hops in a hop bag along with the Irish moss powder. Continue boiling for another 15 to 30 minutes or until hot break. Hot break? Yes, this is a remarkable physical condition that occurs during boil when all of the protein matter in the wort has formed into compact lumps. The wort must boil for at least 1 hour to bring this about. Most often it is quite noticeable in the boiler. However, you can further check for this change by removing a clear glass full of wort from the boiler. If break has occurred the thermal cooling will leave match head size particles at the bottom of the glass; the wort above will be clear and free of any suspended matter. Suspended matter indicates that the wort is undercooked and the boil must be continued. When hot break occurs, turn off the heat and remove the hop bag.

12. Following the directions supplied with the wort chiller, cool the wort as quickly as possible. When cooled, fill two sanitized 12 oz. bottles, cap, and refrigerate them immediately. This will be used to prepare the yeast starter for your next batch of ale. Now, siphon the rest of the wort into the primary fermenter, take and record the SG, which should be 43-45, and pitch (i.e., pour in) yeast starter.

13. From this point, follow the brewing instructions outlined in last issue's column for brewing beer, with three exceptions. First, when you get to step #4 (in the last issue), this process does not apply to all grain beers since you prepared your yeast starter before you started brewing. Second, after two weeks of secondary fermentation, check the FG. It should be 7-8. Take the FG for the next two days. If it remains there, fermentaion is done. Last, when you get to step #14, which is carbonating and bottling, add the ½ tsp of ascorbic acid to the priming solution then proceed as indicated.

Well, believe it or not, that's all there is to it. Here are a couple more ale recipes to keep you from getting bored until next issue.

Marnie's mild ale

This luscious ale is low in alcohol, high in flavor, and has a medium body that makes it a real thirst quencher. Its medium bitterness is balanced by a subtle sweetness that will make it a summertime favorite of many ale lovers.

SG after boil: 35 - 38

FG after fermentation: 7 - 8

- 6 gallons soft water (1½ gal. for mash, 4 gal. to sparge, 2 qts. in reserve)
- 1 tsp. gypsum
- ½ tsp. potassium chloride (This is not the same as the salt substitute you buy in the market which contains other ingredients. Your home brew shop will have a pure form)
- 5½ lbs. English 2-row pale malt
- 8 oz. chocolate malt
- 1½ oz. cascade hops (in boil for 60 minutes)
- ½ oz. fuggles (steep in hot wort for 15 minutes after boil)
- British Ale Liquid yeast (for light bodied ales) or Edme brand dry ale yeast
- ½ tsp. Irish moss powder
- 1 tsp. ascorbic acid
- ¾ cup pure corn sugar

Brewing procedure:

1. Three days before you intend to brew, prepare the yeast starter using liquid yeast combined with the wort

you saved from the stout recipe. If this is your first brew, prepare the starter as outlined in the stout recipe. If you are using dry yeast prepare the starter one day before brewing date.

2. This recipe calls for the infusion mash procedure. Mix mash water with gypsum and potassium chloride and heat to 168º F.

3. Mix treated water with crushed grains as outlined in the stout recipe. Mash for a minimum of 3 hours or overnight.

4. Once starch conversion is verified, heat the sparge water to 168º F and sparge the grains.

5. Collected wort after sparging should be 5½ gallons with SG of 26-28. Adjust with reserve water as necessary.

6. Boil for 60 to 90 minutes or until hot break is reached, adding hops as indicated. Don't forget to add the Irish Moss powder now.

7. Collected wort after boiling and cooling should be 5¼ gallons, with SG of 35-38.

8. Collect two 12 oz. bottles of boiled wort, cap and refrigerate.

9. Pitch yeast, ferment to conclusion, prime and bottle. Don't forget to take the FG and add the ascorbic acid.

This ale should be aged, crystal clear, and ready to drink in three weeks.

Big John's London pale

Here's an ale that really accents the rich malty taste that identifies the use of quality English 2-row malted barley. The maltiness of this brew is well balanced by the strong hop taste, bitterness, and aroma. This is the ale that is fast becoming a favorite of many beer drinkers in this country. If you like Bass or Sierra Nevada pale ale, give this a try.

SG after boil is: 45-48

FG after fermentation: 11-12

6 gallons soft water (7qts. to mash, 4 gal. to sparge, 1qt. in reserve)
2 tsp. gypsum
½ tsp. epsom salt
7 lbs. English 2-row pale
2 oz. Light Crystal Malt
2 oz. cascade (in boil for 60 minutes)
½ oz. cascade hops (in boil for the last 15 minutes)
½ oz. fuggles hops (steep in hot wort at the end of the boil for 15 minutes)
1 pkt. London liquid ale yeast (For pale ales) or 1 pkt. Edme brand dry ale yeast
½ tsp. Irish moss powder (during boil)
1 tsp. ascorbic acid (at bottling)
1 cup pure cane sugar (for bottling)

Brewing procedure:

1. Prepare the yeast starter according to the type of yeast you're using.

2. Using Infusion Mash, heat mash water to 170º F.

3. Add the corn sugar to the wort before starting the boil.

4. Follow production procedure outlined in previous recipe.

Well folks, there you have it. Please write and share your brewing experiences with me. Remember, ale is the wine of grain, and the ale connoisseur, like the wine lover, never forgets the living quality of a well crafted brew.Δ