

All-grain brewing

Infusion mashing for your first all-grain beer.

By John R. Griffiths

INTRODUCTION

When I was invited to write an article for zymurgy, based on my all-grain brewing experience, my thoughts turned to fancy words like decoction mashing, double mashing, and so on. Then, upon reflection I thought "what can I offer to those of you in the home brewing community who want to make your first all-grain beer." I reflected on my first effort a few years ago. I'd done some thirty extract brews (most of which turned out as well as anything I've done since) but there just seemed to be the challenge of that "great leap" of making beer from the raw ingredients. I began as many of us have, by timidly doing a few partial mashes, using perhaps one or two pounds of grains wrapped in cheesecloth. Finally, I thought I was ready for the next step. I'd read a couple of books on how to do it, gathered a few bits of extra equipment to add to my faithful "starter kit", and figured out what I was going to do. Back then, there was no local home-brew club, and no-one I knew had ever done an all-grain mash. So I just did it, after a couple of weeks of getting psyched up (with a few homebrews to try to help me relax of course!). The rest is history! I shipped my first ever effort to a competition in California and it took first place in the Pale Ale category. I was hopelessly hooked - now I'll spend hours slaving over brew pots on some of the more elaborate techniques. However, back to my thoughts for this article. I'm going to try to describe exactly how I would have planned my first all-grain mash if I knew what I know now! Remember as you read on, it's fun, and it's alchemy!

First of all, you will need to decide what style of beer you want to make. I recommend trying a single infusion mash, which is the simplest and shortest procedure.

Once you've done a couple of brews and have learned the basic techniques, you're on the way. The basic aim of mashing is to convert your raw malted grains into a wort, by extracting sugars and other desirables. Once you have done this you'll have a wort ready to boil and hop just as you have always done. Look at your local homebrew supply catalog or store - there are many different grains available. To do a single infusion mash, you'll need to make a beer which requires a well modified malt as the main ingredient. An ideal first brew is a pale ale. If you follow the example described in this article, you'll have the wort in the primary fermenter in about seven hours. OK, this is longer than an extract brew, but in the end it will be your very own beer, and you'll be darn proud of it!

We'll proceed by first looking at extra equipment you'll need, and how to acquire it, then look at planning your brew ahead of time so the actual task will be as easy as possible, then go through the specifics of an example brew session. I'll end the article with a few thoughts on where to go next if you get hopelessly hooked on "all-grain brewing".

EQUIPMENT

I'll assume you already have the basic "kit" available from homebrew suppliers for around forty dollars, with all the goodies like a fermenter, thermometer, hydrometer, racking equipment and so on. You'll need to acquire a few extra pieces of equipment to do an all-grain mash. You may have looked in the magazines and catalogs, and seen all the wonderful high-tech stuff available (and perhaps been put off - do I need to buy all this stuff for my first go?) No! You can acquire or make all of what you need. Personally I would love to own some of this stuff, but I'm still working with the basic equipment described below. Remember, it's alchemy - if the ancient Egyptians could make beer from grain, so can you!

The basic extra equipment you'll need is as follows:

1.) BREW POT

A vessel capable of holding and boiling seven or more gallons of liquid. Stainless steel is best, but expensive. Many suppliers sell 8-gallon enamel pots. Don't use aluminum - it's not recommended as your wort may cause undesirable chemical reactions. You might try local restaurants, to see if they have any 10-gallon heavy-duty stainless-steel stockpots that are about to be discarded - a few dents won't make any difference to your beer! A great advantage of thick stainless steel is it's heat capacity, important in maintaining temperature during the infusion process. You can compensate with a thinner pot by wrapping a couple of layers of water heater insulation wrap (the aluminum-covered bubble-wrap stuff) around the pot during the infusion. Affix it with duck tape (for more on duck-tape and brewing, read on).

2.) LAUTER-TUN

This is what you'll use to separate the spent grains from the liquid to give wort. The cheapest system is illustrated by Charlie Papazian on page 290 in the "New Complete Joy of Homebrewing". All you need are two five gallon plastic buckets, and a screw tight spigot. The buckets can be acquired from your local supermarket. They get them full of dairy frosting and stuff (ask for empty throw-aways!) A spigot will run about four bucks from your homebrew supplier. Drill the bottom of one full of quarter inch holes. Drill a hole for the spigot as low as possible in the side of the other bucket, cut the rim off the inner bucket so that the two glove together with about one to two inches bottom space, and you have a lauter-tun. A five gallon system will comfortably sparge up to about eleven pounds of grain - you can get a bit more in by duck-taping the two together around the top seal (or just be prepared to mop up the overflow!).

3.) WORT CHILLER

Chilling the wort is considered essential, it inhibits possibility of bacterial and yeast infection if you cool the boiling wort to pitching temperature as soon as possible. The simplest method is to circulate cold water through a copper coil immersed in the

hot wort. You can buy these for around thirty dollars, but they come with the screw-on faucet adapters (laundry or garden hose type). I don't have any compatible faucets, so I made a chiller from 40 feet of 3/8-inch inside diameter copper pipe and 10 feet of plastic tubing bought from a local hardware store. Check the dimensions of your brew pot, wind the tubing around a bucket or pan so that the coil will be about two inches in from the sides of your pot, and bend the tubing upwards to make inlet/outlet connections. Be careful bending copper tubing - always bend slowly over a round object six inches or more in diameter, or it will crimp irreversibly. Cut the 10-foot plastic tubing in half, attach one piece to each end of the copper coil and it's ready. Attach it to your cold water faucet however you can - I just stuff the end up it and use duck tape. You can also tape the inlet/outlet hoses to your sink rim to fix them in place. Clean your wort chiller in hot water and scrub after use. Don't use chemical solutions, they do funny things to copper.

4.) MEASURING DEVICES

You will need to measure out grain for your mash. Grain is sold by the pound, and can be bought crushed from most suppliers. So, what if you need 7-lbs of a 10-lb sack (grain is usually a lot cheaper if you buy 10-lb plus). Easy, take a 1-lb bag of a specialty grain, toss it in a tall plastic container, and mark a line at the "full" point with a permanent marker. Most grains have the same approximate volume per pound, but use separate marks for whole versus crushed grains. Slight errors won't matter in your recipe (remember it's alchemy!). Then if you need 7 lbs in of one type, take seven scoops (to the line) from your 10 lb bag -presto! You can buy 1 lb grain scales, which are useful for measuring small amounts of specialty grains, but guesstimation in your calibrated container will work just as well.

Liquid measuring is also required. If you have a pint or quart jar, great- but measuring 3 gallons for your mash, or 6 + gallons for your sparge water, is very

tedious. I offer a simpler solution. Take a stainless steel saucepan which holds 2-3 quarts. If you don't know it's capacity, pour in 12 oz. long neck bottles of water until almost full, then take the total ounces, divide by 32 and that's the quart capacity of your saucepan. Write it down (and reserve that pan for brewing forever, you can use it later for mash-transfer and run-off, and won't have to worry about sanitizing it after every time you cook a can of soup).

5.) EXTRA BOILING PANS.

Whilst your brew is sitting in your brew pot, you will need to boil 6-gallons of sparge water. If you have another large pot, fine. If not, you can boil lesser amounts in two or more pots.

6.) OTHER HANDY STUFF

A.) Extra thermometer:

With an extra thermometer you can keep one in the mash, and use the other one to monitor the sparge water temperature. Thermometers take a couple of minutes to stabilize, so moving one frequently from mash to water takes time to get an accurate reading.

B.) Stirring spoon :

You'll need this to stir your grains. I haven't yet found an "automatic" one, so I suggest purchasing a 12-15" long heavy-duty plastic spoon. You can also use this when sparging. Simply hold it right way up, and slowly pour the wort over it in a spraying action.

C.) Plastic tubing:

A few extra feet is always useful to have on hand. A 12-inch or so piece to fit over your lauter-tun spigot helps cut down splashing (and helps prevent bad bugs getting mixed into your wort.)

D:) Duck tape

Just keep a couple of rolls handy! I've mentioned a couple of uses

above. Basically, if something leaks (and it will !) use it ! I cannot brew without it, but all my fellow FLOPS members ridicule me. What can I say, if it works, don't knock it !

PLANNING YOUR BREW SESSION

This section is the main reason I have written this article. All-grain (or any) brewing, in my experience, comes down to one thing - plan ahead. Whether I'm doing a 20 - hour double-mash, Scotch ale or a 5-hour infusion mash I.P.A., I like to know ahead of time what I need to be doing at any time. This requires a detailed outline of what you are going to attempt. It may take you several hours to write this out, but, trust me it's time well spent. It doesn't mean it will happen as intended (remember it's alchemy) but you still need to know what you should be doing, and to record what actually happens. It's too late, once you're in the middle of a brew session, to suddenly say to yourself "what do I do next?" Our great Guru's advice to relax etc. won't help you much then! My message is simple - plan ahead!

OK - so how do you plan ahead? First you need to know what your going to brew, and decide upon a recipe. For your first all-grain brew, I would recommend using a published recipe, for a beer which you think you'll like, and stick fairly closely to the listed ingredients. You can begin improvising later, when you have a comfortable grasp of your equipment and techniques. Then you need to research and write up a brew schedule, which should include an outline of your recipe and procedures, and space for recording specific times and observations. This isn't practical just by using a published recipe, there simply isn't enough space to annotate it. Brewing log-books are not much help either, there is little if any space to include details of procedures, and the framework tends to be too rigid; you'll spend too much time worrying about what to enter on a particular line, or indeed what it even means. You'll also need to learn some new procedures. As a hesitant would-be all-grain brewer I studied two books at length - Charlie Papazian's "Complete Joy of Home Brewing" and Dave Miller's "Complete Handbook of Home brewing", Both detailed the new techniques I would need to learn -

basically mashing and sparging. Both books give fine advice - but it's not always the same, particularly in regard to times and temperatures (which are different for each beer style of course, but sometimes for the same style). I did my first couple of mashes using both books by my side, flip-flopping between instructions as I brewed. Then I realized the solution was to figure out what I was going to do with my equipment, and to write it down ahead of time. I like to think of what follows as "armchair brewing"- something I still practice before every brew-session. At this stage you can be quite relaxed, of course.

Armchair brewing? No, it's not an exotic dream trip to Britain or Bavaria, (but you can enjoy a few homebrews). What you will do is design your first all-grain brew. Remember, you are trying to design a complete outline geared to your own equipment on hand.

When planning a brew session all I use are a notepad, pen and pencil, plus any books I want to refer to - it's that simple. First, when you've decided upon a recipe, make a list of what grains, hops, yeast, and additives that you will need. In this article, I'll use an I.P.A. as an example (see box) but you can adapt any recipe to this method. Next you'll need to figure out how to make your beer. This is the time to do your homework. Read up on pale ales and infusion mashing. I recommend Dave Miller's "Complete Handbook of Home Brewing", particularly chapters 17-25, as a source for information on basic techniques. For more information on pale ales, Terry Foster's "Pale Ale" has a wealth of fascinating detail, Brewing specifics are covered in pages 84 through 106. You may feel overwhelmed by all the "new" information at hand - but at this stage you can relax, remember our goal is to translate it all to a one-page brew schedule. Sift through the information, asking yourself "What do I really need to know?" Make notes under the following headings:

- 1) Grains- types and quantity

II) Water - volumes and treatment

III) Mash procedure - times and temperatures

IV) Hops - types and times of addition

V) Yeast - type and usage.

At this stage, any questions that should arise can be resolved by further reading and research. When you feel comfortable that you know what to do, it's time to prepare the brew schedule.

Refer to the box - this is my schedule for a typical I.P.A. You can write out such a schedule by hand. There are four basic components, differentiated by type-face in the example; briefly these are:

I) Major headings (at left, bold type) :**GRAINS, WATER, MASH-IN** etc.). These break down the procedure into basic units. As such they are applicable to every mash.

II) Details of ingredients and procedures (regular type). This is the core of your schedule. Record ingredients and procedures as you plan to carry them out. Include specific time and temperature objectives for each step.

III) Actual specifics (light italic). Here is where you record details of what actually happens as you brew. temperatures achieved, pH, and brew specifics (original and final gravity, dates, etc.).

IV) Timing (bold superscripts). This is where you relate your brew schedule to "real time". In the example, I'm assuming the mash-in water is up to heat (175F) at 0.00 and that you will use a stop watch. In practice I record the actual time I begin, and add increments progressively , referring to a clock. I pencil in projected times only a few steps ahead. This way, I can erase and re-record what actually happens. For example,

until you've done a brew, you won't know how long your stove takes to raise the mash-out temperature from 155 to 170 F, or to raise 6 gallons of wort to a boil. These are details you'll get used to with using your own equipment, and are helpful in designing future brews. You could of course pencil in the timing for the whole session, but believe me, a brew session will never go exactly as planned - remember it's really alchemy! By recording times as you proceed, you'll have a base for knowing what to expect next time you do a similar mash, and begin to "learn" your own equipment and it's capabilities.

YOUR FIRST ALL-GRAIN BREW.

You're ready! The big day is approaching, and it's time to begin! Let's follow through the I.P.A. recipe and discuss a few of the finer points. First, a check-list of what you should do ahead of time.

I) Brewing schedule neatly condensed to a page, as described above and illustrated in the box.

II) Ingredients on hand: grains, hops and yeast (a yeast starter if you plan to use one should be prepared a few days ahead; follow the packet instructions for liquid yeast).

III) Mash-in water boiled and treated as necessary. If you're using municipal water, measure about a half-gallon more than required for the mash-in, and boil for thirty minutes., to drive off any chlorine. Leave to cool uncovered overnight, and add any salts required when cooled. My city water is "soft", so I'll add about 10 grams (2 teaspoons) of gypsum (calcium sulfate) for this recipe. You can request a (free) water analysis from your local water district, but don't get over-worried about your water at this stage, most works fine for brewing as long as it's wet!

IV) Measuring devices calibrated however you choose, as outlined previously.

V) Equipment assembled and sanitized. Use a cleanser such as Clorox, and be

sure to rinse everything very thoroughly.

Now you're ready to begin. Set aside about eight hours if you plan to brew in the daytime (I'm a nocturnal brewer - it is feasible to do the mashing and sparging, then cover the wort and boil it the next morning. It will take longer to bring to a boil, but you can erase and adjust the penciled-in times accordingly).

Let's begin! Your brew-pot should contain about 12 quarts water, after pre-boiling and cooling. Re-heat it to 170F, and record the "start" time. Remove from stove-top and add the crushed grains, measuring quantities by weighing or by volume, and stir, stir, stir! It's important to saturate all of the grain, and attain an even mash consistency. If your brew-pot is thin-walled, this is the time to wrap insulation around it. Stick a thermometer into the middle of the mash, allow to equilibrate, and record the temperature. If it's close to 155F, OK, if not add some hot or cold pre-boiled water to adjust. You can also extract a tablespoonful of liquid at this stage, and check the pH, which should be between 5.0 and 5.5. Once the temperature is stabilized at about 155F, cover the brew pot with aluminum foil, and you can relax for about 90 minutes (don't over do it, there's more hard work to come!).

During the 90 minute infusion, prepare the sparge water. Boil about 6 gallons, and let it cool uncovered to about 180F (this is where a second thermometer is handy). Monitor the mash temperature, if it drops below about 152F, add a little boiling water, and stir vigorously until mixed in, and check the temperature again. A few degrees off will not be catastrophic, but aim for the recommended temperatures.

Next, assemble your lauter-tun. Set it on something so that the spigot will be a little above the rim of your brew pot when the latter is placed on the floor for the run-off. I use an old steel chair - if you use anything else, cover it completely with a heavy plastic cloth, to avoid wetting from leakage (which will almost certainly occur!). Pour a pan or so of sparge water into the lauter-tun, so that the perforated inside bottom is covered by about half an inch or so. Then transfer the mash to the lauter-tun gently,

and let sit for 15 minutes. At this stage, remove the insulation from your brew pot, and wrap it around the lauter-tun.

After 15 minutes, begin the run-off. I use a couple of 2-quart pans, and affix a short length of plastic tubing to the spigot to below the pan rim, to prevent splashing. Open the spigot slowly, and let the flow begin. At first it will be quite cloudy. Put the second pan under the spigot, and pour the first full pan back over the grain (you can use your upturned stirring spoon to distribute the liquid evenly). Repeat for about 15-30 minutes, after which the run-off should be clear. Replace the pan with your rinsed-out brew pot, and continue the run-off. By now your sparge water should be at about 170F. Begin pouring pan-fulls over the grains, keeping the liquid level a little above the grains (again use your upturned spoon to even the water distribution). Keep sparging until you have collected about 6.5 gallons of wort in your brew pot. Transfer the brew pot back onto the stove, and you're ready to boil the wort.

The rest of the procedure is similar to doing an extract brew, except that you have a larger volume of wort. Bring the wort to a boil - this takes up to an hour on my stove. Once you achieve boiling, pencil in the time on your mash schedule, and add 90 minutes for end time. Also pencil in times for your hop additions, and add appropriately. Once the boil is complete, remove the brew pot from the stove (remember it will be hot!) and set up your wort chiller. Cooling to about 65F should take 20 minutes or so. Transfer the cooled wort to your fermenter, leaving the last residue in the brew pot. You can do this either by pouring directly, or racking through a piece of tubing (keep the end above the bottom of the brew pot, to avoid clogging). You should have 5.5 gallons in the fermenter. Stir to oxygenate, and record the original gravity (O.G.). Pitch the yeast, cover, air-lock, and now you can relax and have as many home-brews as you feel like!

After fermentation is complete, rack to a secondary . Record the date and gravity (S.G.) and allow to sit for a few days. Residual solids will settle out in the secondary,

and you'll be ready to bottle your first all-grain brew. Rack into your sanitized primary, record the final gravity (F.G.), prime with corn sugar dissolved in boiling water or wort, and bottle. For this I.P.A., wait a few weeks, then taste and enjoy!

THE NEXT STEPS

Once you've done an all-grain brew, you will probably be "hooked" like most of us. The satisfaction of designing and doing your own mash from basic ingredients is quite something! You'll become familiar with your equipment and the procedures for an infusion mash, and ready to brew more and different beers. I would suggest you do a few more infusion mashes at first. Several other styles of beer lend themselves to this technique, such as stouts, porters, English bitters and Scotch ales. The major variables are the grains used, and the specific mash temperatures. You can find recipes in *Zymurgy* and many brewing books. Follow them, but don't be afraid to begin experimenting a little. Vary the hops; try liquid yeast or reculture previously used yeast, there are infinite possibilities. For background reading and definitions of beer styles, I strongly recommend the Brewers Publications series of books (which currently cover nine styles). All of these books provide recipes, but you'll need to dig around in the text to work out your mash schedule. To me this is part of the fun of homebrewing.

Beyond the single step infusion mash, there are several other techniques you can tackle. Beers such as German-style altbiers, bocks and pilseners, which use less-modified malts, are best made using a step-infusion process. This is similar to what we have discussed above, but the mash-in temperature is lower - usually around 130F - to allow a protein rest. After 30 minutes or so, heat and stir the mash vigorously to bring to 155F, or the desired starch rest temperature called for in your recipe. Strong Scotch Ales, Imperial Stout and barley wines can be made using the single-infusion technique, but by doing two mashes back-to-back (Allow 15-20 hours if you're going to try this). Reserve the first three gallons of the first sparge; use the rest as mash-in liquid for the second batch of grains. Sparge the second mash, and add the first 2-3 gallons to the

reserved wort. Boil to make a strong ale. Sparge out the rest of the grains, and you can use this to make a batch of a somewhat weaker brew. Finally, for beers such as weiss or weizenbock, you may want to try decoction mashing. This is discussed by Greg Noonan in "Brewing Lager Beer." It's complex-sounding, but if you follow my suggestions on how to plan a brew-session ahead of time, it will be a lot of fun.

I hope this article has demystified the process of all-grain brewing, and encouraged you to try. You don't have to spend a lot of extra money on equipment, and your ingredients will cost less than buying extracts in the long run. Remember, my basic message is: plan ahead, then do it! Once you are comfortable with your equipment, you can add to it or modify it as you will, and try the more complex techniques as you choose. One final recommendation - unless you live on the proverbial desert island - join a home-brew club. The Summer 1995 edition of Zymurgy lists hundreds of clubs nationwide - join one and experience the fellowship and knowledge of fellow home brewers. You'll find a wealth of advice available for the asking. But remember, it's your brew, and it's essentially modern-day alchemy!

EXAMPLE RECIPE FOR 5 GALLONS.

INDIA PALE ALE: Batch #109: 10/29/94

GRAINS: 10lbs Pale Ale malt **WATER:** 1qt/lb = 12qts
1lb light crystal (20° L) Add 10grams (2tsp) gypsum
1/2lb roasted barley
(All grains crushed)

MASH-IN: Heat water to 170°F 0.00 Add grains and stir vigorously until no dry
pockets 0.15 Temp 160°F Adjust temperature to 155°F 0.25 pH 5.4
Hold mash at 155°F for 90 minutes 1.55
[Heat and boil 6 gallons sparge water during the starch rest, allow to
cool to 170°F]

MASH-OUT: Heat mash to 170°F stirring constantly 2.15

SPARGE: 6 gallons at 170°F. Underlet lauter-tun to half-inch above false bottom.
Transfer grains from brew-pot. Allow to settle 15 minutes 2.40
Begin run-off, recirculate until clear 3.00 Sparge with 170°F water into
brew-pot until 6 1/2 gallons wort collected 4.00

BOIL: Heat to boiling 4.45 Boil 90 minutes 6.15

HOPS: 1 oz Chinook (A% 12.8): +15 mins 5.00
2 oz Irish Northdown (A% 9.4): +60 mins 5.45
1 oz Kent Goldings (A% 5.5): dry hop in secondary
1/2 oz Hallerta (A% 4.1): dry hop in secondary

CHILL: To 65°F (actual 70°F) 6.40 Transfer to primary fermenter

YEAST: Two packs Nottingham Ale yeast. Stir in vigorously, cover and airlock 7.00

SPECIFICS: O.G: 1.062 F.G: 1.018 Alcohol by volume 6.3%
Bottled 11/17/94. Primed with 1 cup corn sugar in 1 cup boiling wort.
Yield: 47 bottles.

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BIOGRAPHY

John Griffiths, a proud Welshman transplanted via Australia and Canada to Fayetteville, Arkansas, and is a founding member and the Primary fermenter (President) of FLOPS (Fayetteville Lovers of Pure Suds), the second-oldest home brew club in Arkansas. He has been a home brewer for seven years, largely self-taught in the days before he met other home brewers and organized FLOPS. His all-grain beers have won over a dozen awards in local, regional and national competitions, and he has formulated and brewed a "guest" 10 - barrel batch of "Dr. John's Magic Stout" at the Ozark Brewing Company in Fayetteville.