

IMPROVING KIT BEERS BY PARTIAL MASHING

Colin Weaver, April 2003

INTRODUCTION

Partial Mashing is a halfway step between kit brewing and all-grain brewing, that allows results nearly the equal of all-grain recipes to be obtained using simple and cheap equipment that anyone can build in a couple of hours. If you are already boiling your wort, then you probably have most of the necessary equipment on hand.

What does partial mashing involve? Simply put, you use the same techniques employed by all-grain brewers and even commercial breweries, but on a small scale designed to replace part of the extract or sugar in your kit beers with fresh all-grain wort. A partial mash of around 1.5Kg of grain produces enough wort that only a small amount of dextrose or malt extract need be used with a 1.7Kg kit, instead of the usual 1Kg or more. 1.5Kg of grain doesn't sound like much, but it allows you to use all manner of specialty grains and adjuncts to create flavours that are simply not available to a kit or extract brewer.

Many home brewing books advocate extract and specialty grains brewing as the next step up from kits, however I am of the opinion that partial mashing gives far superior results for not much more effort. For me, partial mashing was the first step on the road to all-grain brewing, and I still brew around half of my beer using the methods and equipment presented here.

Advantages of Partial Mashing over Specialty Grain Steeping:

- Steeping permits only a limited range of specialty grains to be used. Specifically, steeping of grains limits you to using only crystal malt, highly roasted malts (chocolate malt, roast malt, etc.), and roasted adjuncts like roasted barley.
- Base malts, specialty malts like Vienna, Munich and wheat malt, or un-malted adjuncts like un-malted wheat, flaked barley and rolled oats cannot be used without mashing, as for conversion to fermentable sugars they rely on the action of enzymes activated at specific temperatures in the mash. For example, it is difficult to accurately brew a style calling for a proportion of Munich malt (e.g. a Dunkel or Altbier) without performing at least a partial mash.
- Mashing produces better results from crystal malts than steeping alone, possibly due to the effect of enzymes on the complex sugars in the already converted crystal malt. Steeping of crystal malt frequently results in an over-sweet cloying flavour, particularly if insufficient sugar or dextrose is used in an extract and grains recipe.
- The resulting beer tastes better! The fresh grain character obtained from mashing is nearly impossible to reproduce using just extract.
- Head retention is much improved. Extract and kit beers frequently suffer from poor head formation and retention. I have yet to see a partial mash beer exhibit this problem.
- Techniques necessary for all-grain brewing will be mastered, but the partial mashing process is far more forgiving. A few degrees error in the temperature of an all-grain mash may result in a beer that is too dry, or too sweet and cloying, depending on whether the temperature was low or high. While such errors will still affect the quality of the wort obtained from a partial mash, the use of a kit or extract tends to moderate the effect of such mistakes.

EQUIPMENT

In order to perform efficient partial mashing and use the recipes presented later, you will need the following equipment:

- A small, well insulated container to use as a mash tun. A blue Styrofoam drink cooler, available from Big-W works well for mashes of up to 1.75Kg of grain, and loses less than 2 degrees C over the course of a 60 minute mash.
- A reasonably accurate thermometer. A Technitherm thermometer available from Big W and most kitchen stores is adequate, although I do not recommend using one for all-grain brewing.
- A 10-litre mini lauter tun.
- A stainless steel pot of at least 16-litre capacity, available from Big W or any kitchen store.
- A hot liquor tank capable of holding about 14 litres of hot water. A plastic fermenter is adequate for this.
- A heat source capable of bringing 14 litres to a rolling boil. Most stoves are adequate, but I use a 3-ring gas burner from Barbeques Galore as I have been evicted from the kitchen. Note that ceramic cook-tops with recessed elements are not suitable for brewing, as they take a long time to reach the boil and a boil-over of hot wort may pit the ceramic surface and invalidate the warranty.
- A 1 litre plastic jug.
- A small saucer or plate.
- A large wooden or plastic spoon / mash paddle.

BUILDING THE MINI LAUTER TUN

The key to successful partial mashing is having the right equipment to effectively drain wort off the mash. The design presented here is a small-scale “Zapap” lauter tun, a two-bucket design popularised by Charlie Papazian in “The Complete Joy of Homebrewing”. It consists of two food grade buckets fitted together, one inside the other, to provide a screen allowing wort to be drawn off the mash.

To build your lauter tun you will need the following components:

- Two 10 litre food grade buckets (available from Bunnings)
- A length of 8mm diameter tubing (obtained from any homebrew store)
- A plastic clip, used to regulate run-off speed during the sparge (homebrew store)
- An airlock grommet for a Coopers type plastic fermenter. (Big-W or homebrew store)
- A bubbler-type airlock. (Big-W or homebrew store)

In addition, for assembly you will need:

- A power drill.
- A 1/16th inch drill bit.
- A 1/4 inch drill bit.
- A Stanley knife.
- Sandpaper and a sanding block, or power sander.
- A couple of hours spare time.

Construction steps:

1. The two buckets are the outer bucket and inner bucket respectively.
2. Remove the wire handles from both buckets.
3. Select the outer bucket and drill a 1/4 inch hole in the side, as close as possible to the bottom. This is the outlet for run-off from the mash. It is best to drill a 1/8th inch pilot hole first.
4. Use the Stanley knife to trim any plastic shavings away from the hole.
5. Fit the airlock grommet in the hole.
6. Using a 1/16th inch drill bit, drill holes at roughly 5mm spacing in the bottom of the inner bucket, creating a false bottom used to drain wort from the base of the mash. This step is very time consuming.
7. Using the Stanley knife, trim any external ribbing from the outside of the inner bucket, and then sand the cuts to a smooth finish. This allows the bucket to slide as far as possible into the outer bucket.
8. Using the Stanley knife cut the spear off the bottom of the bubbler-type airlock. Sand the cut to a smooth finish. Keep the spear and discard the body of the airlock.
9. Fit the 8-mm plastic tube to the spear. The other end is inserted into the space between the false bottom and the base of the tun, via the airlock grommet.

RECIPE FORMULATION

Partial mash recipes may be formulated using brewing software like Promash, or the online recipe calculator at <http://hbd.org/recipe>. If brewing using a kit, the bitterness and colour of the kit must be estimated, or consult the specifications if available.

I use and strongly recommend the HBD recipe calculator, as it is free, convenient for rapid formulation of recipes, and directly supports partial mashing:

The Beer Recipator 2.2 - Netscape

File Edit View Go Bookmarks Tools Window Help

http://hbd.org/cgi-bin/recipe/recipe?4105450

The Beer Recipator 2.2

Enter estimated volumes (in liters). **Important:** Fill in these fields first so that the calculations in the tables below can be carried out properly.

Sparge runoff: *Leave this blank if doing an extract only recipe.*

Boil volume: *Enter the volume of wort you will be boiling.*

Final volume: *Enter the total batch size.*

Mash [Help](#) [Calculate!](#) [Add Grain](#) [Find Efficiency](#)

Enter your typical mash efficiency for recipes of this type.

Mash efficiency (%): [Adjust](#)

Enter the grains to be used in the mash or use the "Add Grain" page to select the grains.

Grain	kg	g	%	Extract (%)	Points	Color (°L)	HCU
British pale	1		83%	81%	10.0	2.5	1.1
British crystal 50-60L		40	3.3%	72%	0.4	55	1.0
Roast malt		60	5.0%	57%	0.4	525	13.8
Flaked barley		100	8.3%	68%	0.8	2.2	0.1
			-		-		-
Calculate!					1.20kg	11.7	16.0

Given the mash efficiency, the estimated runoff SG is: **1.028**

Boil [Help](#) [Calculate!](#) [Add Extract/Sugar](#)

Enter any malt extracts or sugar added to the boil.

Ingredient	kg	g	%	Extract (%)	Points	Color (°L)	HCU
Coopers Lager Kit	1.7		85%	79%	27.7	6	4.5
Dextrose		300	15%	85%	5.3	0	0.0

Document: Done (4.827 secs)

Once the efficiency of your partial mashing system is known (65% is typical), it is possible to design recipes with a high degree of accuracy. I generally obtain a starting specific gravity close to the value given by the HBD calculator.

Some rules of thumb for partial mash recipe formulation:

- If using significant quantities of un-malted adjuncts, at least 50% of the grain should be base malt: pale malt, pilsner malt or wheat malt. Vienna and Munich malt are capable self-converting but cannot convert large quantities of adjuncts.
- Do not use less than 200g of sugar or 250g of dextrose in a standard size batch, or the result will be too sweet and cloying. 500g or more sugar may be used for drier or stronger beers.
- Use crystal malts sparingly, up to a maximum of around 300g in a standard 19 - 23 litre recipe. If additional colour is desired, a small amount of roast malt may be used without major effects on flavour.
- If using a significant quantity of wheat malt, or un-malted adjuncts, add rice hulls to the mash to avoid a stuck sparge, although this is not a major problem with partial mashing.

THE BREWING PROCESS

A partial mash beer may be made either in a single session of around 3.5 hours, or two separate sessions, saving the run-off from a mini-mash in PET bottles, which are frozen for later use. I have had excellent results saving and freezing wort in this manner, and it allows a brew session to be broken up over two work nights. Saved all-grain wort is also a superior medium for making yeast starters.

Mash Steps:

1. Pre-heat 3-4 litres of water to around 75 degrees C. Keep a jug of room temperature water handy. Boil the kettle so you have boiling water on hand.
2. While the water is heating, crush all grain and adjuncts (unless using pre-crushed grain) and add to Styrofoam cooler mash tun, along with 1tsp of calcium sulphate and 1tsp of cane sugar.
3. Add hot water to the mash tun, stirring as you go to break up any dry "dough balls" that form. When you have added between 2.5 and 3 litres of hot water, measure the temperature and adjust up or down using small additions boiling or room temperature water depending on whether the temperature is above or below the target temperature. For a partial mash of around 1.2Kg of grain, the cooler should be almost full when the correct temperature is reached.
4. When the mash temperature is right, put the lid on the mash tun and wait for 1 hour. A quick temperature check at 30 minutes won't hurt - just add some boiling water to bring the temperature back up if it has dropped too far.
5. After 1 hour, the mash should be fully converted. This may be verified by performing a conversion check with Iodine (Betadine). A converted mash will also have a sweet malt taste.
6. Heat 8 litres of sparge water to around 80 degrees C and transfer to your plastic fermenter hot liquor tank. The temperature will drop a few degrees on transfer into the room temperature plastic container. Adjust the pH of the sparge water to below 6.0 using tartaric, lactic or phosphoric acid if desired.
7. Assemble your mini lauter tun and click the regulator clip to the closed position.
8. Transfer the contents of the mash tun to the lauter tun as gently as possible.
9. Place a saucer or some aluminium foil on top of the grain bed.
10. Using an outlet tube placed on the saucer or foil, run water off the hot liquor tank into the lauter tun until it is nearly full.
11. Recirculate, by placing the end of the run-off tube from the lauter tun into a plastic jug, and opening the clip until the outlet tube fills, then closing the clip a couple of clicks so that a gentle out-flow is achieved. When the jug is nearly full, the clip and add the run-off back to the top of the lauter tun as gently as possible.

12. Repeat step 11 until a clear run-off is achieved. This generally takes about 1.5 - 2 litres.
13. Place any hops used for first wort hopping into the brew pot.
14. Place the run-off tube from the lauter tun into the brew pot, and run off gently until around 8 litres of wort have been collected, topping up the lauter tun from the hot liquor tank if necessary to achieve the desired volume.

Once the mash runnings have been collected, brew as per normal by boiling the results of the mash along with any malt extract, sugar and the contents of the can kit (added 10 minutes before the end of the boil). Add hops according to the schedule from your recipe.

KIT SELECTION AND SPECIFICATIONS

All recipes presented here specify Coopers kits, as these are readily available, make an excellent base for partial mashing, and have known specifications courtesy of the US importer's web site: <http://www.cascadiabrew.com>.

Coopers Kit	Bitterness (IBU)*	Colour (SRM)*
Canadian Blonde	21	3.6
Lager	21	4.5
Draught	20	4.5
Real Ale	29	8.1
Bitter	32	15.2
Dark Ale	28	20.3
Stout	43	65.9
Pilsner	22.9	3.6
India Pale Ale	31	12.2
Nut Brown Ale	31	12.2
Wheat	17.5	3.6

* Bitterness (IBU) and colour (SRM) assume a standard 23-litre batch size.

The specifications for the Coopers Bavarian Lager kit are not available, but are unlikely to differ significantly from other lager kits.

Equally good results can be obtained using other high quality kits (e.g. ESB, Morgans), or by extract brewing using liquid malt extract and boiling additional hops for 60 minutes. The Morgans web site, <http://www.morgansbrewing.com.au>, also provides kit specifications.

With the exception of the stout and wheat beer recipes, I prefer to use so-called "lager" kits as these provide a neutral base for adding flavour and colour using speciality grains in the partial mash. Partial mash wheat beers must be based on a wheat beer kit or wheat malt extract, all of which are a blend of wheat and barley malt extract. For the recipes that specify a Coopers Lager kit, any of the following kits may be used:

- Coopers Lager,
- Coopers Draught,
- Coopers Pilsner,
- Coopers Bavarian Lager,
- Coopers Canadian Blonde,
- Other equivalent "lager" kits.

When selecting a can kit, or liquid malt extract to use in a partial mash recipe, check the use-by date on the can carefully, as stale extract is a major cause of oxidised off flavours.

RECIPES

<p style="text-align: center;">PALE ALE</p> <p><i>Batch Size:</i> 19 litres <i>Can Kit:</i> 1.7Kg Coopers Lager <i>Extract/Sugars:</i> 150g cane sugar 100g raw sugar 100g light dried malt extract <i>Partial Mash:</i> 60 minutes @ 67°C <i>Grain/Adjuncts:</i> 1.5kg English Pale Malt # 150g English Crystal 55L # 10g Roast Malt 1tsp Cane Sugar 1tsp Calcium Sulphate <i>Sparge Runoff:</i> 8 litres <i>Boil Size:</i> 14 litres <i>Boil Duration:</i> 60 minutes <i>Boil Schedule:</i> 30g Fuggles Pellets 5%AA @ 20 min Can Kit @ 10 min Irish Moss @ 5 min 20g Fuggles Pellets 5%AA @ end <i>Bitterness:</i> approx. 36 IBU <i>Colour:</i> approx. 8 SRM <i>OG:</i> 1.048 <i>FG:</i> 1.012 <i>Alcohol:</i> approx. 4.8% <i>Yeast (liquid):</i> Wyeast 1028, 1275 or 1968 <i>Yeast (dried):</i> Safale S-04, Danstar Nottingham or Windsor</p>	<p style="text-align: center;">IRISH RED ALE</p> <p><i>Batch Size:</i> 19 litres <i>Can Kit:</i> 1.7Kg Coopers Lager <i>Extract/Sugars:</i> 150g cane sugar 100g raw sugar <i>Partial Mash:</i> 60 minutes @ 67°C <i>Grain/Adjuncts:</i> 1.5kg English Pale Malt # 90g English Crystal 55L # 60g Roast Malt 100g Flaked Barley 1tsp Cane Sugar 1tsp Calcium Sulphate <i>Sparge Runoff:</i> 8 litres <i>Boil Size:</i> 14 litres <i>Boil Duration:</i> 60 minutes <i>Boil Schedule:</i> 20g Goldings Pellets 5%AA @ 15 min Can Kit @ 10 min Irish Moss @ 5 min <i>Bitterness:</i> approx. 25 IBU <i>Colour:</i> approx. 12 SRM <i>OG:</i> 1.044 <i>FG:</i> 1.011 <i>Alcohol:</i> approx. 4.4% <i>Yeast (liquid):</i> Wyeast 1084 or 1968 <i>Yeast (dried):</i> Safale S-04 or Danstar Nottingham</p>
<p style="text-align: center;">IRISH STOUT</p> <p><i>Batch Size:</i> 19 litres <i>Can Kit:</i> 1.7Kg Coopers Stout <i>Extract/Sugars:</i> 250g dextrose <i>Partial Mash:</i> 60 minutes @ 67°C <i>Grain/Adjuncts:</i> 1.4Kg English Pale Malt # 150g Roast Barley 150g Flaked Barley 1tsp Cane Sugar 1tsp Calcium Sulphate <i>Sparge Runoff:</i> 8 litres <i>Boil Size:</i> 14 litres <i>Boil Duration:</i> 60 minutes <i>Boil Schedule:</i> Can Kit @ 10 min <i>Bitterness:</i> approx. 45 IBU <i>Colour:</i> > 60 SRM <i>OG:</i> 1.045 <i>FG:</i> 1.012 <i>Alcohol:</i> approx. 4.2% <i>Yeast (liquid):</i> Wyeast 1084 or 1968 <i>Yeast (dried):</i> Safale S-04 or Danstar Nottingham</p>	<p style="text-align: center;">AUSTRALIAN ALE</p> <p><i>Batch Size:</i> 19 litres <i>Can Kit:</i> 1.7Kg Coopers Draught <i>Extract/Sugars:</i> 500g cane sugar 100g light dry malt extract <i>Partial Mash:</i> 60 minutes @ 67°C <i>Grain/Adjuncts:</i> 1.6Kg Schooner Malt 80g Crystal Malt 20g Roast Malt 1tsp Cane Sugar 1tsp Calcium Sulphate <i>Sparge Runoff:</i> 8 litres <i>Boil Size:</i> 14 litres <i>Boil Duration:</i> 60 minutes <i>Boil Schedule:</i> 10g Pride Flowers 10%AA @ 30 min Can Kit @ 10 min Irish Moss @ 5 min <i>Bitterness:</i> approx. 28 IBU <i>Colour:</i> approx. 7 SRM <i>OG:</i> 1.052 <i>FG:</i> 1.010 <i>Alcohol:</i> approx. 5.6% <i>Yeast (liquid):</i> Coopers Pale Ale bottle culture. <i>Yeast (dried):</i> Coopers, from can kit.</p>

= Bairds Malt (UK)

* = Weyermann Malt (Germany)

RECIPES

<p style="text-align: center;">CZECH PILSNER</p> <p><i>Batch Size:</i> 19 litres <i>Can Kit:</i> 1.7Kg Coopers Lager <i>Extract/Sugars:</i> 300g dextrose 100g light dry malt extract <i>Partial Mash:</i> 60 minutes @ 67°C <i>Grain/Adjuncts:</i> 1.6kg German Pilsner Malt* 1tsp Cane Sugar 1tsp Calcium Sulphate <i>Sparge Runoff:</i> 8 litres <i>Boil Size:</i> 14 litres <i>Boil Duration:</i> 60 minutes <i>Boil Schedule:</i> 20g Saaz Pellets 4%AA First Wort Hopped 30g Saaz Pellets 4%AA @ 60 min Can Kit @ 10 min Irish Moss @ 5 min <i>Bitterness:</i> approx. 38 IBU <i>Colour:</i> approx. 5 SRM <i>OG:</i> 1.048 <i>FG:</i> 1.012 <i>Alcohol:</i> approx. 4.8% <i>Yeast (liquid):</i> Wyeast 2206, 2124 or 2278 <i>Yeast (dried):</i> Saflager S-189</p>	<p style="text-align: center;">HEFEWEIZEN</p> <p><i>Batch Size:</i> 19 litres <i>Can Kit:</i> 1.7Kg Coopers Wheat <i>Extract/Sugars:</i> 300g dextrose 100g light dry malt extract <i>Partial Mash:</i> 60 minutes @ 67°C <i>Grain/Adjuncts:</i> 800g German Pilsner Malt * 800g German Wheat Malt * 1 cup of rice hulls 1tsp Cane Sugar 1tsp Calcium Sulphate <i>Sparge Runoff:</i> 8 litres <i>Boil Size:</i> 14 litres <i>Boil Duration:</i> 60 minutes <i>Boil Schedule:</i> Can Kit @ 10 min <i>Bitterness:</i> approx. 18 IBU <i>Colour:</i> approx. 5 SRM <i>OG:</i> 1.048 <i>FG:</i> 1.012 <i>Alcohol:</i> approx. 4.8% <i>Yeast (liquid):</i> White Labs: WLP300 or 380 Wyeast: 3068, 3333 or 3638 <i>Yeast (dried):</i> Safale K-97</p>
<p style="text-align: center;">DUNKELWEIZEN</p> <p><i>Batch Size:</i> 19 litres <i>Can Kit:</i> 1.7Kg Coopers Wheat <i>Extract/Sugars:</i> 300g dextrose 100g light dry malt extract <i>Partial Mash:</i> 60 minutes @ 67°C <i>Grain/Adjuncts:</i> 700g German Pilsner Malt * 750g German Wheat Malt * 50g Roast Malt 100g Carafa Special 1* 1 cup of rice hulls 1tsp Cane Sugar 1tsp Calcium Sulphate <i>Sparge Runoff:</i> 8 litres <i>Boil Size:</i> 14 litres <i>Boil Duration:</i> 60 minutes <i>Boil Schedule:</i> Can Kit @ 10 min <i>Bitterness:</i> approx. 18 IBU <i>Colour:</i> approx. 16 SRM <i>OG:</i> 1.048 <i>FG:</i> 1.012 <i>Alcohol:</i> approx. 4.8% <i>Yeast (liquid):</i> White Labs: WLP300 or 380 Wyeast: 3068, 3333 or 3638 <i>Yeast (dried):</i> Safale K-97</p>	<p style="text-align: center;">DÜSSELDORF ALTBIER</p> <p><i>Batch Size:</i> 19 litres <i>Can Kit:</i> 1.7Kg Coopers Lager <i>Extract/Sugars:</i> 300g dextrose 100g light dry malt extract <i>Partial Mash:</i> 60 minutes @ 67°C <i>Grain/Adjuncts:</i> 750g German Pilsner Malt * 750g German Munich Malt * 100g Carafa Special 1 * 1tsp Cane Sugar 1tsp Calcium Sulphate <i>Sparge Runoff:</i> 8 litres <i>Boil Size:</i> 14 litres <i>Boil Duration:</i> 60 minutes <i>Boil Schedule:</i> 30g Tettnang Pellets 4%AA @ 60 min 20g Tettnang Pellets 4%AA @ 15 min Can Kit @ 10 min Irish Moss @ 5 min <i>Bitterness:</i> approx. 40 IBU <i>Colour:</i> approx. 14 SRM <i>OG:</i> 1.048 <i>FG:</i> 1.012 <i>Alcohol:</i> approx. 4.8% <i>Yeast (liquid):</i> White Labs: WLP029 Wyeast: 1007 <i>Yeast (dried):</i> Safale K-97</p>

* = Weyermann Malt (Germany)

USEFUL INTERNET RESOURCES

- BABB:
<http://www.babbrewers.com>
- Promash:
<http://www.promash.com>
- The HBD Online Recipe Calculator:
<http://hbd.org/recipe>
- John Palmer's "How to Brew":
<http://www.howtobrew.com>
- The Australian Craftbrewing web site:
<http://craftbrewer.org>
- The Australian Craftbrewing email list:
<http://new.craftbrewer.org/Digest/messages/index.shtml>
- The rec.crafts.brewing newsgroup:
<http://groups.google.com/groups?q=rec.crafts.brewing&hl=en>
- Wyeast:
<http://www.wyeastlab.com>
- White Labs:
<http://www.whitelabs.com>
- DCL Yeasts:
http://www.dclyeast.co.uk/DCL_Main/main_brewing/craftbrew_index.htm
- ESB (Sydney): Australian importer of White Labs yeast.
<http://www.esbeer.com.au>
- Grain & Grape (Melbourne): Australian importer of Wyeast.
<http://www.grainandgrape.com.au>
- Bairds Maltings (UK): specifications for Bairds malt.
http://www.scotgrain.co.uk/main_frame.htm
- Weyermann Maltings (Germany): specifications for Weyermann malt.
<http://www.weyermann.de>