

## Midland Craft Brewers Yeast Day

A workshop covering the use and storage of dried and liquid yeasts for the small scale craft brewer.

**Programme:** We aim to cover the basic aspects of yeast handling, short and long term storage of strains, preparation of starters and slant media. There are notes on different techniques and advice on how to manage fermentations, with practical demonstrations backed up by written notes and discussion.

### **We aim to cover;**

- ⤴ Sources of yeast including Wyeast packs, White Labs vials, Brewlab slants and dried yeast
- ⤴ Preparing a yeast starter, step-up stages and appropriate pitching rates
- ⤴ Managing the fermentation
- ⤴ Outline of short and medium term methods of yeast storage
- ⤴ Preparing agar slants for yeast storage (*practical*)
- ⤴ Preparing a starter from a home grown or Brewlab slant (*practical*)
- ⤴ Transferring yeast cells from a master culture using sterile transfer techniques (*practical*)
- ⤴ Streaking a slant from a white Labs vial (*practical*)
- ⤴ Yeast maintenance and problems that may occur / acid washing
- ⤴ Alternative techniques

## General Notes

### Dried Yeast

Most craft brewers have started out using dried yeast and very good results have been obtained including prizes won at national competitions. However it isn't a matter of buying any packet available and just "chucking it in," we need to take a few steps to ensure we get the best results possible. There are several well known strains available from Lallemand, Fermentis and more recently Mauribrew, and whilst dried yeast has a good shelf life when stored refrigerated, if stored at room temperature it can lose 20% of its viability within a year. So buy from a specialist dealer and store in the fridge till needed. Dried yeast should always be rehydrated with ten times its weight in water at 25 – 29C for ale strains and 21 - 25C for lager strains. The water for rehydration should be brought to the boil first both to sterilise and remove chlorine, then cooled to the correct temperature in a small jug. After sprinkling the dried yeast on the surface, leave for 15 minutes before stirring and then leave a further 15 minutes before pitching. If the temperature is more than 6C greater than the wort, add equal amounts of wort to the jug allowing a few minutes rest to avoid "shocking" the yeast by sudden temperature changes. On the Fermentis website [www.fermentis.com](http://www.fermentis.com) there is an excellent download called "*Tips and Tricks*" which contains valuable advice about how to get the best results from dried yeast. One point to note is that if you decide *not* to rehydrate dried yeast, then it should be pitched into the wort at 20 – 24C then left to cool down to the normal fermentation range of 18 – 22C. ( for ales )

*Advantages of dried yeast; Cost, convenience, no starter required, consistency.*

*Disadvantages; Limited in choice to a few commercial strains that tend in general to be more "neutral" in character than liquid yeasts.*

**Liquid Yeast sources;** We have available to us the following;

*White Labs:* These yeasts are supplied in heavy duty plastic vials containing roughly 100 billion cells each.

*Wyeast Activator:* This yeast is supplied in a “smack-pack” which should be activated at least 4 hours before using by placing on a hard surface and striking to burst the inner membrane which contains a nutrient. If well within date and undamaged by heat, the pack should swell within 4 hours however older or heat damaged packs can take longer, even days to activate.

Both the Wyeast packs and Whitelabs vials are claimed to be sufficient for direct pitching into a 19L batch of beer, however for larger brews or incorrectly stored / handled packs a 1.5 – 2.0L starter is strongly recommended.

*Brewlab slants:* These can be obtained directly from Brewlab and are usually posted out within 3 – 5 working days so are guaranteed to arrive fresh and in good condition. The instructions for use recommend that a 300ml starter is prepared which is assumed to be sufficient to inoculate a 23L brew. However for larger volumes and stronger beers, a 150 – 200ml starter further stepped up to 1.5 – 2.0L would be appropriate to ensure a complete and thorough fermentation.

***Advantages of liquid yeasts;*** *Vast number of available strains with varying characteristics to suit all styles of beer.*

***Disadvantages;*** *Initial cost, time spent in preparing starter.(s)*

**Preparing a yeast starter** For yeast packs and vials a simple 1.8L starter can be prepared as follows. Dissolve 160 – 180g dried malt extract in 2 litres of water and boil for 10 minutes, then cool as rapidly as possible to around 20C before transferring to a suitable sterilised container such as a demijohn or 2 litre flask. After shaking the container to admit some air the vial or pack can be added, then after covering loosely with foil should be kept at room temperature for 12 – 24 hours, at which time the starter should be fermenting vigorously and be ready for pitching into a 20 – 30L batch. Ideally the starter should have an OG of 1.038 – 1.040 and a pH of around 5.0 so if your water alkalinity is high, it will be beneficial to add a few drops of A/M/S ( C/R/S ) or a small pinch of citric acid to help bring the starter within range. Shaking the yeast starter intermittently to disperse CO<sub>2</sub> build up will help to increase the total cell count, whilst a stir-plate will save you the effort! (see below) A few hops ( or more conveniently hop pellets ) may be added when boiling the starter, however this is not essential and note that a highly hopped starter will have a negative effect on yeast viability.

**Managing the fermentation** some hints and tips

- ⤴ aerate the wort well before pitching the yeast, a simple way to do this is to collect the wort in half filled gallon water containers which are capped and shaken vigorously for several seconds before adding to the FV. This should give dissolved oxygen levels of around 8 – 10 ppm and is considerably more effective than an air-stone, that is unless the latter is delivering pure oxygen.
- ⤴ Try and cool the wort to 18C before pitching the starter then insulate the FV against sudden temperature changes or better still build a fermentation chamber or cupboard. When fermentation takes hold, the heat produced will cause the temperature to rise by a few degrees to about 20 - 22C which is ideal for most ale strains.
- ⤴ Some top cropping yeasts form a large head and this may need gentle rousing back into the wort to stop fermentation slowing down. The top layer of dirty yeast can be skimmed off if

necessary.

- ⤴ When the terminal gravity has been reached, cover the FV and rest for at least 24 hours before cooling (if possible) to assist clarification. The beer can then be bottled / kegged directly, or racked to a second enclosed tank if desired for dry-hopping or further clarification if needed. However if you do rack to a secondary vessel take great care to minimise any aeration, this can result in oxidised beer with its cardboard like taste.
- ⤴ Adding a yeast nutrient such as Murphy's Yeast-Vit or Wyeast Nutrient will benefit the yeast and help prevent slow or incomplete fermentations, these can be caused by a deficiency in the wort of zinc, nitrogen or amino acids. A ¼ teaspoon added to the wort at pitching should be adequate for a 25L batch, alternatively the nutrient can be added during the last 10 minutes of the boil and the dose increased to ½ teaspoon, as some nutrient is absorbed by the trub.

### **Saving yeast for short and long term storage**

For short term storage yeast can be collected from the FV and kept for up to a week in a sterilised container stored in a fridge at 1 – 4C. For collecting yeast from top-cropping strains, it's best to discard the first crop after about half way through the fermentation. Then when the head has properly reformed and before the fermentation is starting to slow down, remove some clean yeast with a sterilised spoon and place in a jug or jar which should be loosely covered with foil to allow escape of any CO<sub>2</sub> whilst under storage. The amount for re-pitching must be decided largely by experience, however there is a very useful calculator for this very purpose on [www.mrmalty.com](http://www.mrmalty.com) With bottom cropping strains the yeast may be recovered from the base of the FV after racking but there will also be trub, dead and mutant cells present. Thus the quality will not be so high as with yeast recovered from top-cropping, however if a Conical FV is used, the first settlings (which contain most of the dead cells and trub) can be dumped and the clean yeast which settles later can be recovered.

For longer term storage some craft brewers simply omit the primings from a particular bottle whilst packaging, then fill almost to the brim and store in the fridge for up to a couple of months. The sedimented yeast is then used to prepare a 150 - 200ml starter which should be further stepped up to 1.5 – 2.0L before pitching. Other craft brewers have experimented by storing yeast slurries under sterilised distilled water, the slurry however must first be rinsed several times to remove any beer traces.

However the professional approach is to store the yeast on agar slants, which when grown and refrigerated will keep for up to six months. This is performed by streaking a slant with yeast using an inoculating loop, the slant is then allowed to grow at room temperature for 2 – 4 days before being refrigerated. During the growth period the cap must be vented to release any CO<sub>2</sub> which has built up, alternatively the caps can be loosened by a quarter turn and the slants inverted until grown. For long extended storage periods, large scale breweries and yeast banks freeze their yeast cultures under glycerol at -80C, however this is beyond the scope of most craft brewers.

**Yeast strain maintenance** It makes sense to take some precautions to make sure that your yeast remains in top condition and to be aware of potential problems that may occur. A question often raised is “how many generations should I use my yeast for” and this must depend largely on your own particular technique, attention to cleaning and sterility, the strength of beers produced and the characteristics of the particular strain that is being used. Certain yeasts are more robust than others particularly in respect to mutation, autolysis and temperature extremes. Some craft brewers renew the strain when it has reached three generations, others after five, whilst some maintain the same strain for many more generations whilst maintaining the quality of their beer.

Some warning signs that the yeast may require renewing are briefly noted below.

- ⤴ Extended fermentation times when all other factors are equal
- ⤴ High terminal gravities and elevated beer pH readings ( under-pitching, possible mutation, tired or stressed yeast )
- ⤴ Increasingly hazy beer which may also be resistant to fining ( bacterial infection or wild yeast contamination )
- ⤴ Vegetal / cooked corn ( common wort bacteria *o.proteus* )
- ⤴ Phenolic taints and off flavours ( wild yeast )
- ⤴ Acetic aroma ( bacterial infection )
- ⤴ Autolysis – earthy smell taste, burnt rubber ( stressed or tired yeast with large proportion of dead cells )
- ⤴ Loss of characteristics / esters

These faults may not occur suddenly, but instead build up gradually with each successive generation to a point where the beer is well below quality standard and eventually has to be discarded.

Renewing the strain at the first sign of any trouble or off flavours would be a sensible precaution, however there are a few steps that can be taken to prevent or minimise these problems.

For example, pitching a sufficient quantity of yeast and ensuring the wort pH is correct will prevent long lag times and reduce the possibility of infection with common wort bacteria. Acid washing is a relatively simple technique that will kill wort and other gram negative bacteria but will not remove certain lactic bacteria or wild yeast. In this process, the yeast slurry for pitching is lowered to a pH of between 2.0 – 2.5 by *cautiously* adding food grade phosphoric acid whilst stirring. The slurry must be kept below 4 C and held at this temperature for between one and two hours and then pitched into the wort as soon as possible. Some of the more traditional breweries acid wash their yeast routinely after a certain number of generations, this is regarded as a sensible precaution.

## **Individual Techniques**

### *Peter's methods.*

With a strong emphasis on top-cropping strains, yeast is stored on agar slants for periods of between two weeks and six months, although for very short term use freshly cropped yeast may be stored in the fridge for up to four days before re-pitching. Home made slants are produced using both 30ml and 60ml polypropylene vials. When half filled with agar wort, the 30ml slant contains at least the equivalent surface area of a Brewlab slant whilst the 60ml vial has at least twice that surface area.

When a brew has fermented more than half of the available sugars, a small amount of clean yeast is skimmed into a jug and 1 x 30ml plus 2 x 60ml slants are streaked, and once grown, stored in the coldest part of the fridge at 1 – 4C. The two 60ml slants are used within three months to inoculate a well aerated 1.0L starter, which after 24 hours is pitched directly into a 28L brew of up to og 1.045. The small 30ml slant is kept for up to 6 months and when needed, a 200ml starter is prepared which after 24 hours is stepped to 2.0L, this in turn is pitched into the brew which in this case may be of a higher gravity. Peter's practice of inoculating a 1 litre starter directly from 2 x 60ml slants may be regarded by many as “cutting corners.” However the fermentations have been entirely normal, ( save for a slightly extended lag time ) with similar terminal gravities and pH measurements compared to brews made with the double step-up stage or from a fresh yeast pack.

Some strains have been kept going for many generations and for at least a year using this method whilst acid washing has been used on two occasions, more as a preventive than remedial measure.

One strain was replaced after many generations because the flavour was becoming increasingly bland with the loss of desirable fruity esters. Thankfully there have been no problems with infection or mutation so far and at the present time four ale strains are in intermittently in use, these being Y1469, ( W. Yorks ) WLP004 ( Irish ) Y1728 ( Scottish ) and Brewlab 2556 ( Burton ) and all seem to be robust and well behaved. Y1318 can also be recommended and this too performed well

over a lengthy period and is very suitable for top-cropping. Yeast-vits are routinely used at the minimum recommended level, Peter believes that they have been beneficial in helping to maintain yeast and subsequent beer quality.

### Alan's Methods

#### YEAST SLOPES

Method can be used for either spray dried wort or product from a batch of beer in preparation.

##### A. Spray dried wort.

1. Ensure that the universals (25ml) and caps are clean.
2. Prepare wort as for the yeast seed vessel at 75grams spray dried malt extract per 500ml of water.
3. Pressure cooker will take 27 universals at 10ml/universal (total 270ml). Therefore, add about 40 grams per 350 ml of water and so should end up with about 270ml
3. Agar to be used at 3% (w/v) so require about 9 grams of agar for 27 slopes.
4. Add agar to hot wort, mix thoroughly and then aliquot into universals.
5. Pressure cooker for 15 minutes at 20 psi.
6. Remove carefully and allow to cool at an angle. Store cool and inspect before use.

#### YEAST

Yeast stocks are restreaked every 4-5 months as noticeably lose viability towards 6 months. Stocks held WLP-001, 023, 300 and 800 and Marstons (also Champagne yeast).

#### YEAST SEED VESSEL (Aerobic)

1. Bruclean the 1L duran plus lid and stirrer bar. Separately, 10ml pipette, plastic sieve, and plastic funnel.
2. Water 450ml and 0.3ml of CRS and small amount of yeast nutrients.
3. Add 45 grams of spray dried malt to cold acidified water and bring to the boil with a few hop cones (the higher the alpha acid the better). Boil 10 minutes.
4. Rinse duran and plastics thoroughly and keep lid in place on duran.
5. While hot and with swirling filter wort through sieve and funnel. Cool in cold water bath with lid on.
6. Shake thoroughly to dissolve maximum concentration of air.
7. Rinse yeast slopes (3), prepared previously with cooled wort (twice) using pipette with bulb) to transfer yeast from agar.
8. Put foil on duran and place in cupboard on stirrer plate at 20°C. The culture should be active in 6-18 hours, visibly opaque. Ensure stirrer provides vortex for maximum aeration.
9. To bulk up yeast, boil (10 minutes) 450 ml water with 40grams of spray dried malt, cool and aerate and add to culture after approx. 48 hours to a total of approx.800ml.
10. Add seed culture (36-48 hours later) to aerated wort in fermenter (up to 23L) and stir well.
11. It is possible to switch off stirrer a couple of hours before yeast is required so that the bulk of used malt extract can be decanted and this is recommended in some articles on the subject.



