

YEAST PITCHING RATES

Official NORTHERN BREWER Instructional Document

OVERVIEW

WHAT IS A YEAST PITCHING RATE?

BASICALLY ITS THE AMOUNT OF YEAST ADDED TO COOLED WORT. THIS 'RATE' IS NEARLY ALWAYS MEASURED IN MILLIONS OF YEAST CELLS PER MILLILITER OF WORT.

The amount of yeast needed is most dependent on the original gravity of your beer and the fermentation temperature. Simply, the higher the original gravity, the more yeast you need and the colder you ferment, the more yeast you need. Most calculations are based on a different system of gravity called 'degrees Plato (°P)'. The simple conversion from specific gravity units to degrees Plato is included below.

Beer style and finished product should also be taken into consideration. There are many ways to affect your final product of which the pitching rate is a very simple one. The cleaner you want your beer, the more yeast you would use and vice versa. Say, for instance, you wanted an English pale ale that was quite fruity. You would first choose a yeast that produced copious amounts of esters. If this yeast didn't produce enough esters for their taste one could pitch around 10-15% less yeast which itself would increase the amount of fruity character (per 'differing pitch rates' section).

WHAT DOES PITCH RATE MEAN TO ME?

- **LOW PITCH RATE** - stuck fermentation, high finishing gravity, lots of fruity character, increase in off-flavors
- **HIGH PITCH RATE** - Fast fermentations, lack of mouthfeel, yeasty flavors, lack of fruity character

AVERAGE PITCHING RATES

ALES

- **OG < 1.055 (<14°P)** = ~0.5 MILL CELLS/ML/°P
- **OG > 1.055 (>14°P)** = ~1.0 MILL CELLS/ML/°P

LAGERS

- **OG < 1.055 (<14°P)** = ~1.0 MILL CELLS/ML/°P
- **OG > 1.055 (>14°P)** = ~1.5 MILL CELLS/ML/°P

NOTE - mill cells/ml/°P = Millions of cells per ml of wort per degree plato. For example, an ale of 12°P would use approximately 6 mill cells/ml/°P

TYPICAL YEAST CELL COUNTS:

	50 mL SMACK PACK	125mL XL SMACK PACK	PITCHABLE TUBE	YEAST STARTER
APPROXIMATE CELL COUNT (BILLIONS)	15-18	45-60	30-60	200

YEAST PROPAGATION

OVERVIEW

Tailoring your yeast propagation ensures the brewer has an adequate yeast supply and, more importantly, decreases their batch-to-batch variability many times over (e.g., ensures reproducibility). Of all the differences between home and commercial brewers, this aspect of brewing is ultimately the one that makes the most difference. Commercial brewers need to be able to reproduce the same beers brew after brew. Apart from the actual brewing of the beer, the biggest problems facing brewers are having the same numbers of healthy active yeast ready to ferment batch after batch. The only way to do this is to either physically count your yeast. Home brewers don't need to be as exact as their commercial counterparts and can use calculations to approximate growth. These calculations you performed above.

- **NOTE:** All basic information on making a starter can be found on our Yeast Starter instruction page. The information provided below is to be used to optimize your yeast propagation to produce the the required number of yeast.

QUESTIONS

At this point you have already calculated that you will need to make a starter. You know the number of yeast you have and have determined the number of yeast you need. To tailor the yeast propagation (e.g. starter) to your needs you will need to answer the following questions:

- **1. WHAT SIZE FLASK WILL YOU BE USING?** - The size of your flask will limit the maximum size of your starter. Basically, the larger the volume of starter you create, the higher number of yeast you produce. A good rule of thumb is to have the starter volume be no more than 2/3's of your total flask volume.
- **2. DO YOU HAVE A STIR PLATE?** - Using a stir plate will increase the rate and number of yeast produced.
- **3. WHICH BRAND OF YEAST WILL YOU USE?** - Will you be using Wyeast, White Labs or dry yeast? We assume that both Wyeast and White Labs contain approximately 100 billion yeast cells and use this data for the charts below. Although definitely functional, the relatively low cost of the dry yeast dissuades us from recommending using it in a starter. Frankly, its cheaper and equally effective just to buy more packets of it than to take the time and energy to make a starter with it

Having answered these questions and using the charts provided below one can find their optimum starter.

ONE VS TWO STEP PROPAGATION

SINGLE STEP PROPAGATION

When most people make a starter they do a single step starter. Basically they make about one liter of starter, add their yeast, ferment it over night and then pitch it. This is a one step propagation. Very straightforward and very easy. This sort of starter works with the majority of beers but not the higher gravity ones or those for higher volumes of beer production (>5gal). The biggest challenge is that to get the number of yeast needed the amount of starter gets into the gallons and most people don't have a 2 gallon flask to make a starter in. Additionally, the more you dilute your yeast the exponentially longer it will take for the yeast number to increase. For best results, the yeast need to be in close quarters.

TWO STEP PROPAGATION

A simple way to get around the volume problem is to perform a two step propagation. This requires that a much smaller starter be made, the liquid decanted off and then fresh wort of a given volume be added to the yeast propagated from the first stage. Let alone does this require less volume of starter, it produces more healthy active yeast than the single stage. It does however take another day or so which requires more planning.

YEAST PITCHING RATES

HOW DO I CALCULATE THE NUMBER OF YEAST I NEED?

To calculate your beer's pitch rate you need to know a few things. They are the original gravity, the final volume of beer and your chosen pitching rate (from above). Sometimes you will need to make a starter, many times not. Use the simple calculation below to find the numbers of yeast you need or search the web for a rate calculator as there are many available.

- **NOTE** - There are a lot of large numbers thrown around and some units you may not understand. Just plug in your numbers and you'll be all set.

DO I NEED TO MAKE A STARTER?

(A) _____ bill of cells needed

(B) _____ bill of cells I have

- **YES** - A > B - follow instructions below

- **NO** - A < B - get brewing!

YEAST CELLS NEEDED:

Pitch rate chosen: _____ millions of cells/ml/°P x 1,000,000 = _____ cells/ml/°P

Predicted OG: _____ / 4 = _____ degrees Plato (°P)

Wort volume: _____ gal x 3785 ml/gal = _____ ml

Total cells required = _____ pitch rate x _____ °P x _____ ml = _____ cells required

Convert to billions of cells: _____ cells / 1,000,000,000 = _____ billions of cells

PROPAGATION CHARTS

HOW TO USE THE CHARTS

SINGLE STAGE PROPAGATION

- 1. **CHOOSE WHICH CHART YOU NEED BASED ON THE USE OF A STIR PLATE.** Note - if not using a stir plate swirl the yeast as often as possible
- 2. **FIND THE NUMBER OF CELLS YOU NEED IN THE EXTREME RIGHT COLUMN** and follow it back to find the volume of starter you need.
- 3. **MAKE YOUR CHOSEN VOLUME OF STARTER**
- 4. **PITCH YOUR SMACKPACK (SWOLLEN) OR TUBE**
- 5. **FERMENT 12-16 HOURS AT ~70F**
- 6. **BEFORE PITCHING LET THE YEAST FALL TO THE BOTTOM AND DECANT OFF AS MUCH OF THE LIQUID AS POSSIBLE.** Chilling the starter in the freezer will speed up this process. This is **MANDATORY** when using a very high volume of starter to keep from diluting your beer.

NO STIR PLATE		WITH STIR PLATE	
Volume (Liters)	Billions of Cells	Volume (Liters)	Billions of Cells
0	100.00	0	100.00
0.5	133.80	0.5	187.36
1	180.54	1	252.84
2	243.75	2	341.22
3	290.50	3	406.70
4	328.92	4	460.63
5	362.41	5	507.38
6	392.13	6	549.01
7	419.19	7	586.86
8	444.17	8	621.69

EXAMPLE - IF YOU NEEDED 180 BILLION CELLS YOU WOULD NEED A 1 LITER STARTER (NO STIR PLATE) OR 0.5L STARTER (STIR PLATE).

TWO STAGE PROPAGATION

- 1. Choose which chart you need based on the use of a stir plate. Note - if not using a stir plate swirl the yeast as often as possible
- 2. Find the number of cells you need in the extreme right column
- 3. Decide on the best combination of 1st and 2nd volumes for your system to meet your yeast needs
- 4. Make your 1st volume of starter, add yeast as for the one step propagation and ferment 12-16hours at ~70F.
- 5. Let yeast fall to bottom and decant as much liquid as possible.
- 6. Add your 2nd volume of starter and ferment it like the 1st volume.
- 7. Before pitching let the yeast fall to the bottom and decant off as much of the liquid as possible.

NO STIR PLATE			WITH STIR PLATE		
1st Volume (L)	2nd Volume (L)	Billions of cells	1st Volume (L)	2nd Volume (L)	Billions of cells
0	0	100	0	0	100
0.5	0.125	146	0.5	0.125	248
0.5	0.25	199	0.5	0.25	335
0.5	0.5	267	0.5	0.5	453
0.5	0.75	318	0.5	0.75	539
1	0.125	174	1	0.125	294
1	0.25	234	1	0.25	397
1	0.5	316	1	0.5	536
1	0.75	377	1	0.75	639
2	0.125	206	2	0.125	349
2	0.25	278	2	0.25	471
2	0.5	375	2	0.5	636
2	0.75	447	2	0.75	757

EXAMPLE - LETS SAY I NEED 300 BILLION YEAST AND I HAVE A TWO LITER FLASK WHICH LIMITS MY VOLUME. FOR NOT USING A STIR PLATE I THEN CAN USE EITHER 0.5L-1ST AND 0.75L-2ND OR 1.0L-1ST AND 0.5L-2ND.