Yeast Pitch Rate and Starter Calculator

Pitch your yeast like the pro's do with this easy to use calculator that supports dry yeast, liquid yeast, slurry, and starters. Calculates liquid yeast viability based on manufactured date. You get to choose your desired pitch rate in million cells / milliliter of wort / degree plato. Also calculates how big of a starter to make and how much DME to add to that starter. Up to three step-ups are supported, so you can even start from a yeast slant! Two different growth curves are supported. The first comes from recently published research at Braukaiser, and the second from a study by Chris White.
Part 1: Calculate how many yeast cells are required for your batch given your desired pitch rate and if you have enough yeast.

Yeast Pitch Rate:

Units:	◉ US - Gallons / oz ○ Metric - Liters / g
Sugar Scale:	◉ Gravity (1.xxx) ○ Plato °P
Wort Gravity (OG):	`1.050` (1.xxx)
Wort Volume:	`5.0` Gallons
Target Pitch Rate:	`Pro Brewer 1.25 (Ale, or High Gravity Ale) ▼` (million cells / ml / degree plato)
Yeast Type:	`Dry Packets ▼`
Dry Yeast Amount:	`11.5` (grams)
Cell Density:	`8` (billion cells / gram) *cell count estimates*
	UPDATE

Cells Available:	**92 billion cells**
Pitch Rate As-Is:	**0.39M cells / mL / °P**
Target Pitch Rate Cells:	**293 billion cells**
Difference:	**-201 billion cells**
	Needs starter (see below), or more yeast.

Part 2: Make a starter if required, supports up to 3 step-ups.

Yeast Starter - Up To 3 Step-Ups:

Starting Yeast Count: [_____] (Billion Cells)   GRAB FROM ABOVE

> *Enter the number of cells you are starting with, or click the 'grab from above' button if you set up your yeast in the previous section.*

Starter - Step 1:

Starter Size (L)	Gravity (1.xxx)	Growth Model and Aeration	
2	1.036	Braukaiser - Stir Plate ▾	UPDATE

DME Required:

Growth Rate:

Ending Cell Count:

Resulting Pitch Rate:

Starter - Step 2: ☐

Starter - Step 3: ☐

Related Posts:

- Yeast Pitch Rates Explained
- How To Make a Yeast Starter (OG 1.040)
- Stir Plates and Growing Brewing Yeast Quickly
- StirStarter Equipment Review

How the calculator works:

We selected the most commonly accepted figures from manufactures, beer experts, and literature to bring you something that saves you time and makes your beer turn out better!

Yeast counts, viability, and growth rates should be treated as estimates. In reality, they depend heavily on factors like temperature, yeast strain health, nutrient levels, yeast generation, the specific strain of yeast, etc. **If you are using liquid yeast, you will be encouraged to do a starter. <u>That alone will take your beer to the next level.</u>**

Choosing a Pitch Rate - we put you in control:

The Target Pitch rate drop down has the following values:

- Minimum manufacturer's recommendation: 0.35 (ale only, fresh yeast only)
- Middle of the road Pro Brewer 0.75 (ale)
- Pro Brewer 1.00 (high gravity ale)
- Pro Brewer 1.50 (minimum for lager)
- Pro Brewer 2.0 (high gravity lager)

We recommend 0.75 for ales below 1.060 / 15 Plato. High gravity is considered above 1.060 / 15 Plato. Double those numbers for lagers.

[Click here to read more about target pitch rates, and where they come from.](#)

Dry Yeast - billions of cells per gram:

- *No one agrees on the number of yeast cells per gram in dry yeast!*
- This is made more confusing because each yeast strain has different size cells and clumping tendencies.
- We put in a reasonable default of 10 billion cells per gram of dry yeast.
- Kaiser located a study which reports the following data on dry yeast ranging from **8-18 billion cells per gram**:

Yeast	B cells/g
Safale K-97	14
Safale S-04	8
Safbrew T-58	18
Safbrew S-33	16
Saflager S-23	10
Saflager S-189	9

Adapted from: Van Den Berg, S., & Van Landschoot, A. (2003). Practical use of dried yeasts in the br
CEREVISIA, 28(3), 25-30 (Table 1).

- [Mr.Malty](#) says that dry yeast contains **20 billion cells per gram**. Unfortunately we could not find a reference to a study that supports that number.
- From the manufacturers:

    - [Fermentis](#): > **6B cells/gram** for US-05 and S-04.
    - [Danstar](#): > **5B cells/gram** for Nottingham yeast.
    - These numbers sound conservative and do not match with the study referenced above. According to our pitching calculator, with dry yeast, using the mfg's number of 6B cells/g, to hit a pitch rate of 0.75 (M cells / ml / ° P) for a 5 gallon batch @1.050 would require 3x 11g packs!

- Link to a researcher claiming 20B, [but only has an n of 1](#).
- Most dry yeast packs come in 5g or 11g amounts. With dry yeast, starters are typically not made because dry yeast is relatively cheap - just buy more packs to hit the target pitch rate.

Liquid Yeast Logic / Assumptions:

- A pack/vial contains 100 billion cells at the date of manufacture.
- Liquid yeast viability drops 21% each month, or 0.7% each day, from the date of manufacture. The assumption is the yeast viability drops in a linear fashion. In 4.75 months or 143 days, this calculator assumes the yeast is 100% dead (100 / 0.7 = ~143).
- From the [White Labs FAQ 11/2012](#): *What is the shelf life of White Labs Yeast? Quick Answer: 4 Months. Long Answer: …. After 30 days in the vial, the viability of our yeast is 75-85%,…*
- There is plenty of online debate as to how the decay works in real life (exponential vs linear). Additional research is called for.

Yeast Slurry:

- Default slurry density is 1 billion cells / mL, but you can adjust it. Some sources say it is as high as 5 B / mL.
- Specify the amount of slurry in Liters.

Yeast Starters:

- You can start from a slant, and go through up to 3 steps to achieve your desired pitching rate.
- DME is assumed to provide 45 ppg.
- Based on the selection under Growth Eq. & Aeration, different yeast growth equations will be used. See next section for details.

Yeast Growth Equations:

- The first growth equation is by Kaiser of **Braukaiser.com**. This model is based on Billions of cells of growth per gram of extract (B/g).

  Detailed information, including the equation is here.

  NOTE: The Braukaiser model should only be used with stir plates. For very large starters (+5L) the results may be high as there is no upper growth limit in the current equation. *More data is being collected and we expect to enhance this functionality when the results are in from Kaiser!*

- The remaining growth factors are based on an empirical study done by Chris White, which is detailed in:

  > White, Chris, and Jamil Zainasheff. *Yeast: The Practical Guide to Beer Fermentation.* Boulder, CO: Brewers Publications, 2010. 139-44. Print.

  This model is based on an inoculation rate leading to a yeast growth factor. We approximated results from that study and fitted it to an equation provided below. There are some caveats to the model to be aware of.

  The maximum growth factor is 6 (the starter will never grow past that amount).

  The saturation point for a starter is 200 million cells/ml (the starter not grow at that inoculation rate).

  The growth curve is geared for a starter gravity of 1.036 (9 ° P).

  The initial study did not address stir plates or shaking methods. However, anecdotally, aeration and stirring are said to provide positive benefits. We do not have a citation for this unfortunately, but if you can point us towards one we would be happy to update this page and the calculator logic.

  At this point the yeast calculator is quite conservative: no aeration: no adjustment, shaking regularly: +0.5 boost to growth factor, stir plate: +1.0 boost to growth factor.

  Data points extrapolated from Chris White's experiment:

Inoculation Yeast

Rate (B/L)	Growth Rate
5	5
6	4.5
7.4	4
9	3.57

9	3.57
10	3.36
11.1	3.15
12.5	2.93
14.2	2.71
16.6	2.45
20	2.17
22.2	2.02
25	1.86
28.5	1.69
33.3	1.51
40	1.31
44.4	1.2
50	1.08
57.1	0.96
66.6	0.82
80	0.68
90.9	0.57
100	0.51
111.1	0.44
125	0.37
142.8	0.28
166.6	0.2
200	0.1

Running that through a polynomial solver gave us:
G = (12.54793776 * x^-0.4594858324) - 0.9994994906
(where x is the inoculation rate)

For more reading:

- http://braukaiser.com/blog/blog/2012/10/08/yeast-growth-experiments-some-early-results/
- http://www.yeastcalc.com/growthcharts.html
- http://beersmith.com/blog/2011/01/10/yeast-starters-for-home-brewing-beer-part-2/
- http://maltosefalcons.com/tech/yeast-propagation-and-maintenance-principles-and-practices
- http://www.mrmalty.com/starter_faq.php

This Calculator is Parameterized:

The following query string variables may be appended to the URL to setup the calculator with pre-filled values. This is how the link between the recipe editor and the yeast calculator works.

- **og** - the OG of the recipe in gravity points or degrees plato.
- **units** - us or metric.
- **batchsize** - the wort volume, expects a number.
- **sugarscale** - sg (for gravity), or plato.
- **pitchrate** - a value that matches the pitch rate drop down, 0.35, 0.75, 1.0...
- **yeasttype** - dry or liquid.

Example: yeast-pitch-rate-and-starter-calculator/?
og=16.2&units=metric&batchsize=22.70&sugarscale=plato&pitchrate=1.0&yeasttype=dry

Thanks for using our calculator. You might be interested in the **Complete Recipe Builder**. Recipes can be saved, printed, shared, and brewed for complete record keeping.

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