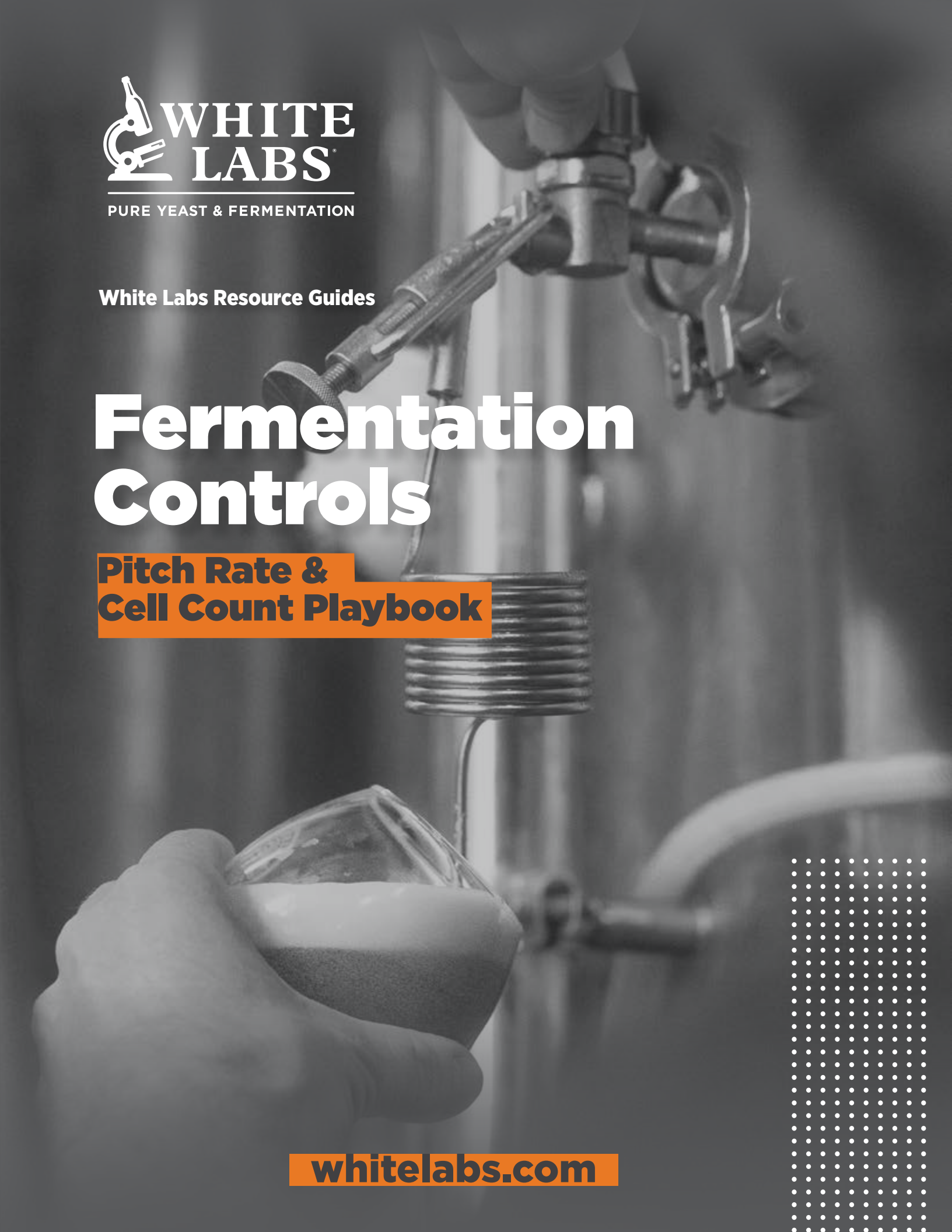
WHITE LABS®

PURE YEAST & FERMENTATION

White Labs Resource Guides

Fermentation Controls

Pitch Rate & Cell Count Playbook



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Happy Yeast = Happy Brewers

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Purpose

With great sanitation practice, there are 3 key variables that we can dial in and control on the cold side to affect our fermentation and flavor of a beer.

3 Keys for Control

Fermentation dynamics you control:

- **Pitch Rate**
- **Fermentation Temperature**
- **Dissolved Oxygen**

Create a Predicable outcome:

- **Fermentation Rate**
- **Final Gravity**
- **Flavor**

In this guide, we'll learn how to control our pitch rate from ideal pitch rates to how to cell count and repitch for the next batch of beer.

Risks of Under/Over Pitching

Under or Over-Pitching can cause potential yeast stress and variable growth, resulting in:

- **Variable Flavor Production & Rise of "Off-Flavors"**
- **Fermentation Speed, such as Slow/Stalled Fermentation**
- **Flocculation Issues**
- **Different Harvest Volumes Yields**
- **Health of Future Generations**

Cell Growth & Styles

Cell Growth = Beer Flavor

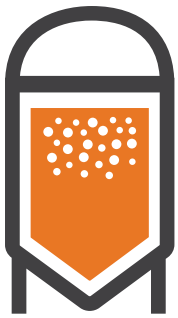
Pitch Rates Can Enhance a Beer Style

Brewers often change pitching rates based on style in order to achieve different levels of aroma & flavor for a certain style.

	Cell Growth	Flavor Production	Examples
Low Pitching Rates	High	Increased Yeast-Derived Flavor	Beer Styles with a significant amount of yeast-derived flavor • Hefeweizens • Saisons • Belgians
High Pitching Rates	Low	Decreased Yeast-Derived Flavor	Cleaner Beer Styles, Colder Temperatures, or Bigger Beers • Lagers • Imperial Stout

Recommended Pitch Rates

Ale



Also Good For Low to Moderate Gravity Wort (< 18P)

7.5-10	Million cells/mL

or

0.75-1	Million cells/mL/°P

Ale Fermentation Temperature **(> 61°F/ 16°C)**

Lager

Also Good For Higher Gravity Wort (18P+)

15-20	Million cells/mL

or

1-2	Million cells/mL/°P

Lager Fermentation Temperature **(< 61°F/ 16°C)**

Consistent Pitch Rate = Better Cellar Mgmt.

These are tried-and-true industry-recommended pitch rates. Start a recipe at one of these pitch rates to give yeast adequate growth for proper fermentation.

- Consistent pitch rates help achieve more consistent fermentation timelines.
- Creates yeast growth for repitching to allow for maximum generations utilization
- Leads to better cellar planning for optimizing beers in tanks and getting more beers out to customers.

Cell Counting

Achieve More Consistent Fermentations & Flavor

Cell counting yeast and running viability checks helps reduce pitch rate risks by determining the current condition of the culture and the correct amount of live yeast needed for the next brew. This can also greatly reduce yeast cost by reusing generations and pitching the proper amount needed for each brew!

Cell counting can be done in as little as 10-15 minutes but can save you time and money by preventing fermentation issues and unexpected tank times.

SCAN THE QR TO FOLLOW ALONG WITH OUR CELL COUNTING VIDEO ON YOUTUBE

Pitching the right amount of yeast is the key to reliable fermentations and great tasting beer every time.

Required Materials

- Hemocytometer
- Handheld counter
- Kimwipes or other lint-free paper
- Gloves
- Microscope with 400x capability
- 9mL water tubes *
- 15mL centrifuge tubes
- Yeast sample

Dyes Choose 1 of our Recomended Dyes for Cell Counting

Citrate Methylene Blue, 0.01%

- Industry Recommended Acidified Dye.

Dead cells will appear light blue to dark blue.

Dead cells, lacking functional enzymes, cannot reduce the methylene blue, and the dye remains staining the dead cell.

Alkaline Methylene Violet, 0.01%

- Alternative Dye

A basic solution of 10.6 pH. This pH different showcases only the most viable cells to survive. Dead cells will appear pink to violet.

Living yeast cells possess intact cell membranes that prevent the dye from entering.

* For Flocculant Cells:

Instead of Water, try diluting with a solution of: 0.1% EDTA or 0.5% H_2SO_4

Method

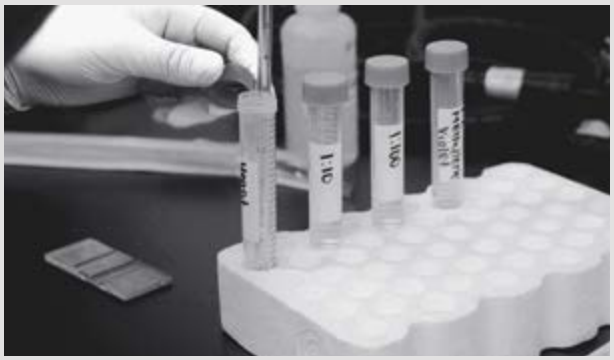
01

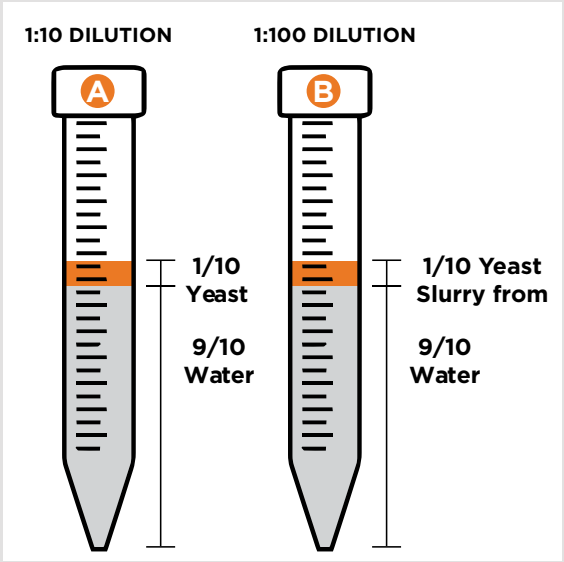
Mix and Dilute the concentrated yeast slurry down to a **1:100 dilution.**

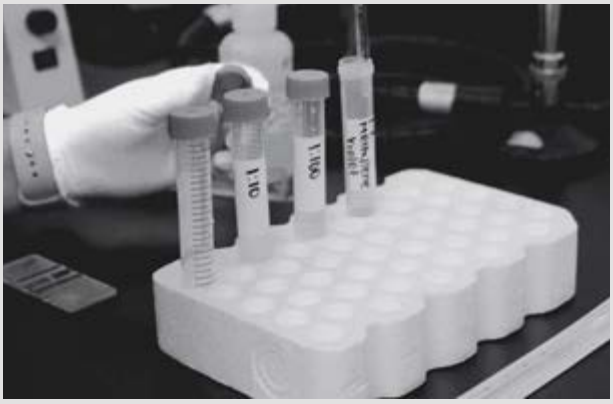
A. Using a **sterile transfer pipette**, pipette 1 mL of yeast and dispense into 9 mL of water. This will make a 1:10 dilution. ***Mix thoroughly.***

B. Using a new sterile transfer pipette, remove 1 mL from the 1:10 dilution and dispense into 9mL of water. This will make a 1:100 dilution. ***Mix thoroughly.***

Note: Yeast fermenting in beer may only need a 1:10 dilution. Additional serial dilutions can always be added or subtracted. **Remember to always note your dilution factor.**







02

Mix and transfer **1mL** of **1:100** sample into an empty 15mL tube. Transfer 1mL of dye into the same tube creating a **1:200 dilution**.

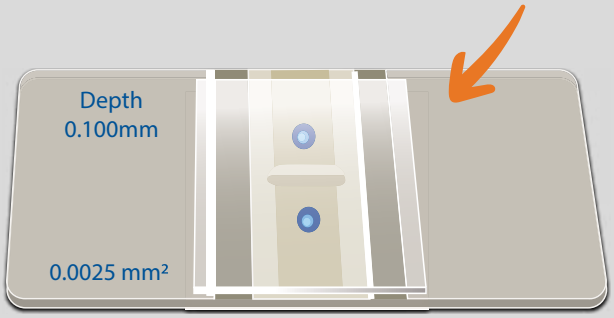
Mix Thoroughly.

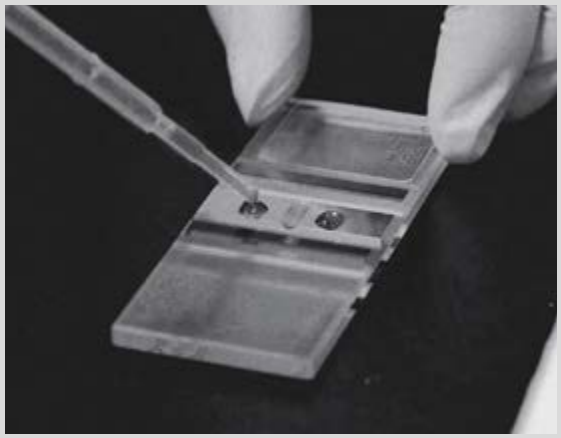
Note: Read the Sample within 1-5 Minutes. Dye will overstain the cells if exposed for too long!

Method

03 Use capillary action or pipette approximately **10uL of your sample** in the center of the counting area on your hemocytometer. *If unable to measure 10uL, place a drop smaller than a pea to cover the grid.*

Gently lay a cover slip over the sample without creating any air bubbles.





DO NOT OVERFILL THE COUNTING CHAMBER

Microscope Tips

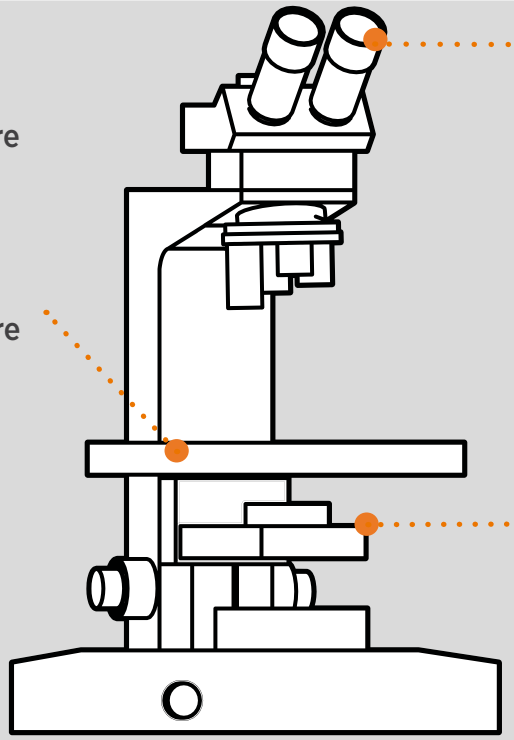
Hard to see? Try these 3 quick adjustments for a better view.

1

Changing the light aperture can help the brightness of what is seen through the lens.

Too bright, and the cells are washed out. Too dark, and cells are not viewable.

SCAN THE QR TO FOLLOW ALONG FOR MORE MICROSCOPE TIPS



2

Microscope lenses can be cleaned with Kimwipes and isopropyl alcohol. Oil from gram staining can blur focus. Be sure to properly clean your microscope lenses routinely.

Try to avoid standard cleaning papers, like paper towels or tissue, as these can scratch the lens.

3

Move the diaphragm/ condenser of the light up and down the microscope stage.

Method

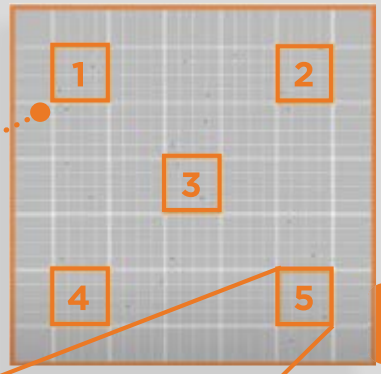
04 Place a hemocytometer on the microscope stage and focus on **10x objective**.

05 Once focused, move on to the **40x objective**. Focus on a single square to count the individual cells. See Example Below

Counting On the Grid

A

Perform counts on the 5 of the 25 squares. We recommend the 4 corners and middle square.



10x

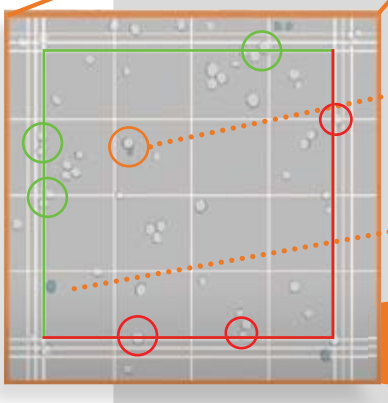
B

Count Cells Touching 2 Sides & Inside Square

Keep sides consistent on all 5 squares

EX. **COUNT** cells on the green line

DO NOT COUNT cells on the red line



40x

C

1. COUNT as a seperate live cell ≥ 50% or larger than the mother cell's size, even if dyed.

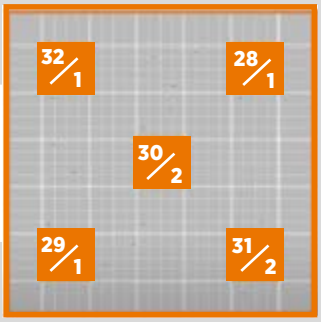
2. DO NOT INCLUDE cells < 50% or smaller than the Mother's cell size.

D

Cells that appear stained are counted as dead cells.

EX.

Live Cells: 150
Dead Cells: 7
Total Cells: 157



06 Record the total number of live & dead cells. Move to the next square until all 5 squares have been counted.

Note: Use Cell Count Numbers for Viability & Slurry Calculations on next page.

Results

Viability Calculation:

07

VIABILITY TIPS

$$\frac{\text{\# Live Cells}}{\text{Total Cells Counted}} \times 100 = \text{\% Viability}$$

With years of research, our estimated viability calculator gives an accurate estimate of our yeast viability based on our QC release date. Try it today!
yeastman.com/info

We typically recommend 85% viability or higher when repitching. Lower viability % may work but have a higher risk of stuck fermentations and adding autolyzed off-flavors

Slurry Concentration Calculation (How Much Yeast do you Have?)

# Live Cells	X 5	X 200	X 10,000 =	Cells/mL
From the total of 5 squares counted	To get the total number of the entire 5x5 grid	Dilution Factor From 1:200 Dilution or use your Dilution Factor if different	Represents the volume in the hemocytometer chamber	Concentration of Yeast Slurry

How Much to Pitch

Pitch Rate Calculation

Ale

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1 From our cell count, we can now determine how much we need to pitch in our next brew!

$$7.5E^{6}\ \frac{\text{Cells}}{\cancel{\text{mL}}} \times \underline{\qquad}\ \cancel{\text{mL}} = \text{Cells Needed for Brew}$$

Industry Recommented Pitch Rate for Ale

Insert Fermentor Vol. in mL (ex. 1bbl = 117348mL)

2 Calculate needed volume from cell needed for brew & slurry concentration

$$\frac{\underline{\qquad}\ \cancel{\text{Cells}}\ \text{(Cells Needed for Brew)}}{\underline{\qquad}\ \frac{\cancel{\text{Cells}}}{\cancel{\text{mL}}}\ \text{(Slurry Concentration)}} = \underline{\qquad}\ \text{mL}$$

Volume of yeast needed to pitch

3 Convert yeast volume needed into weight.

$$\underline{\qquad}\ \cancel{\text{mL}} \times \frac{1.15\text{g}}{\cancel{\text{mL}}} = \underline{\qquad}\ \cancel{\text{g}} \times \left(\frac{1\text{lb}}{453\cancel{\text{g}}}\right) = \text{Yeast Needed in lbs.}$$

Volume of yeast needed to pitch

Cell Density

Note: Use the White Labs pitch by weight cheat sheet on the following page.

Pitching by Weight - Cheat Sheet

Fields indicate How much to pitch in lbs. based on cell viability.
NOT ACCOUNTING KEG WEIGHT (29.7LB/13.5KG)
Estimating Cell Concentration: 1.5 billion cells/mL

% viability

Ale Pitch Rate	BBL	100%	95%	90%	85%	80%
7.5 Mil Cells/mL	1	1.5	1.6	1.7	1.8	1.9
	3	4.5	4.7	5.0	5.3	5.6
	5	7	8	8	8.8	9.3
	7	10	11	12	12.3	13.0
	10	15	16	17	17.5	18.6
	15	22	23	25	26.3	27.9
	20	30	31	33	35.0	37.2
	30	45	47	50	52.5	55.8
	40	60	63	66	70.0	74.4
	50	74	78	83	87.5	93.0
	60	89	94	99	105.0	111.6
	90	134	141	149	157.5	167.4
	120	179	188	198	210.0	223.2

% viability

Lager or > 18P+ Pitch Rate	BBL	100%	95%	90%	85%	80%
15 Mil Cells/mL	1	3.0	3.1	3.3	3.5	3.7
	3	8.9	9.4	9.9	10.5	11.2
	5	15	16	17	17.5	18.6
	7	21	22	23	24.5	26.0
	10	30	31	33	35.0	37.2
	15	45	47	50	52.5	55.8
	20	60	63	66	70.0	74.4
	30	89	94	99	105.0	111.6
	40	119	125	132	140.0	148.8
	50	149	157	165	175.0	186.0
	60	179	188	198	210.0	223.2
	90	268	282	298	315.1	334.8
	120	357	376	397	420.1	446.3

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