



# Making the Most of High Gravity Fermentations

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**WHITE LABS**  
PURE YEAST AND FERMENTATION

# What makes high gravity fermentations so challenging?

## STRESS

- Different factors in any fermentation can cause stress on yeast cells
  - Temperature
  - Shear
  - Gravity
- High Gravity Fermentations (over 1.064 SG/16°P) – osmotic pressure & shock



# How to Make the Best of a Tough Environment...

- Pitch Rate
- Dissolved Oxygen
- Nutrients



# How to Make the Best of a Tough Environment...

Pitch Rate

1 million cells/ml/P?



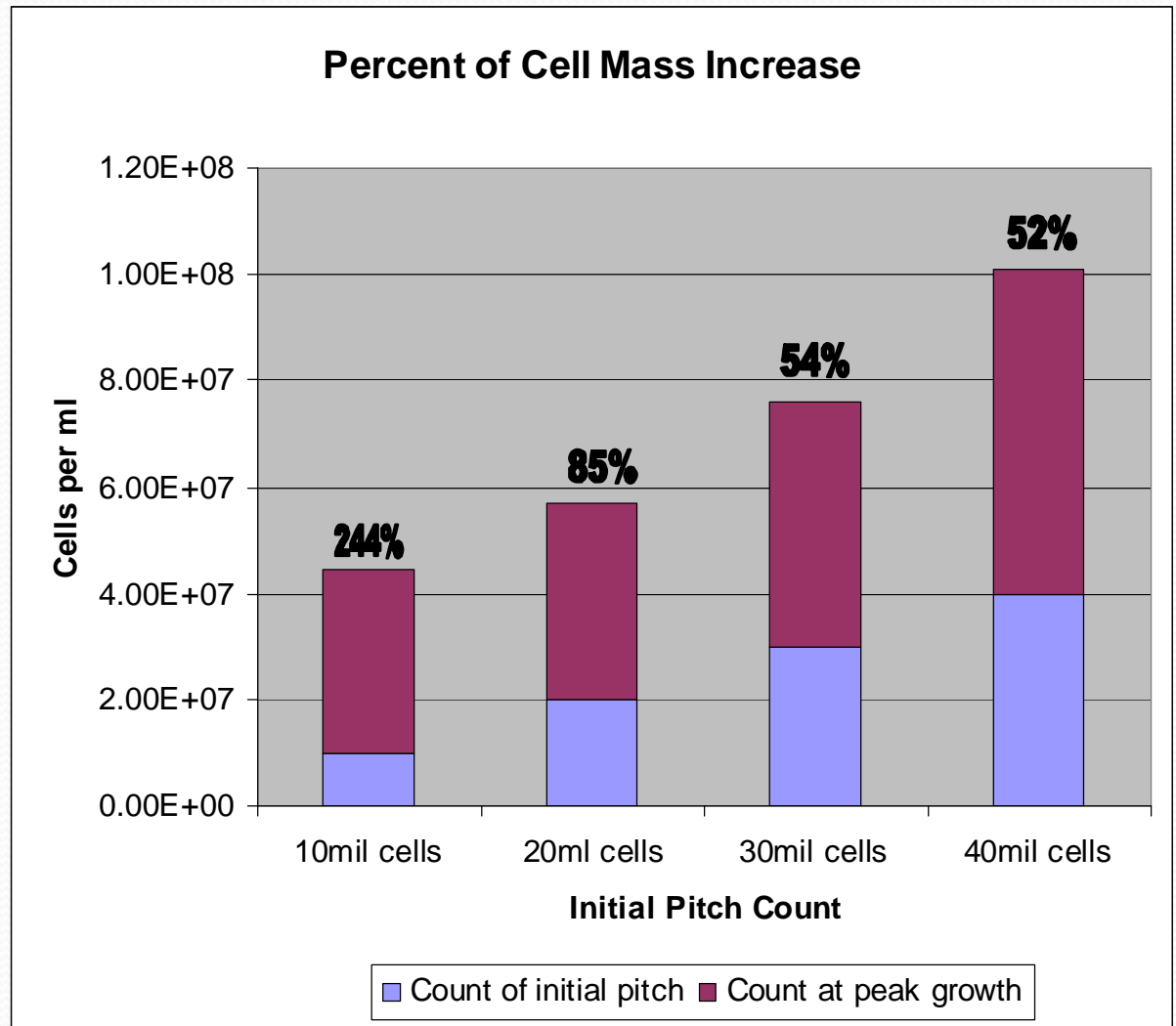
# How to Make the Best of a Tough Environment...

Pitch Rate - Fermentation Trials Show:

	10mil cells	20mil cells	30mil cells	40mil cells
<b>Initial Gravity</b>	18.7	18.7	18.7	18.7
	17.6	16.8	16.5	16
	13.2	12.5	12.1	12
	10.9	9.3	9.7	9.8
	9.1	8.7	8	8.2
	7.3	6.8	6.6	6.6
	5.9	5.9	5.8	5.8
<b>Final Gravity</b>	4.7	4.8	5.1	4.9

# How to Make the Best of a Tough Environment...

Pitch Rate -  
Fermentation  
Trials Show:



# How to Make the Best of a Tough Environment...

## Pitch Rate

- Growth rate is much higher at lower pitching rates = more metabolic activity
- Is this against the standard rule of yeast pitching rates?



# How to Make the Best of a Tough Environment...

## Dissolved Oxygen

- Higher oxygen levels result in lower final gravity
- Again, related to yeast health and higher metabolic activity





# How to Make the Best of a Tough Environment...

## Dissolved Oxygen

	2.71ppm	5.12ppm	9.2ppm	14.08ppm
	0 sec	30 sec	1 min	2 min
Time (hours)				
0	18.7	18.7	18.7	18.7
24	17.6	17.3	17.5	16.9
48	13.5	12.8	12.7	11.9
72	11.7	10.7	9.9	9.5
96	10	9	8.8	7.8
120	7.8	7.3	6.5	6.2
144	6.4	6.3	5.5	5.2
168	5.3	5	4.3	4.3

# How to Make the Best of a Tough Environment...

## Nutrition

- Most high gravity worts – deficient in adequate yeast nutrients:

FAN (free amino nitrogen)

Metal ions (Magnesium)

Unsaturated fatty acids



# Effects on Final Beer Flavor

How does this translate to taste perception and what is optimal???

- Higher gravity generally: ↑ metabolic byproducts (fusels & esters)
- Higher metabolic activity: ↑ flavor byproducts (esters, fusels)
- Higher pitching rate: ↓ acetaldehyde, ↑ fusels
- Higher oxygen: ↓ acetaldehyde, ↑ fusels & esters





Thank You!

Questions??

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