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## A 23.5 MGY per year ethanol plant improves profitability by \$850 K per year by converting to Ethanol Red dry yeast

### Benefit

Ethanol Red\* dry yeast outperformed a competitor's dry yeast by increasing ethanol yield by 1.8%. This can potentially provide \$850,000 in higher profits by increasing ethanol production by 423,000 gallons per year. The Ethanol Red accomplished this improved performance by using 73% less yeast per fermenter.

### Problem

PhibroChem's Ethanol Performance Group approached a Midwestern ethanol plant to trial Ethanol Red dry yeast. There was interest in comparing their current yeast with other options in order to maximize ethanol production. The ethanol plant was currently using a competitor's dry yeast and was not the manufacturer of their dry yeast.

### Solution

The plant followed PhibroChem recommendations on yeast rehydration and propagation. The plant continued to utilize its current process for the competitive yeast. There were no further changes in any other operating procedures. HPLC data for the propagator and fermenter are summarized in Tables #1 & #2. All the data was statistically processed with 95% confidence limits within each category to reduce process data "noise." This throws out data points outside two standard deviations and insures that results are statistically valid.

**Table #1 Propagator Drop Comparison**

Property	Ethanol Red (44 lbs)	Current Yeast Program (165 lbs)	Relative % Difference vs. Ethanol Red
Cell Count (MM/ml)	243.9	221.2	10.3%
Percent Viable Cells	93.8%	91.9%	2.1%
Total Viable Cells (MM/ml)	228.8	203.3	12.5%
Percent Budding	34.7%	34.0%	1.0%

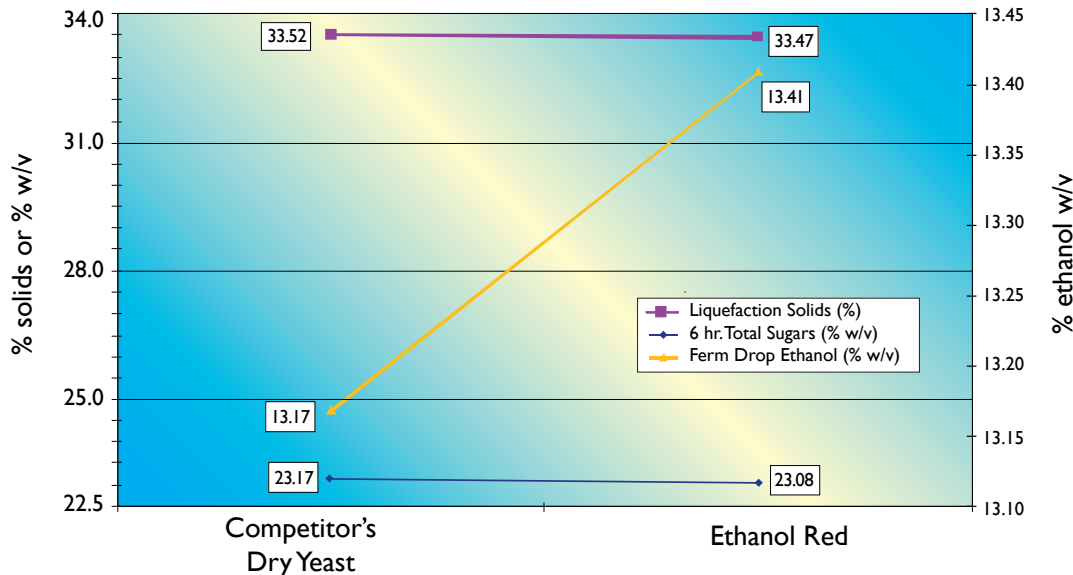
**Table #2 Fermenter Drop Comparison**

Measured Component	Ethanol Red (% w/v)	Current Yeast Program (% w/v)	Relative % Difference vs. Ethanol Red
Acetic Acid	0.05	0.05	0%
Lactic Acid	0.26	0.18	44%
Ethanol	13.41	13.17	1.8%
Glycerol	1.30	1.38	(5.8%)
Glucose (DP1)	0.05	0.04	25%
Maltose (DP2)	0.29	0.29	0%
Maltotriose (DP3)	0.06	0.06	0%
Dextrin (DP4+)	0.66	0.67	(1.5%)

A review of data in both tables indicates that the Ethanol Red had a 10.3% higher cell count with a 73% lower yeast dosing in the propagator. More important is the fact that Ethanol Red had a 2.1% higher viable cell count that will help ethanol yield.

The Ethanol Red was functioning in a high stress environment (44% higher lactic acid) and was functioning very effectively by producing lower levels of glycerol. Glycerol is a byproduct produced by yeast when under stress.

**Figure #1: Fermenter Ethanol concentration, total sugars, and % solids for Ethanol Red and competitor yeast**



**Conclusions**

- The use of Ethanol Red yeast shortened the propagator lag time as compared to the competitive yeast.
- Ethanol Red is more tolerant to a high stress environment.
- Ethanol Red yeast utilized less glucose than the competitive yeast for cell maintenance.
- All of the above benefits resulted in an increased ethanol yield by 1.8%.

**Plant Operating Data**

- Plant operating at 23.5 MM gallons per year production rate.
- Yeast propagator: 9,000 gallon working volume.
- Six fermenters: 148,500 gallon working volumes.
- Fermentation temperature: 89-90 °F
- Fermentation time: 48-52 hours.



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