Fermentation Optimization: Shifting the Status Quo in Ethanol Production

Novozymes

19/06/2023 Dr. Vijay Adapa

Rethink Tomorrow

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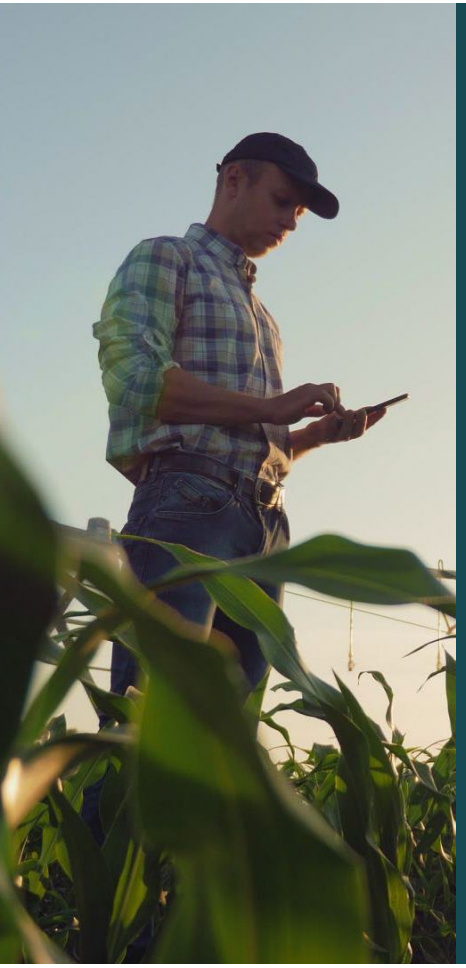
Ethanol Plants are under pressure to maximize margins by improving overall plant efficiency



Conventional Yeast have some significant Paint Points

Lower ethanol yields and higher byproducts formation (Glycerol, Organic Acids, Fusels, Residual Starch and Sugars)

Higher Input costs: Yeast and Enzyme dosage, Boosters, Urea, Energy Costs etc

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Advanced Yeasts are modified to add and modify traits to enable higher fermentation performance

01
Product
Yield

-

02
Input
Costs

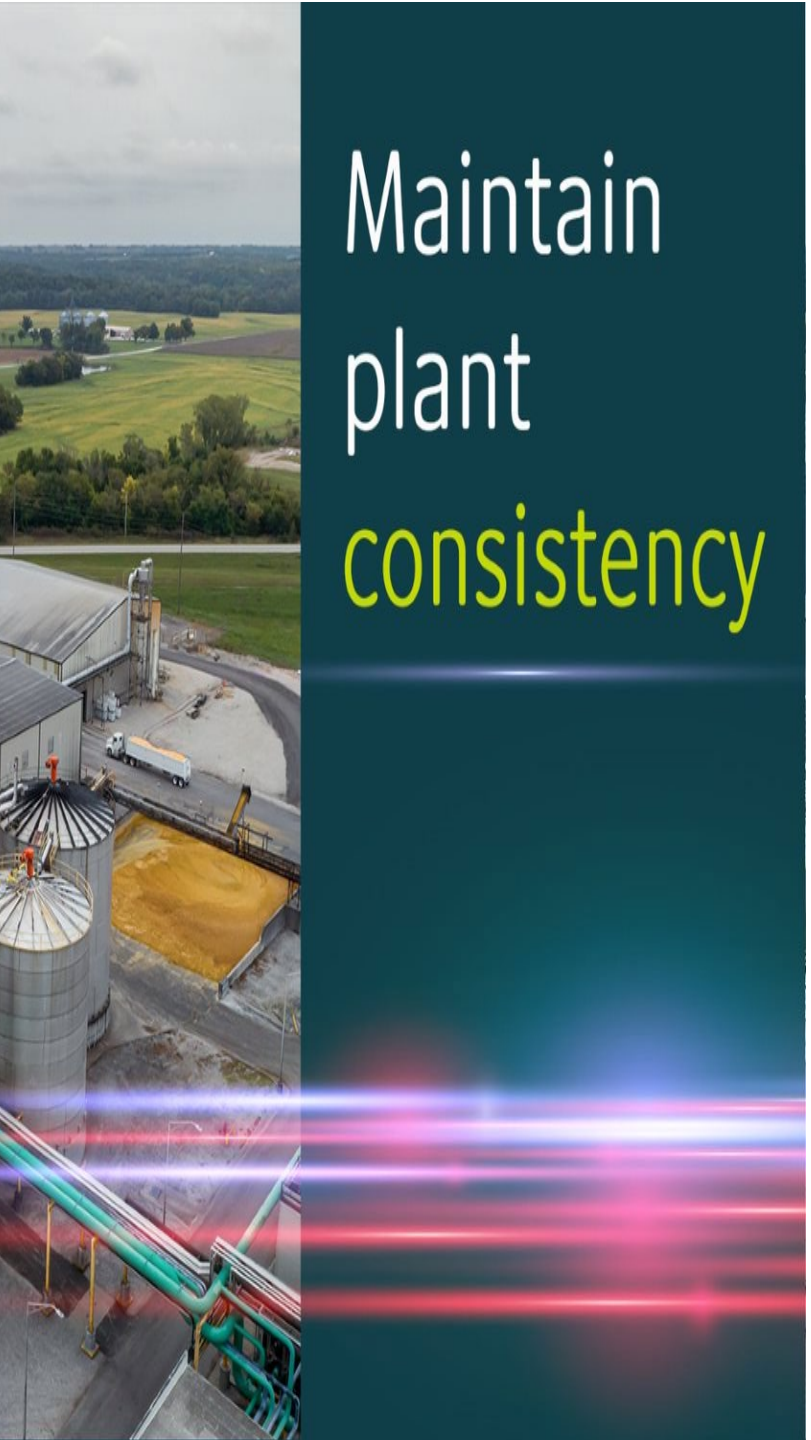
=

03

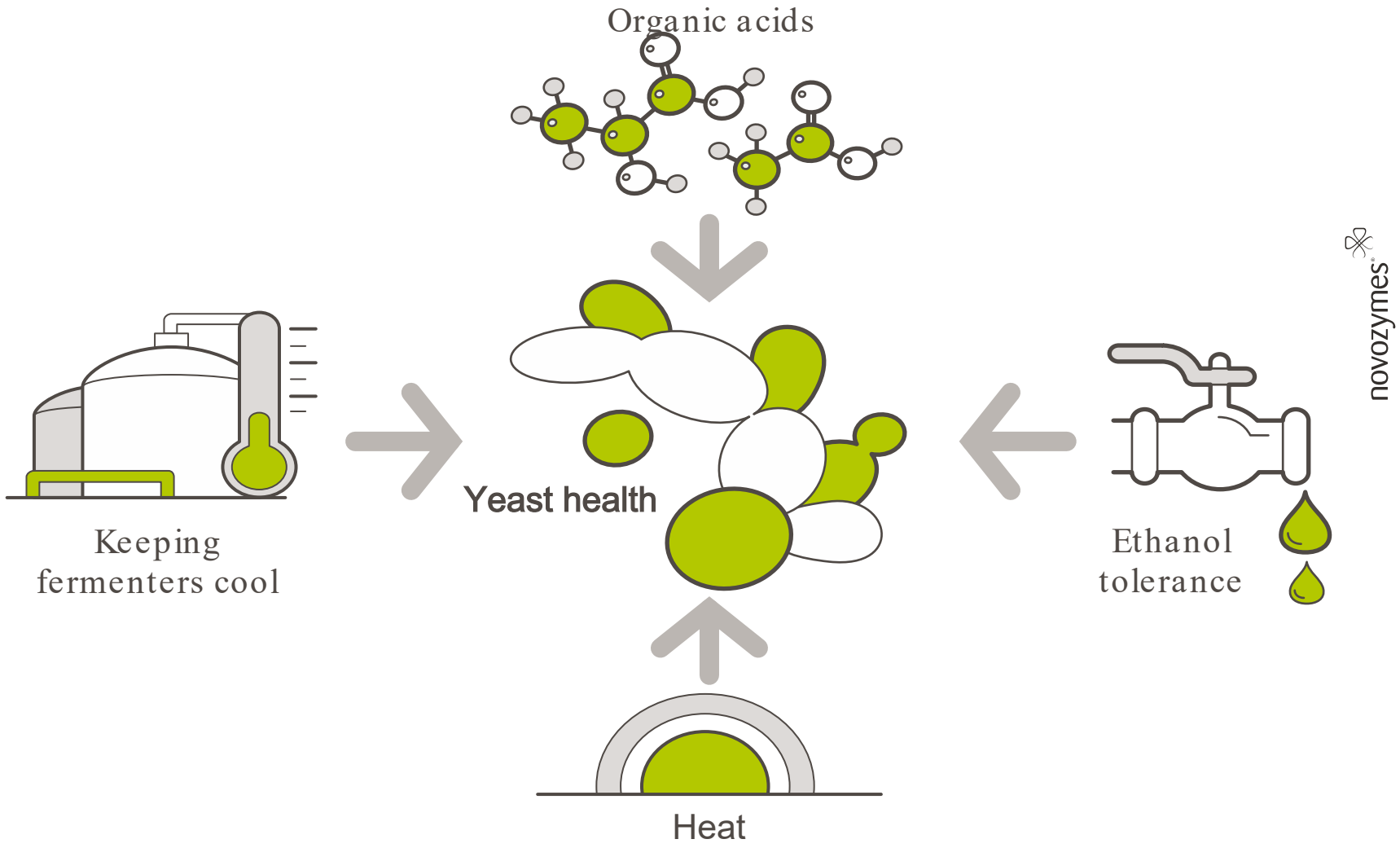
Profit

Produce more Ethanol by reducing by-products formation

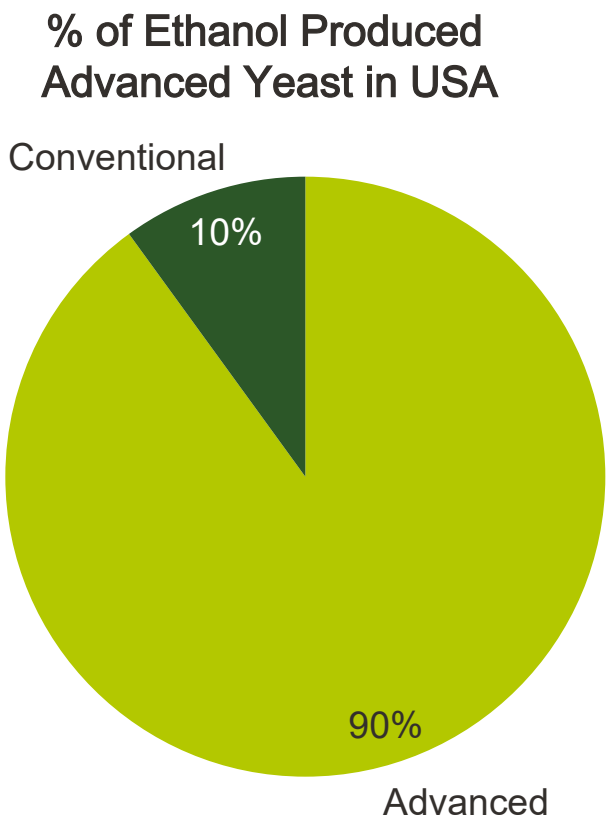
Reduce feedstock input and processing aids, e.g. GA Dosing, Yeast Dosing, Eliminate Yeast Nutrients, Reduce Urea etc

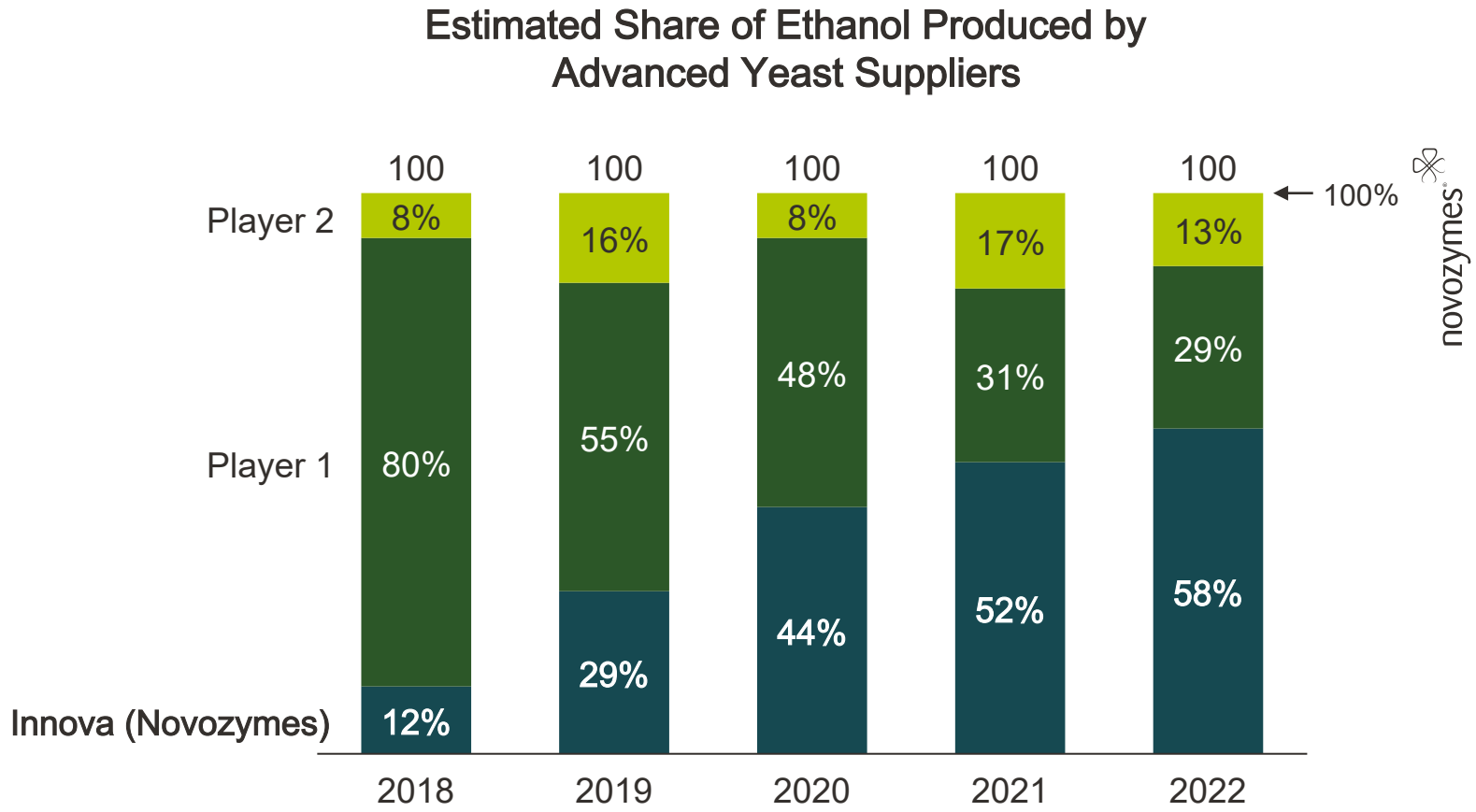


However with Advanced Yeast, maintaining consistent plant performance in face of stressors requires extra attention and effort



Innova yeasts have emerged as the most trusted Advanced Yeast solution due to the unmatched performance and insurance and security against yeast stressors that impact plant operations



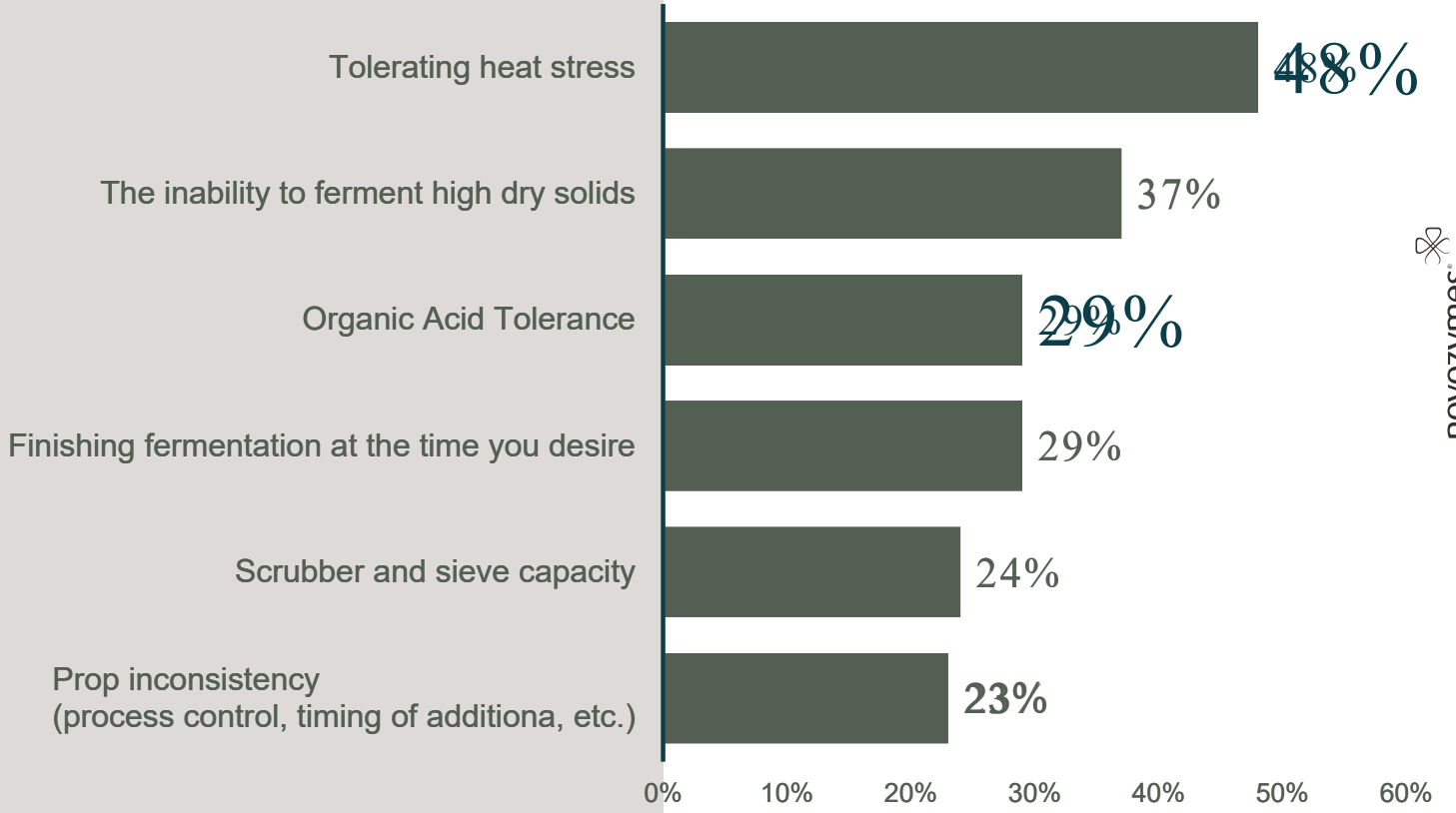


Source: Novozymes market estimates

Top two fermentation challenges

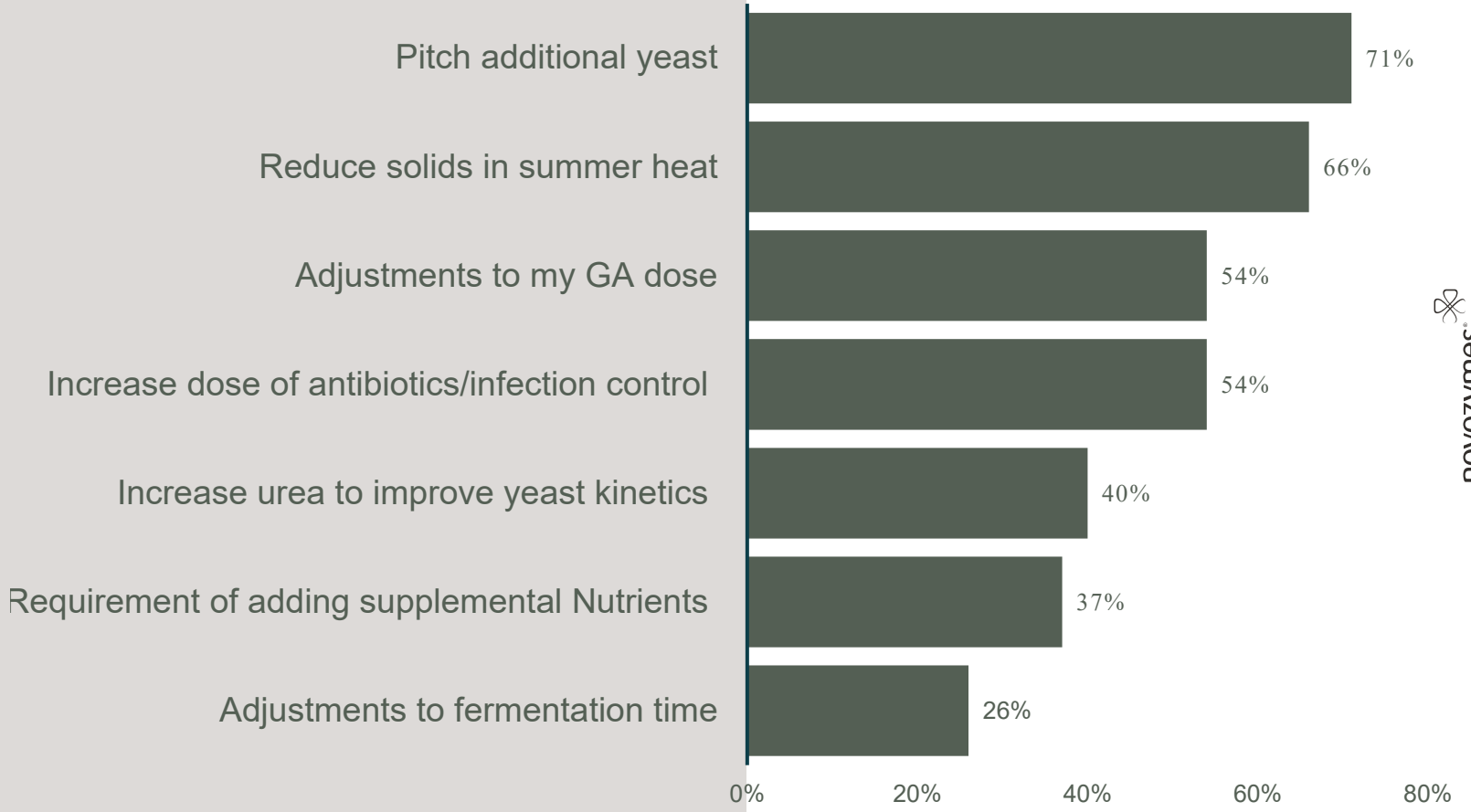
~50%

of ethanol plant employees say tolerating heat stress is one of their top 2 fermentation challenges.



Source: Novozymes industry survey

Without robust yeast, ethanol producers are making **costly changes to their fermentation recipe** to deal with challenges.



Source: Novozymes industry survey

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In the presence of ⩾ 0.2% w/v lactic acid levels
27% of ferms fail with non -robust yeast*

Contamination

Symptoms

Slow ethanol kinetics; decrease in growth rate

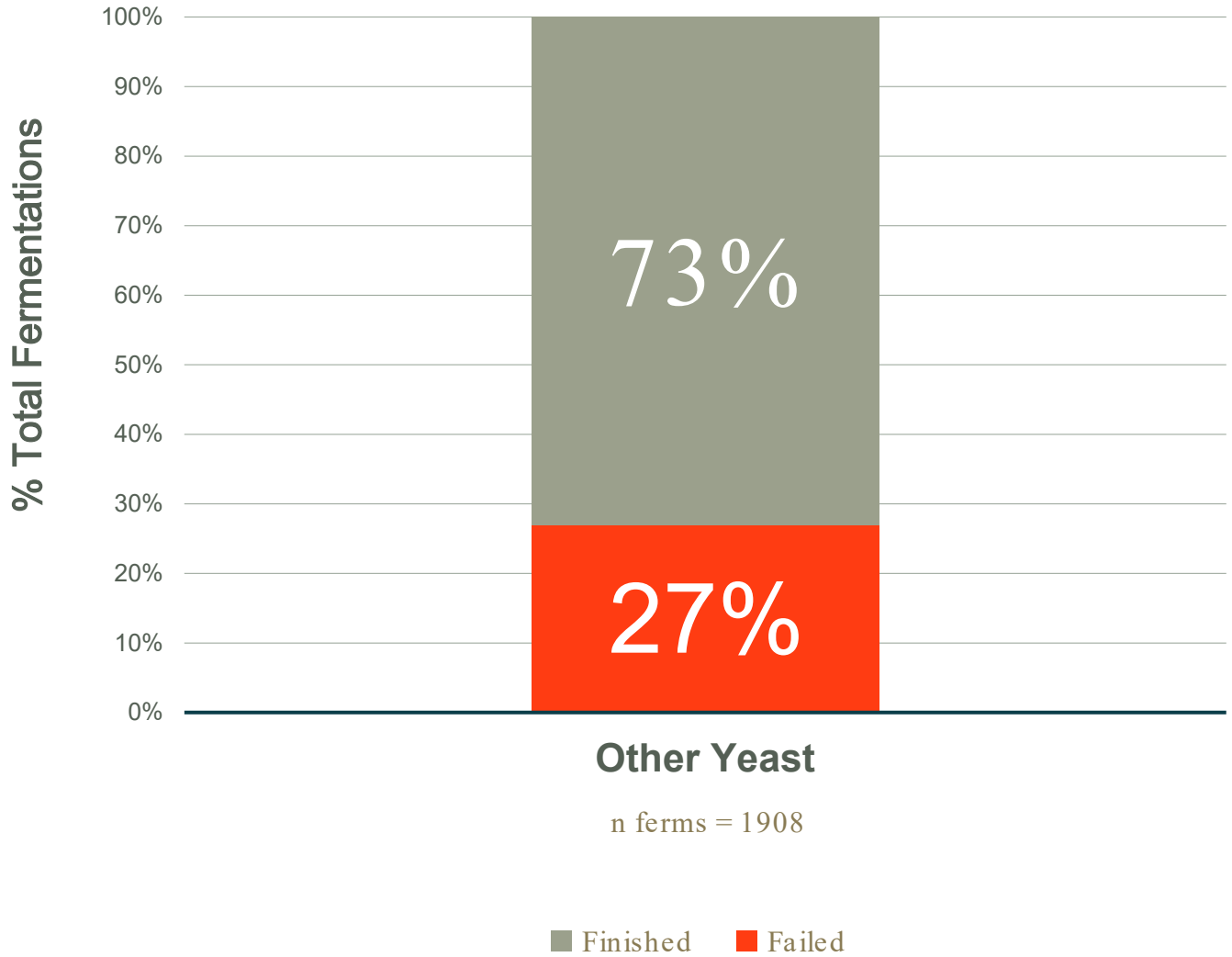
Increase in lactic acid and/or acetic acid levels

Evidence

↑ Glycerol levels

↑ Ferm drop glucose level

↓ Ethanol titers/yield



*Failed ferm had ferm drop glucose >0.2% w/v

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Ferm temperatures excursions exceeding 35 Celsius cause 22% of ferms to fail with non -robust yeast*

High Temperature

Symptoms

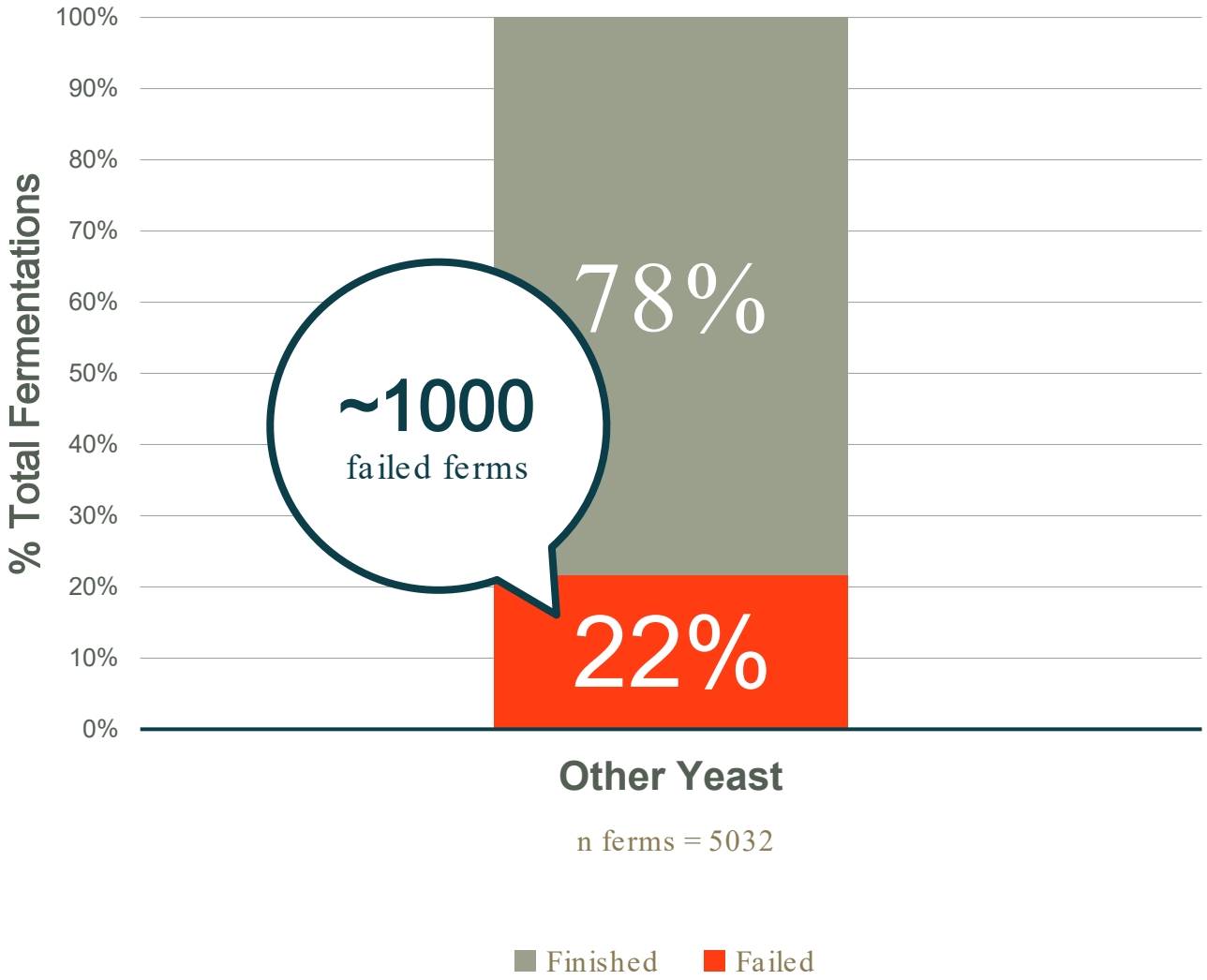
Stalled fermentation (glucose levels rise, ethanol levels do not increase)

Evidence

↑ Glycerol levels

↑ Ferm drop glucose level

↓ Ethanol titers/yield



*Failed ferm had ferm drop glucose >0.2% w/v

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Solution: Change to a robust, advanced yeast

2x more likely to have a failed ferm when using a yeast other than Innova yeast

Compounding Stressors

Symptoms

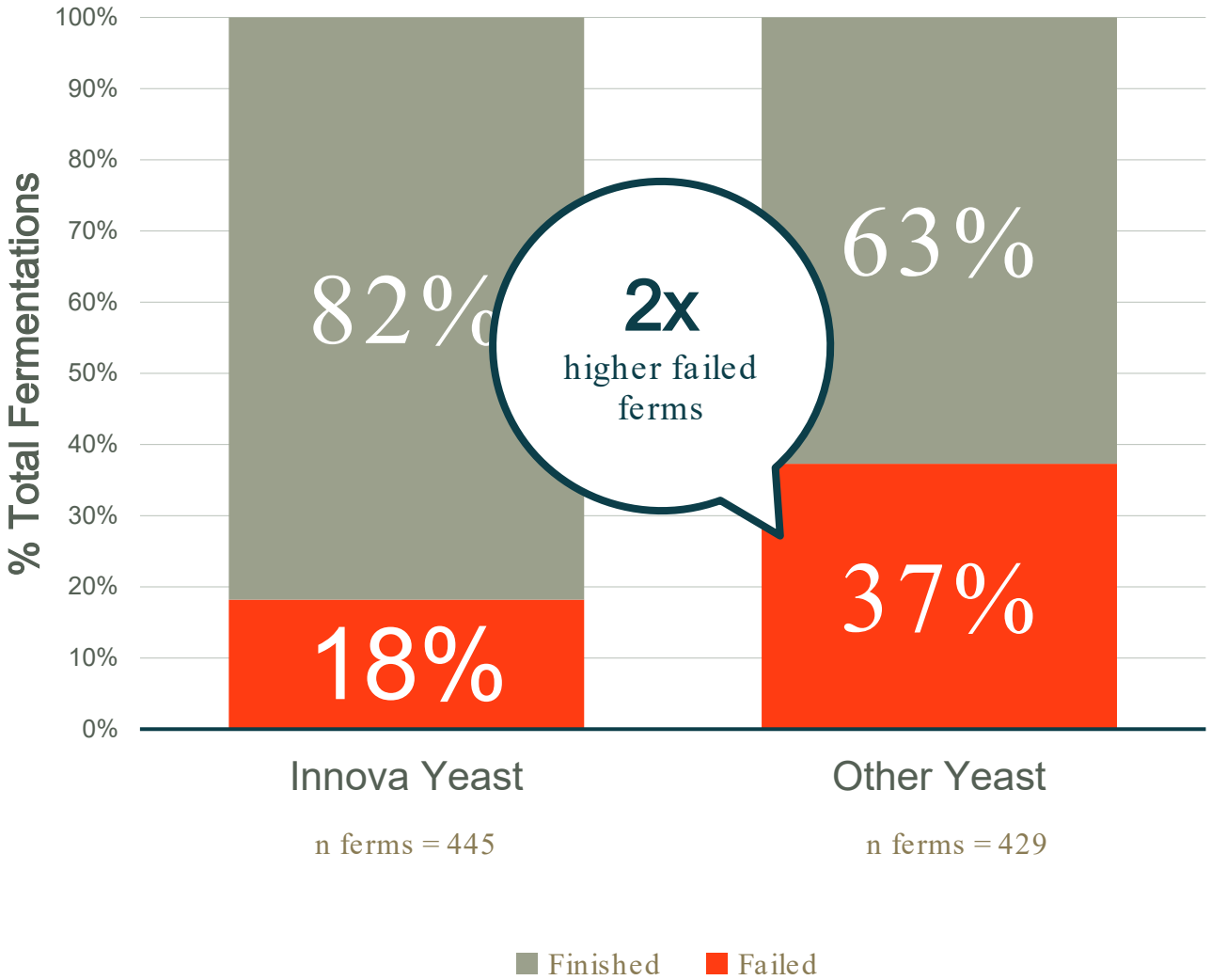
Stressors never seem to line up and only occur one at a time

Therefore when you have compounding organic acid stress (>0.6% w/v) and high temperatures (up to 40°C) an advanced, robust yeast can still finish fermentation

↑ Glycerol levels

↑ Ferm drop glucose level

↓ Ethanol titers/yield



*Failed ferm had ferm drop glucose >0.2% w/v

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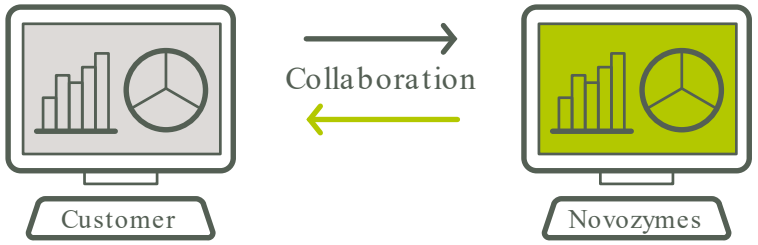
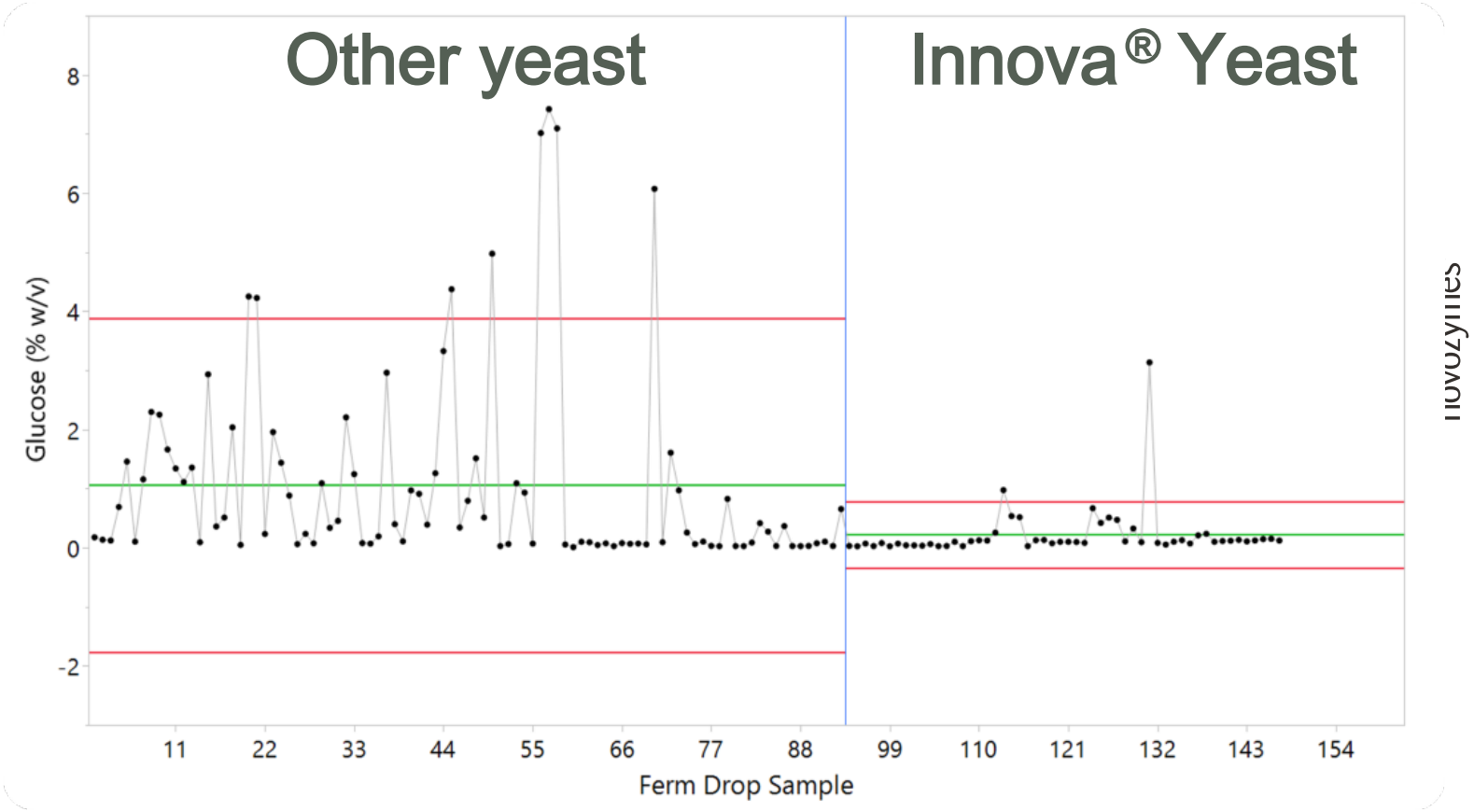
Running a smoother plant

Ethanol production process is theoretically a smooth process

- ✓ Limit mechanical issues
- ✓ Limit biological issues





Innova® Yeast

Helping you excel in the most challenging conditions

Power through temperature excursions

Trust industry leading technology

Drive through high solids

Convert more starch

Push through organic acids

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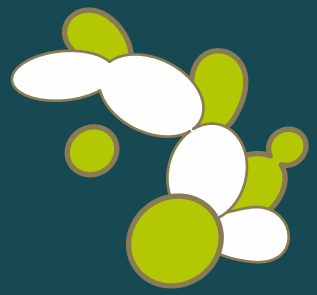
Innova the most trusted brand in the Bioenergy Industry

Conventional Yeast

- **4-5%** efficiency lost to glycerol and organic acids
- **1-2%** efficiency lost due to improper yeast and GA optimization
- **100%** dependence on nitrogen, antibiotics and ideal temperature



Innova®

Innova Yeasts

Unmatched robustness and AA/GA expressing

- **Robust** to high temperature, organics, high alcohol titer
- **3-4%** more yield
- **75%** Less Urea
- **30-40%** Less GA as Yeast itself produces GA
- **100%** Less Yeast Nutrients

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Questions

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