

OREGON WINE




Journey of Extraction
Session 2 – The Art
and Science of Cold
Soak

SYMPOSIUM

February 3 & 4, 2025

Bill Snyder – Winemaker, Decision Hill Wines, Snyder Wine Services
Rachel Rose - Winemaker & Vineyard Director, Bryn Mawr Vineyards
Rich DeScenzo, ETS Laboratories

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Cold Soak 101

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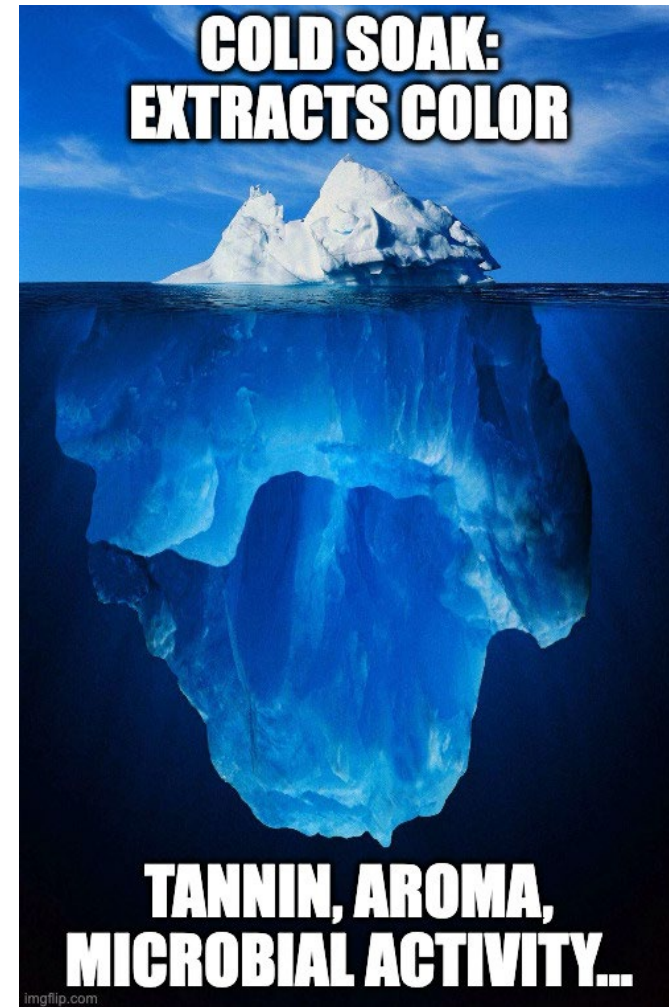


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What is "Cold Soak?"

- Pre-fermentation maceration where must is kept at low temperature to extract color, flavor, and aroma compounds
- Usually...
 - Temperatures below 60F
 - Strive for 50-55F
 - Often 2-5 days
 - But you do you!



Why Cold Soak?

- Chemistry
- Microbiology
- Logistics

Why Pinot Noir?

- Relatively low tannin & color
- Lots of seeds discourages extended maceration in presence of ethanol

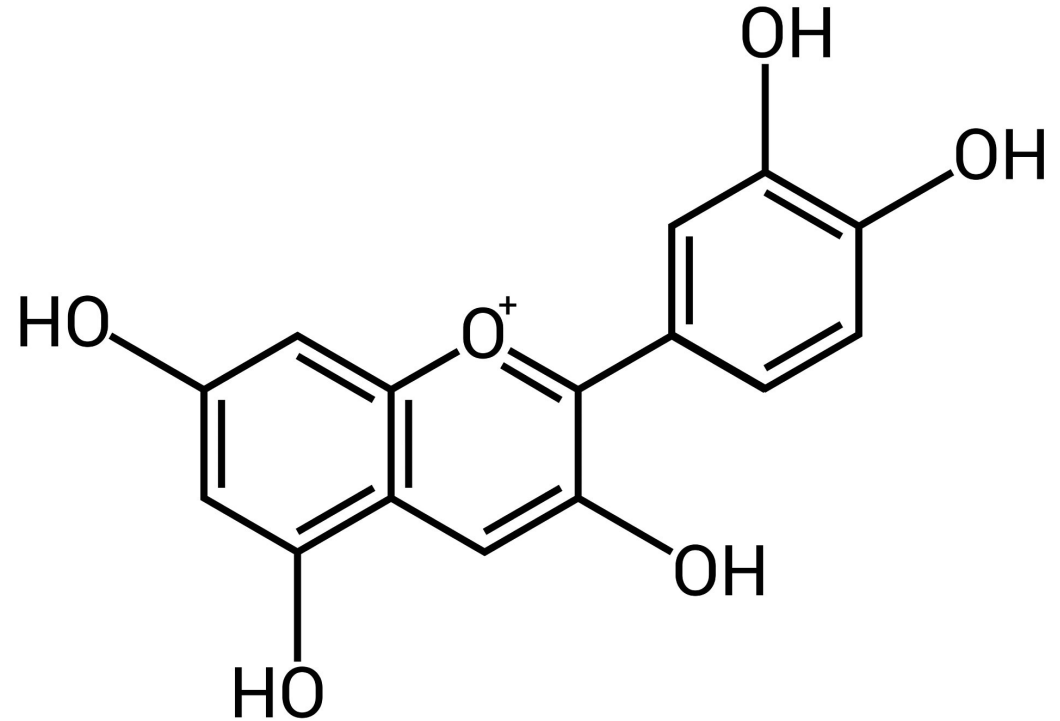
Doing a 5-day cold soak even though I don't know wtf it does for color and tannin extraction



meme credit: @airfriedpaso

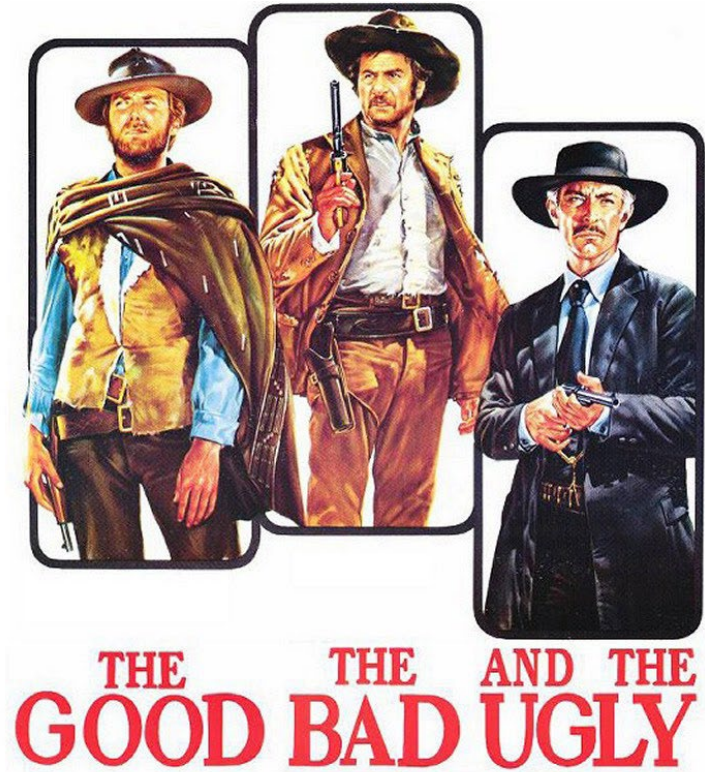
Chemistry

- Maceration before
 - Heat
 - Presence of Ethanol
- **Anthocyanins**
- Total phenols
- Aroma Compounds
- Cryoextraction?
- The main rub:
Stabilization/retention of
compounds during winemaking



Microbiology

- Before primary fermentation
- Inhibit or maintain lag phase for numerous microorganisms
- Possibility for much significant microbiological activity



Logistics

- "Throttle" fermentations
- Saignée timing
- Energy
- Cooling/space capacity
- Contraindications
- Safety



How to Cold Soak

- Night picks (huh?)
- Processing and Triage
- Active Cooling
 - Cold Rooms
 - Plates/Coils/Jackets
 - Heat Exchanger
- Duration and Activities
 - Headspace
 - Cap Management
 - SO₂, Antimicrobials, Bioprotectants
- Warming & Inoculation

Dry Ice? Great for staying anaerobic!

Assuming *perfect* heat transfer, cooling one ton of must (water) from 68F/20C to 54F/12C would take

~89 pounds of dry ice

...to say nothing of uneven cooling, cryoextraction, safety, etc.

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Session 2 – The Art & Science of the Cold Soak

Bryn Mawr Vineyards – Cold Soak Microbiology Trials

Rachel Rose - Winemaker & Vineyard Director

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BRYN MAWR
VINEYARDS

Bryn Mawr Vineyards – Cold Soak Microbiology Trials

Overview of BMV's Cold Soak SOPs

- 25ppm - 35ppm of SO₂
- 5- 10 g/hL custom mix of non-Saccharomyces referred to as " BMV custom BioProtection"
 - *Metschnikowia fructicola*, *Metschnikowia pulcherrima*, *Torulasporea delbrueckii*
- No sequential inoculation of Saccharomyces under normal conditions
- Mostly 2 & 5 ton jacketed SS tanks
- Temperature control via glycol system
- Chill to 50-55F for 2-3 days, then let them gradually warm up*
 - *Because of the safety of using "BioProtect", moderate Temp. of CS, and length of CS

Objective of Cold Soaks at BMV

•—Color

- Fruit Expression
- Microbiology

BMV Cap Management SOP

- Day 0 – processing + dry ice
- Day 1 – No touch + dry ice
- Day 2 – Pump/Over - 1 x volumetric turnover, analysis, + dry ice
- Day 3- Pump/Over - 1 x volumetric turnover, until peak.

Bryn Mawr Vineyards – Cold Soak Microbiology Trial #1

BioProtection in a 0 SO₂ situation.

The concept of "BioProtection"

- The time between grape harvest and active fermentation poses a major risk for the growth and development of spoilage organisms
- Instead of destroying these microorganisms with sulfites, adding a Bioprotection can help control the ecological niche

Stated BioProtection yeast attributes

- Decrease the dosage of SO₂ on the grapes
- Minimizes production of ethyl acetate and acetic acid from native microflora
- Protect grapes and must for up to 5 days if the temperature is also (<50°F)
- Increase the wine's aromatic complexity and add mouthfeel

What the experiment was about?

It was to analyze the microbes present in 0 SO₂ fermentations - one with the addition of Bioprotection and one without.

Objectives of this Trial

- To test manufacturer's claims
- To see if there were any microbial differences on day 0 between the two vineyards and farming methods
 - Esp. true in fermentations with minimal handling such as the case with WC fermentation
- To see how these populations changed over the course of each of the fermentation

Bryn Mawr Vineyards – Cold Soak Microbiology Trial #1

BioProtection in a 0 SO₂ situation.

BioProtect

0 SO₂

+ 10 g/hL BMV custom BioProtection

No-BioProtect

0 SO₂

0 BioProtection

- From the South Face Vineyard in Ribbon Ridge AVA- Conventionally farmed
- SFV Fruit was red grapes of the vintage
- Very clean fruit
- 65% Whole cluster
- 4 -day cold soak at ~ 50F
- Heated ~ 20 hours (2 days) until there were signs of fermentation
- No additional heat or cooling was applied thereafter
- No sequential inoculation
- 18 days on skins
- Pressed off early at 0 Brix, finished in tank, <1.0 g/L R.S went to barrel. 6 days (normal)

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Rich DeScenzo- ETS Laboratories

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The BioProtection Yeasts *Metschnikowia pulcherrima* and *M. fructicola*

- *Metschnikowia pulcherrima* is a highly effective biocontrol yeast due to accumulation of the pigment pulcherrimin in the juice/wine
- The antibacterial and antifungal activity primarily depends on the immobilization of iron by the pulcherrimin pigment in the juice/wine, and varies by strain depending on the amount of pulcherriminic acid produced
- *M. pulcherrima* strains have also been shown to produce enzymes that can have an antimicrobial impact on other yeasts and/or bacteria
- *Metschnikowia fructicola* can produce hydrolytic enzymes like glycosidases, proteases, and pectinases. These enzymes can impact the wine's aromatic and structural properties
- *Metschnikowia fructicola* can inhibit growth of other non-Saccharomyces yeast and bacteria through competition for essential nutrients

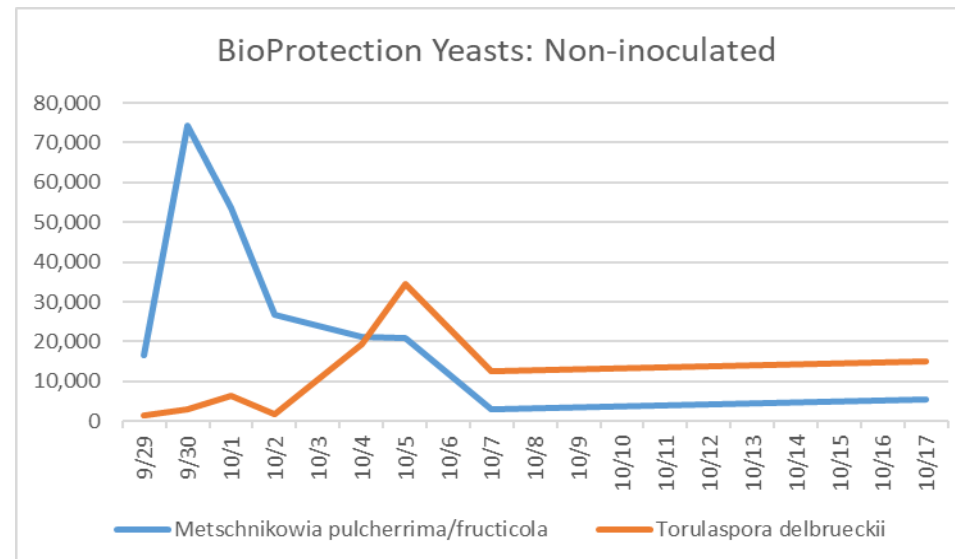
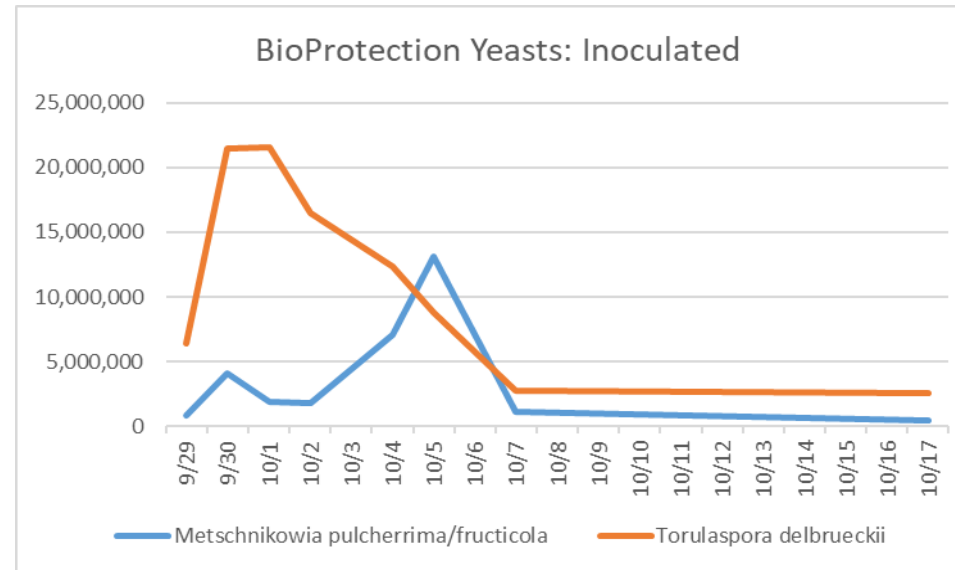
The non-Saccharomyces Yeast

Torulaspora delbrueckii

- *Torulaspora delbrueckii* is used in wine-making to improve wine complexity, decrease volatile acidity, and acetaldehyde content
- *T. delbrueckii* has some tolerance to ethanol, but needs to be used in a co-inoculation with *S. cerevisiae* to complete standard wine fermentations
- There are “killer strains” of *T. delbrueckii* that can inhibit growth of *Saccharomyces cerevisiae* and promote growth of bacteria capable of malolactic fermentation
- Several commercial strains of *T. delbrueckii* are available individually, and in mixed cultures with *S. cerevisiae* and/or other non-Saccharomyces strains

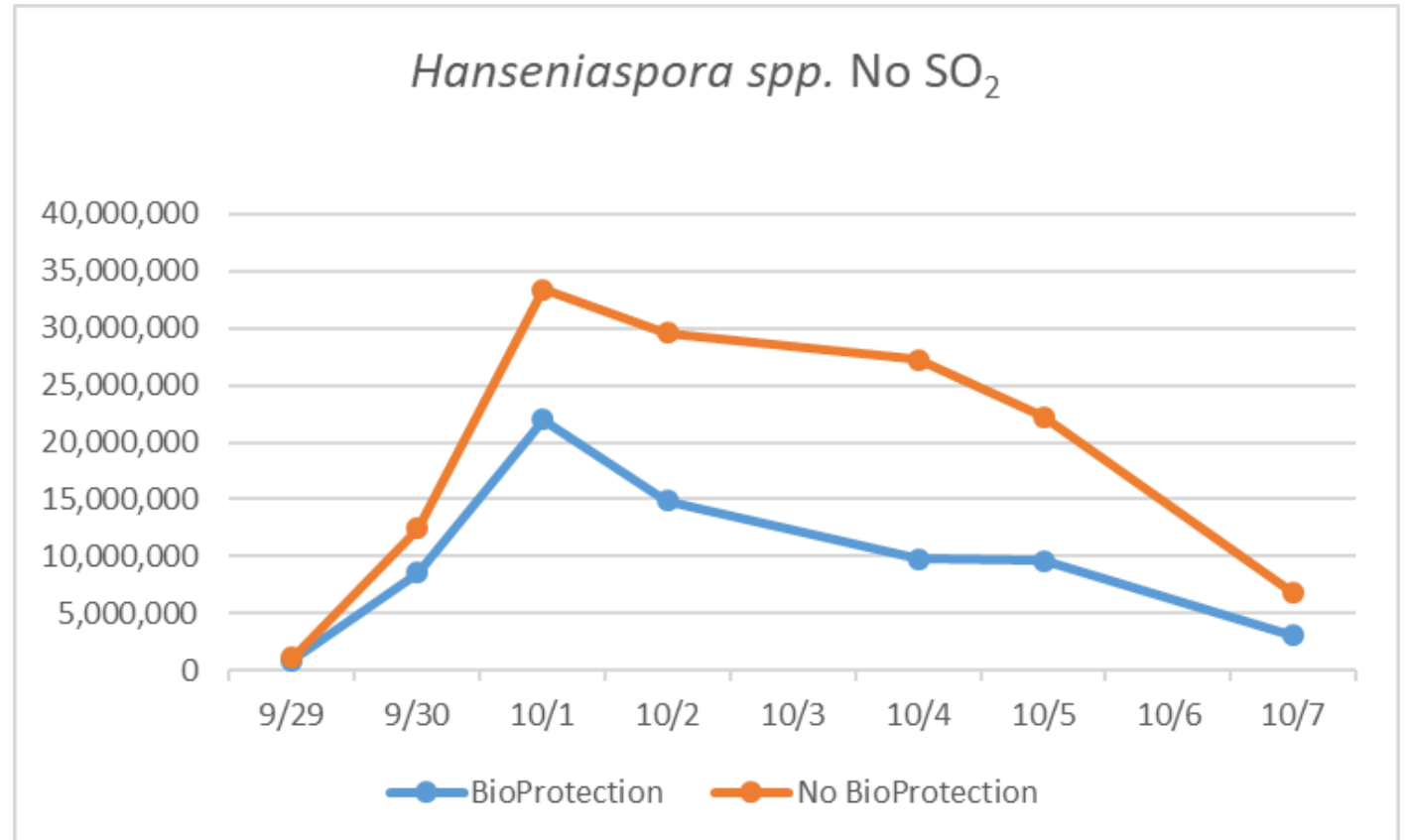
Cold Soak Microbiology Trial #1: Comparison of BioProtection Yeast with Addition vs No Addition, without SO₂

- The BioProtection yeasts *Metschnikowia* and *Torulasporea* were observed in the BioProtection added fermentation
- The BioProtection yeasts *Metschnikowia* and *Torulasporea* were observed in the No BioProtection fermentation, at significantly lower levels (<1%), as compared to the fermentation inoculated with the BioProtection yeasts
- These yeast are naturally occurring and often observed on incoming grapes
- It is unlikely that the reduced population levels significantly impact other microbes in the juice/fermentation



Cold Soak Microbiology Trial #1: No SO₂ Addition, BioProtection Yeasts Impact on *Hanseniaspora* species

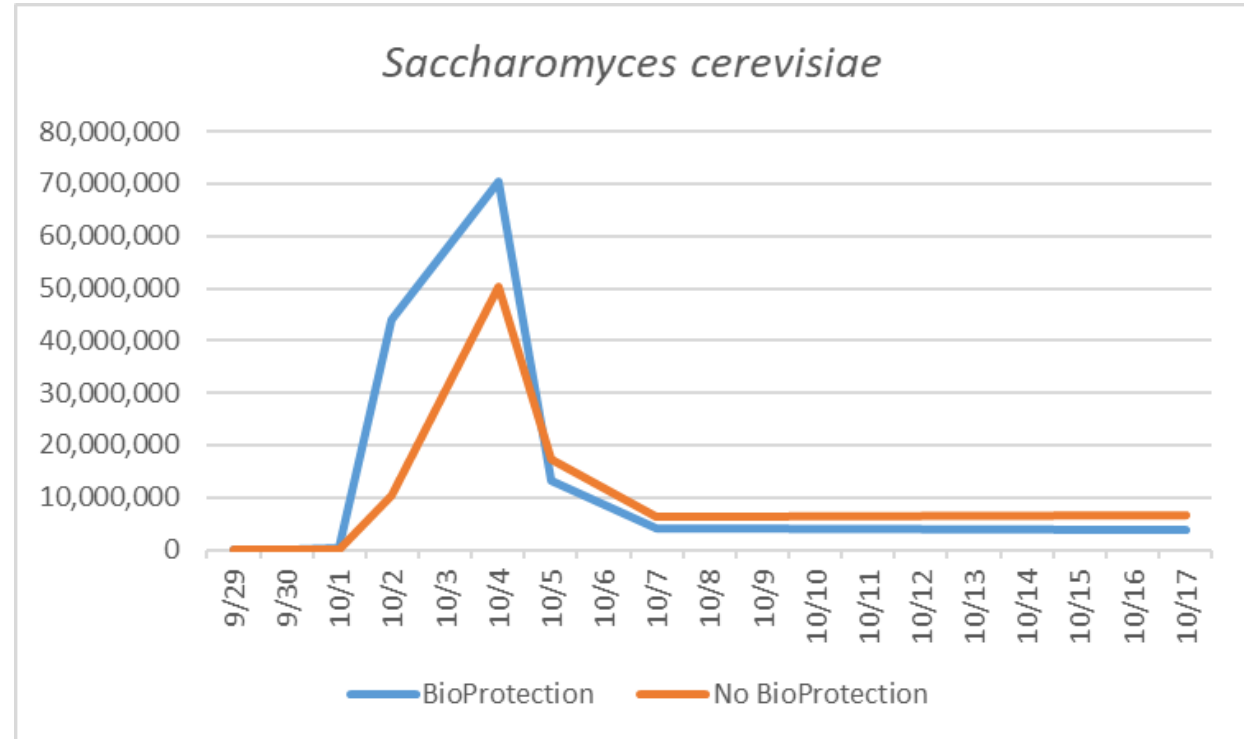
- *Hanseniaspora* spp. are the most common native non-Saccharomyces yeast in the vineyard
- *Hanseniaspora* spp. can produce elevated levels of ethyl acetate and acetic acid, as well as compete for available YAN
- Levels of the native *Hanseniaspora* spp. are reduced in the presence of the BioProtection yeasts



Cold Soak Trial #1 No SO₂ Addition

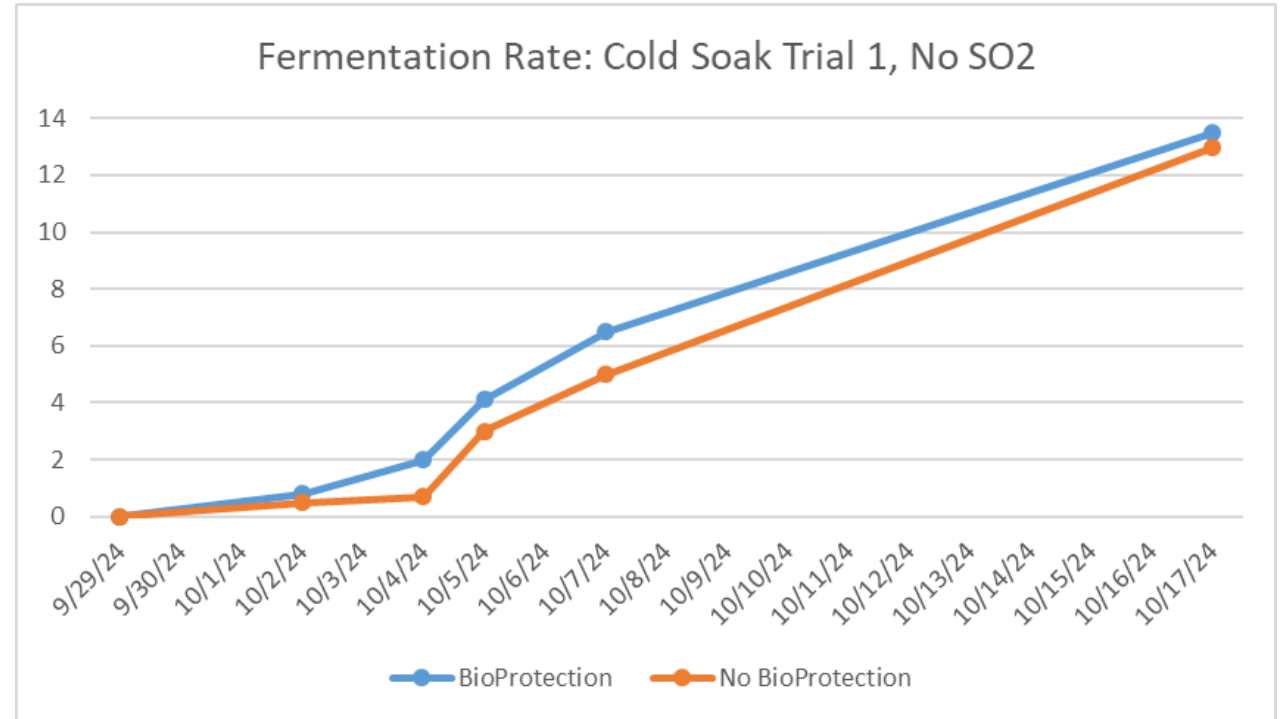
BioProtection Yeasts Impact on *Saccharomyces cerevisiae*

- Levels of *Saccharomyces cerevisiae* are higher and increase faster in the presence of the BioProtection yeast
- This could be due to the reduced competition between *Saccharomyces cerevisiae* and native yeasts, for example *Hanseniaspora spp.*



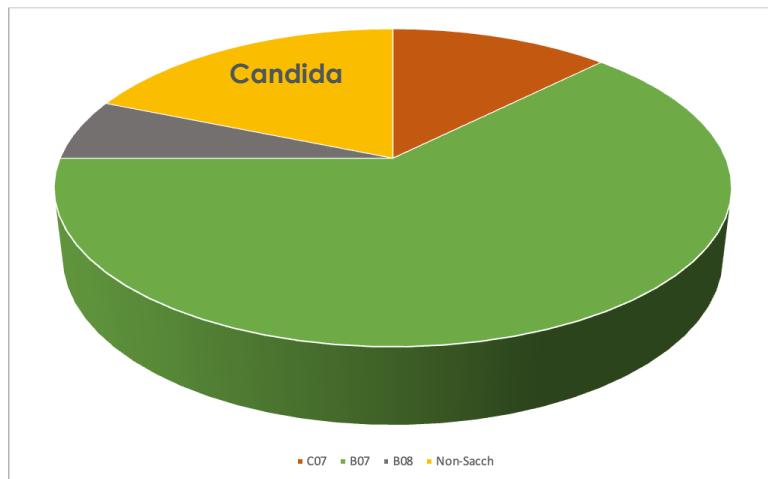
Cold Soak Trial #1 No SO₂ Addition: BioProtection Yeasts Impact on Fermentation Rate

- Must inoculated with the BioProtection yeast appears to start fermentation a little sooner than the No BioProtection yeast ferment
- Could indicate less competition for *Saccharomyces cerevisiae* due to inhibition of other non-*Saccharomyces* yeast

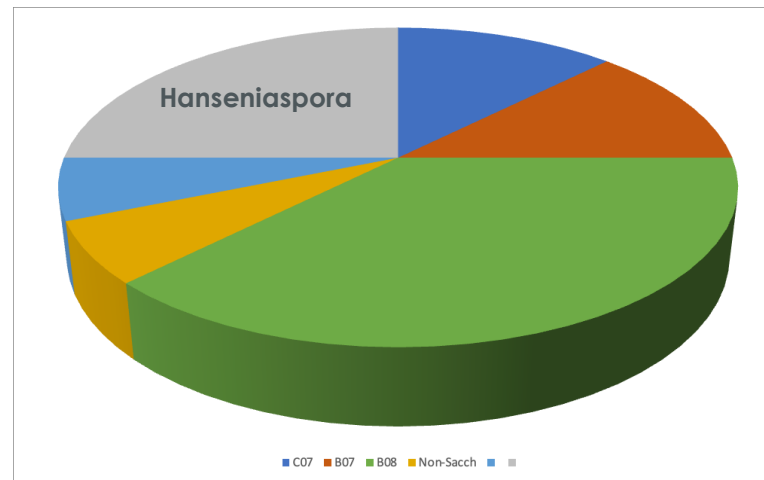


Cold Soak Microbiology Trial #1: Fermentation Yeast Populations at 13 Brix

Yeast Population with BioProtection



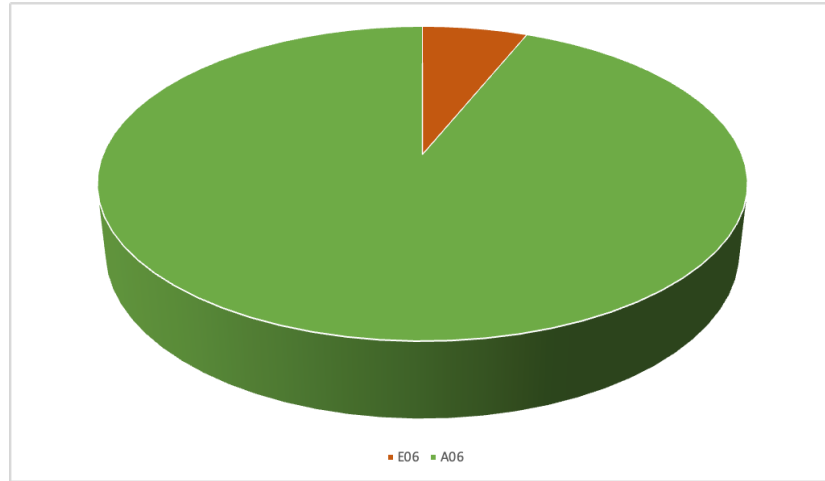
Yeast Population with No BioProtection



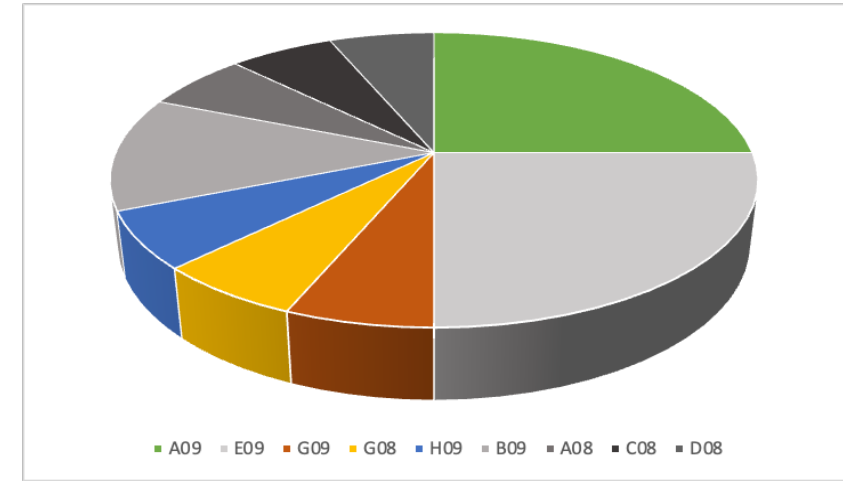
- The fermentations both have the same dominant *Saccharomyces cerevisiae* strain (Green)
- The non-Saccharomyces yeasts present in the BioProtection start of fermentation were species of *Candida*
- The non-Saccharomyces yeasts present in the No BioProtection start of fermentation were species of *Hanseniaspora*
- Three *Saccharomyces cerevisiae* strains were observed in the Bioprotection fermentation, Five *S. cerevisiae* strains were observed in the No BioProtection fermentation

Cold Soak Microbiology Trial #1: Fermentation Yeast Populations at End of Fermentation After Barreling Down

Yeast Population with BioProtection



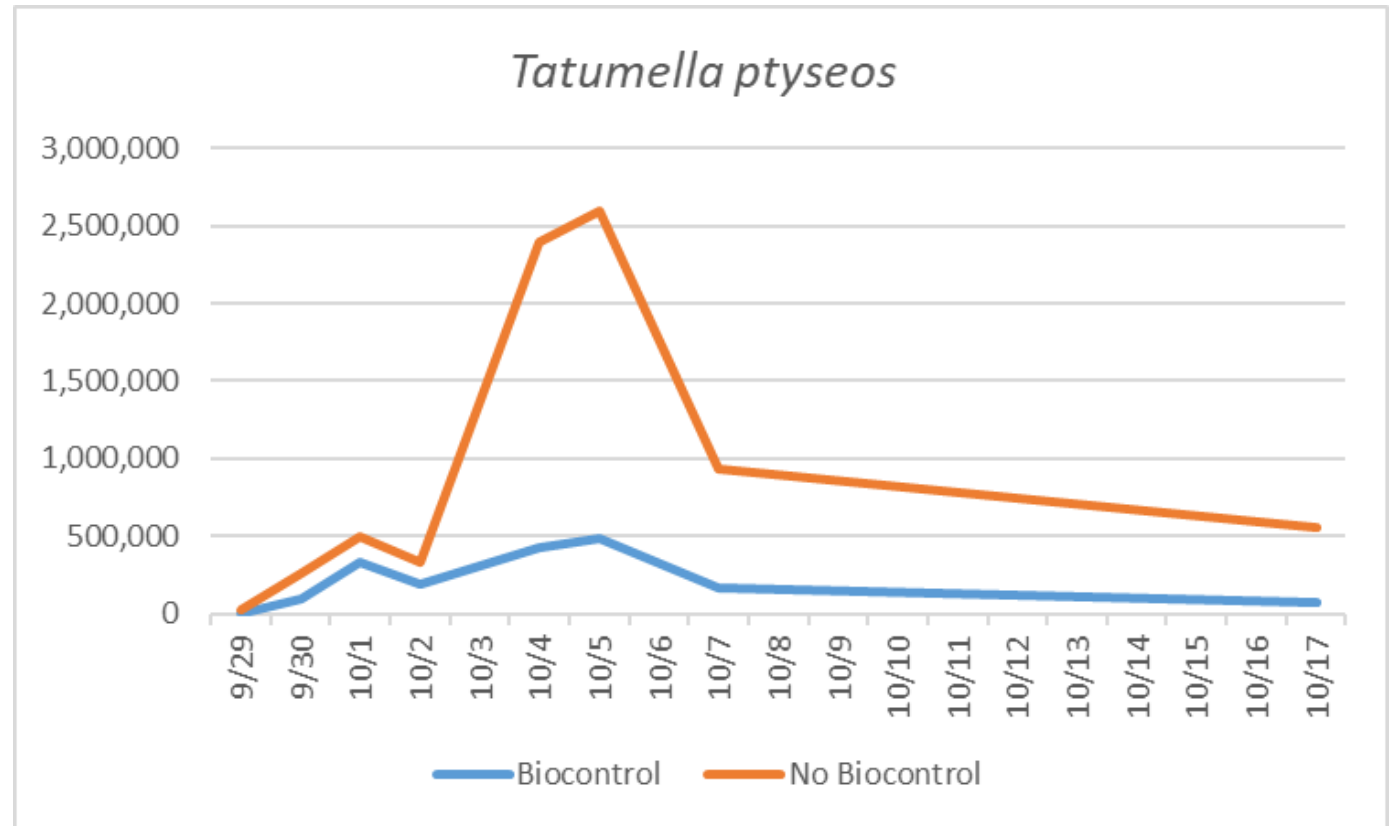
Yeast Population with No BioProtection



- The dominant yeast strain (94%) (Green) observed in the BioProtection fermentation was a co-dominant strain (25%) in the No BioProtection fermentation
- Two *Saccharomyces cerevisiae* strains were present in the Bioprotection fermentation, both strains observed at 13 Brix
- Nine *S. cerevisiae* strains present in the No BioProtection fermentation, four were observed at 13 Brix

Cold Soak Trial #1 No SO₂ Addition Biocontrol Yeasts on *Tatumella ptyseos*

- *Tatumella ptyseos* is a common grape bacteria that can degrade malic acid quickly under the right conditions
- Levels of *Tatumella ptyseos* were reduced in the presence of the biocontrol yeasts
- In the presence of BioProtective yeast there was a 0.2 g/L degradation of malic acid
- In the No Bioprotective yeast, there was a 0.6 g/L degradation of malic acid



Bryn Mawr Vineyards – Cold Soak Microbiology Trial #2

BioProtection in a low SO₂ situation.

Objectives

- Same as trial #1

What the experiment was about?

- It was to analyze the microbes present in low SO₂ fermentations - one with the addition of Bioprotection and one without.

Notable differences between trial #1 & # 2

- During the first trial, we discovered that one of our Non Sacc. products *may have* contained Saccharomyces; therefore, this second trial eliminated 1 of the 3 commercial strains in my custom blend
- Harvest was well underway, and I did not feel comfortable without adding SO₂, so 25ppm of SO₂ was added during processing
- Allowed the opportunity to see how the BioProtect culture responded in a more "normal/realistic " fermentation scenario with added SO₂
- We were able to take a sample of the grapes prior to processing – w/ 0 SO₂ added

Bryn Mawr Vineyards – Cold Soak Microbiology Trial #2

BioProtection in a low SO₂ situation.

BioProtect

25ppm SO₂
+ 10 g/hL BMV BioProtection

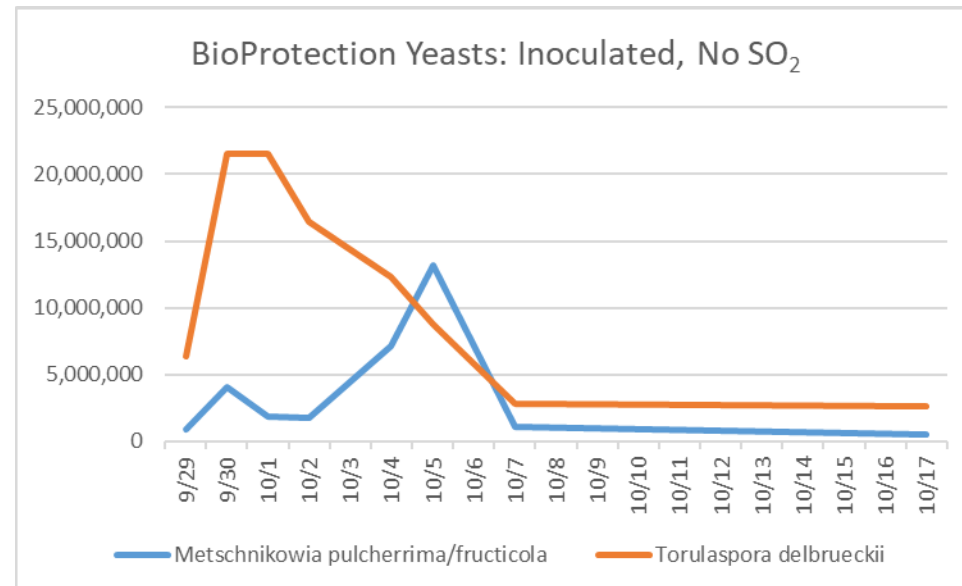
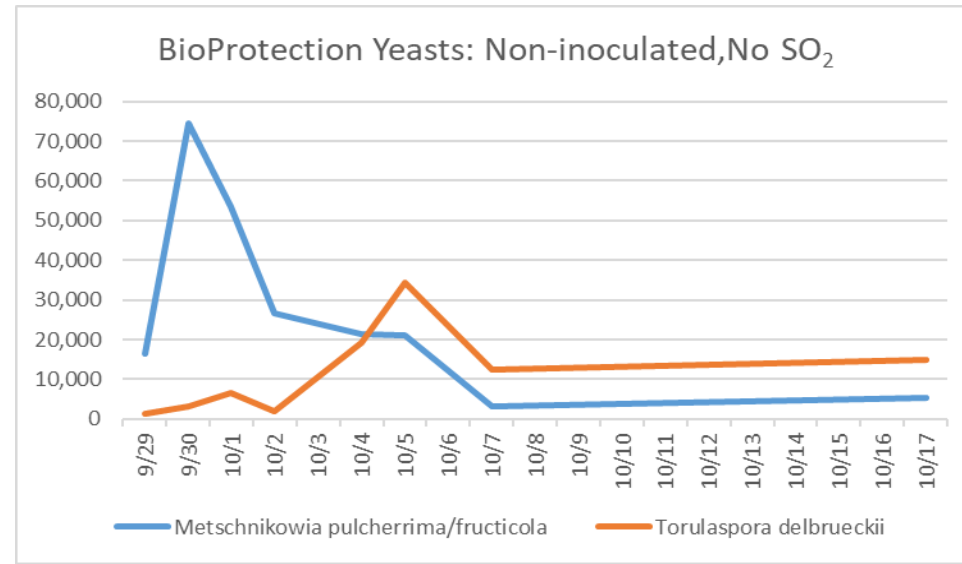
No-BioProtect

25ppm SO₂
0 BioProtection

- From the Bryn Mawr Vineyards – Eola-Amity Hills AVA – Organically Farmed
- BMV fruit was among the last of the reds of the vintage
- Very clean –no rot or bird damage from vineyard monitoring -fruit receipt
- 50% Whole cluster
- + 25ppm SO₂
- 7 -day cold soak at < 50F
- Heated ~ 20 hours (2 days) until there were signs of fermentation
- No additional heat or cooling was applied thereafter
- No sequential inoculation
- 23 days on skins
- Pressed off at –2.0 Brix, finished in tank, <1.0 g/L R.S went to barrel (normal)

Cold Soak Microbiology Trial #2: Comparison of BioProtection Yeast Addition vs No Addition, with SO₂

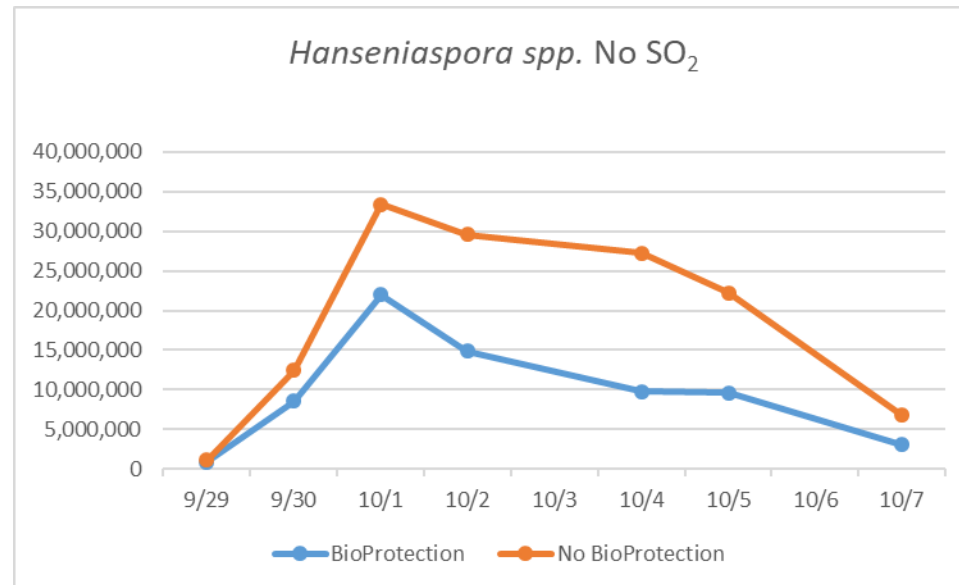
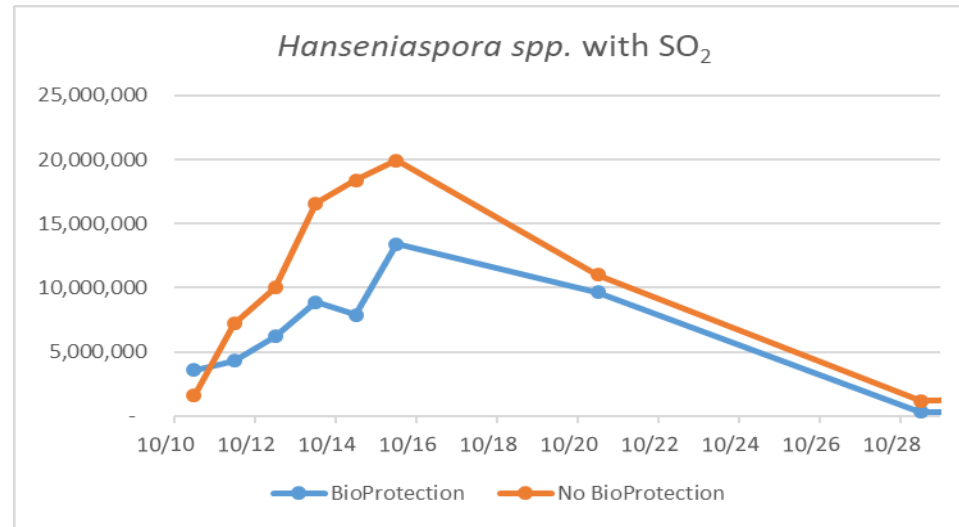
- The BioProtection yeast *Metschnikowia* was observed in the No BioProtection fermentation, at significantly lower levels (<1%) as compared to the fermentation inoculated with the BioProtection yeasts
- Although there was no *Torulasporea* yeast used for inoculation, it was still present at high levels in the initial stages of the BioProtection yeasts added cold soak and appears to be less tolerant of SO₂
- SO₂ addition doesn't appear to impact the inoculated *Metschnikowia* yeast strain



Cold Soak Trial #2: SO₂ Addition

Biocontrol Yeasts Impact on *Hanseniaspora* spp.

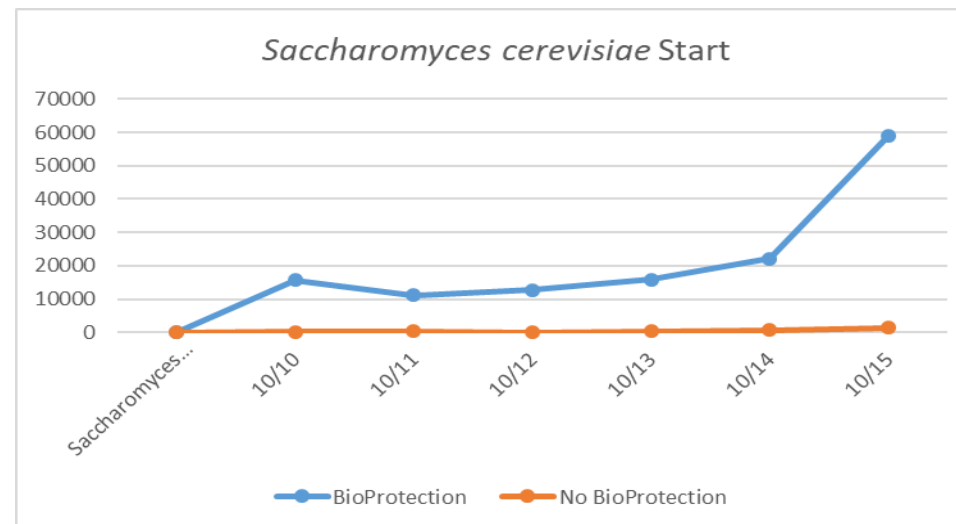
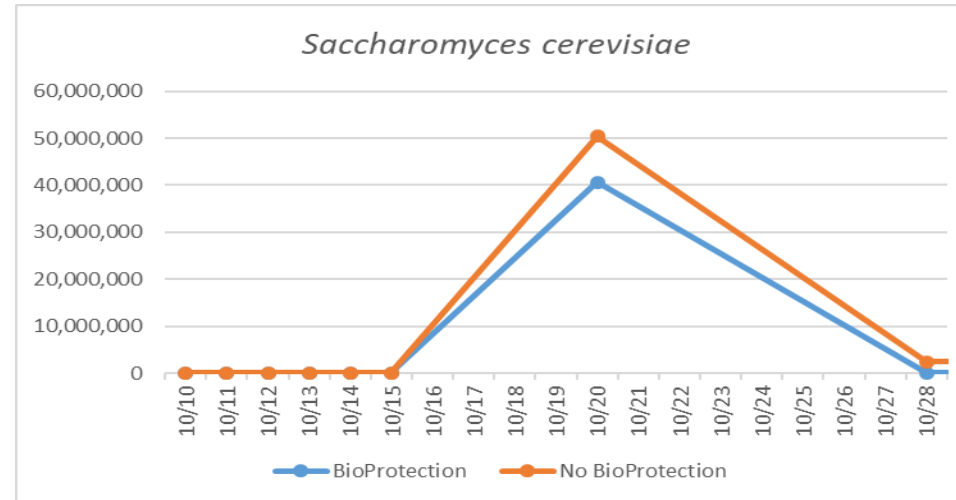
- Levels of the native *Hanseniaspora* spp. are reduced in the presence of the BioProtection yeasts
- The *Hanseniaspora* population is also reduced due to the presence of SO₂
- Appears to be a synergistic effect between SO₂ and the BioProtection Yeasts on the *Hanseniaspora* population



Cold Soak Trial #2: SO₂ Addition

BioProtection Yeasts Impact on *Saccharomyces cerevisiae*

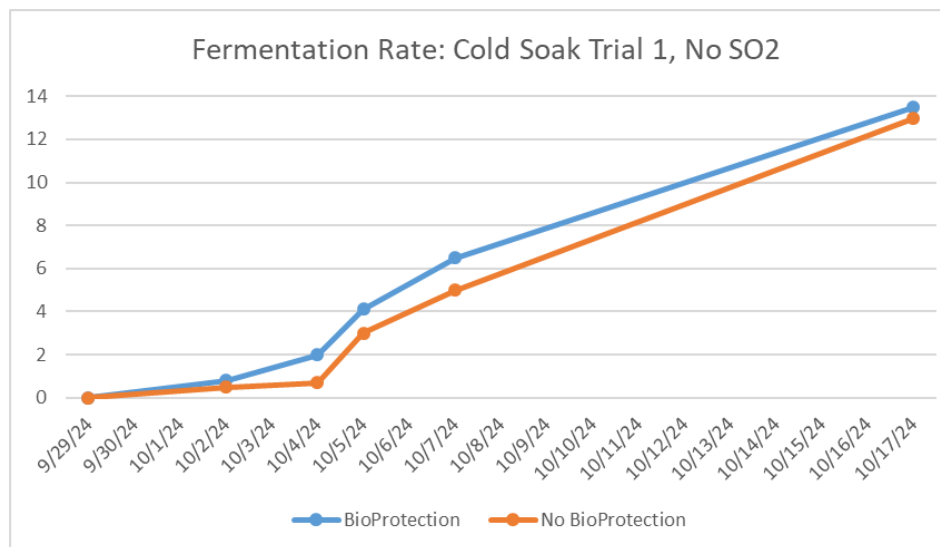
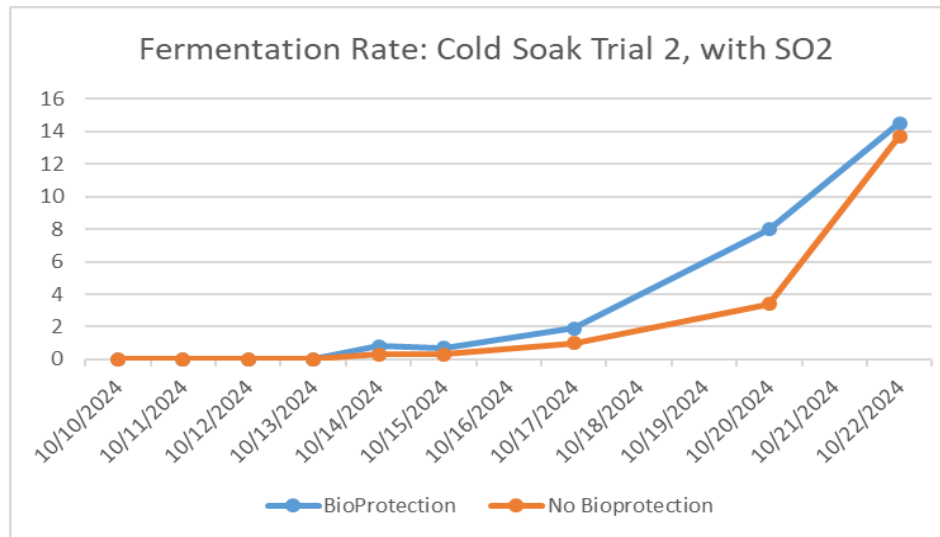
- *S. cerevisiae* population is larger in the No Bioprotection ferment
- An increase in the *Saccharomyces cerevisiae* population was observed early in the fermentation inoculated with the BioProtection yeast, as compared to the No BioProtection ferment
- The fermentation rate indicates fermentation starts sooner in the ferment with the BioProtection yeast added



Cold Soak Trial #2: SO₂ Addition

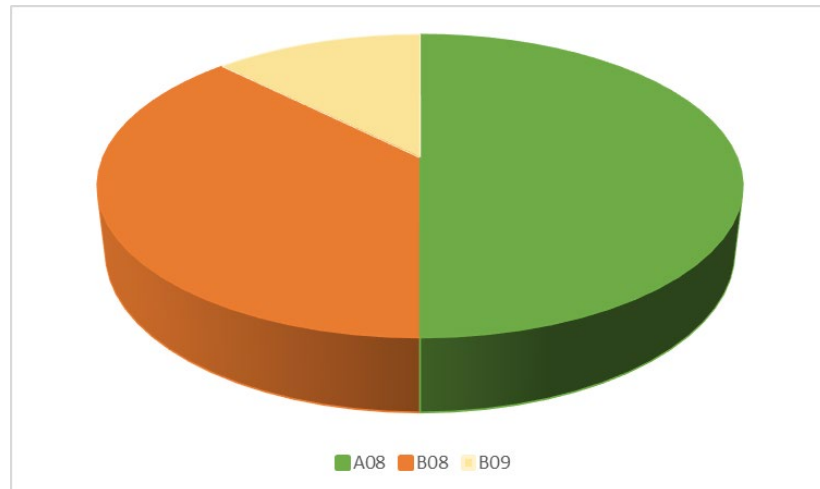
BioProtection Yeasts Impact on Fermentation Rate

- Must without the BioProtection yeast appears to start fermentation slower, and with a longer lag phase than the fermentation with the BioProtection yeast added
- Could indicate inhibition in the No Protection Yeast added fermentation due to competition for *Saccharomyces cerevisiae* with non-*Saccharomyces* yeast
- Similar population profile to No SO₂ ferment, although the ferment with addition of SO₂ finished in 12 days vs 18 days for the No SO₂ ferment

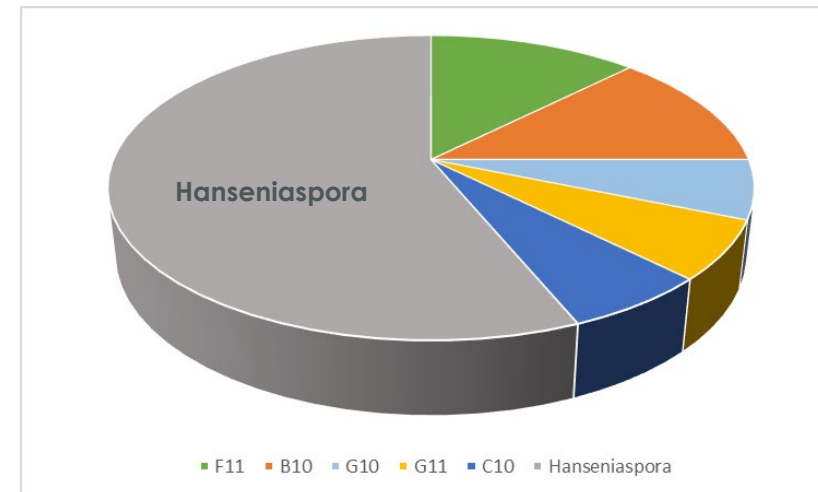


Cold Soak Microbiology Trial #2 with SO₂: Fermentation Yeast Populations at 13 Brix

Yeast Population with BioProtection



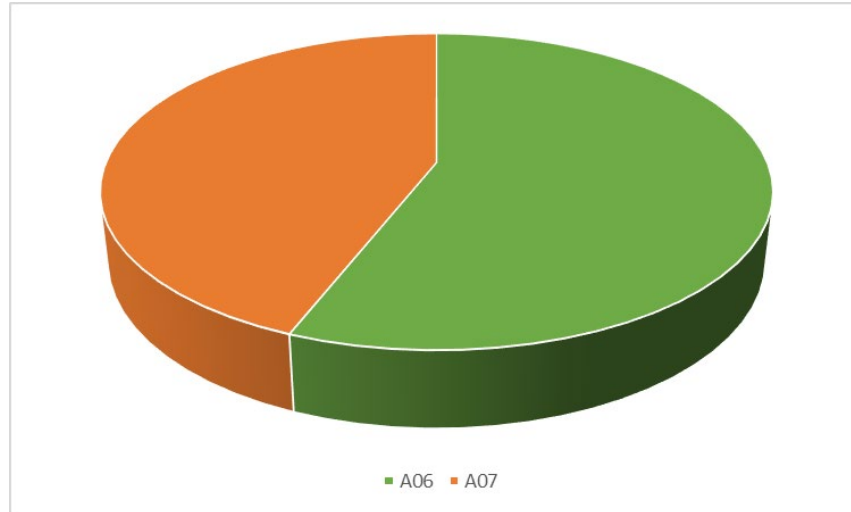
Yeast Population with No BioProtection



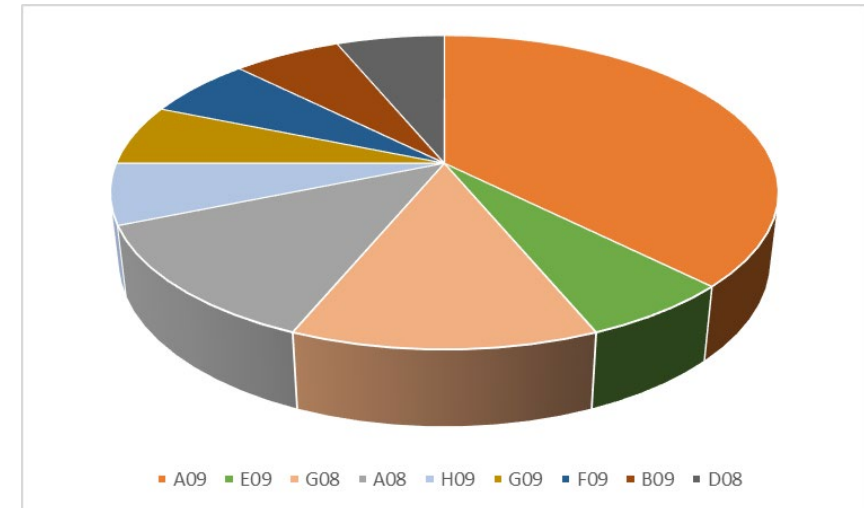
- The two dominant yeast strains (Green/Orange) present in the BioProtection fermentation were also present in the No BioProtection fermentation
- No non-Saccharomyces yeasts were present in the BioProtection fermentation, whereas the No BioProtection fermentation contained 56% Hanseniaspora
- Three Saccharomyces cerevisiae strains present in the Bioprotection fermentation, Five S. cerevisiae strains present in the No BioProtection fermentation

Cold Soak Microbiology Trial #2 with SO₂: Fermentation Yeast Populations at End of Fermentation

Yeast Population with BioProtection



Yeast Population with No BioProtection

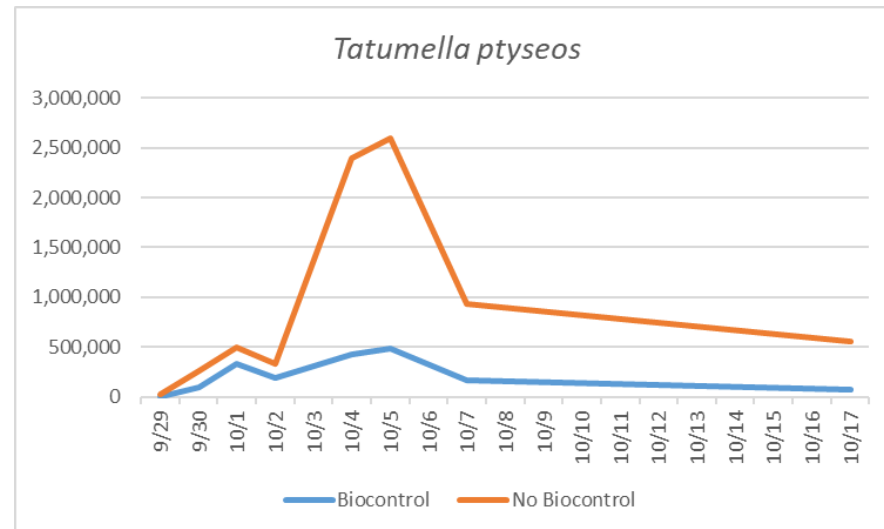
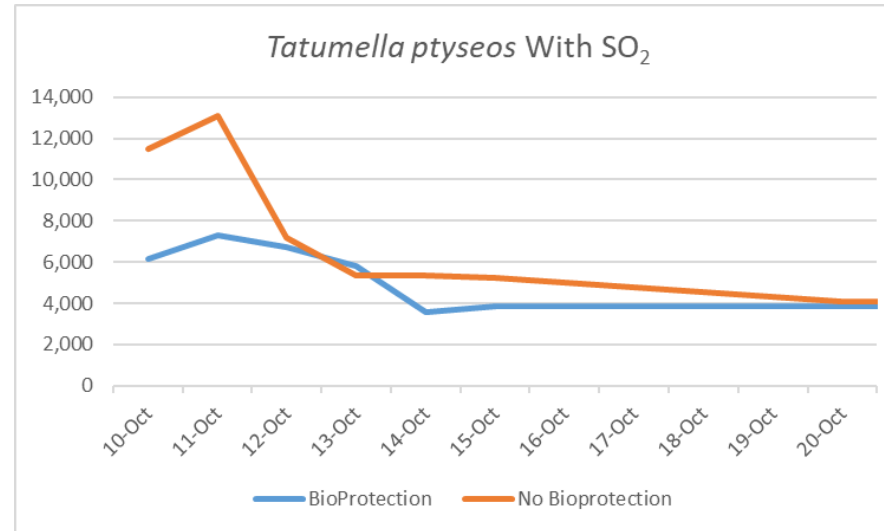


- The dominant yeast strain (56%) (Green) observed in the BioProtection fermentation was present (6%) in the No BioProtection fermentation
- The other strain present (44%) in the BioProtection fermentation was present (38%) in the No BioProtection fermentation
- Two *Saccharomyces cerevisiae* strains were present in the Bioprotection fermentation, both strains observed at 13 Brix
- Nine *S. cerevisiae* strains present in the No BioProtection fermentation, four observed at 13 Brix

Cold Soak Trial #2: SO₂ Addition

BioProtection Yeasts Impact on *Tatumella ptyseos*

- Levels of *Tatumella ptyseos* were reduced in the presence of the biocontrol yeasts
- *Tatumella ptyseos* is sensitive to SO₂
- Presence of SO₂ in the cold soak resulted in a significant reduction in *T. ptyseos* levels
- In the presence of SO₂ and BioProtective yeast there was a 0.1 g/L degradation of malic acid
- In the presence of SO₂ and No Bioprotective yeast, there was a 0.2 g/L degradation of malic acid

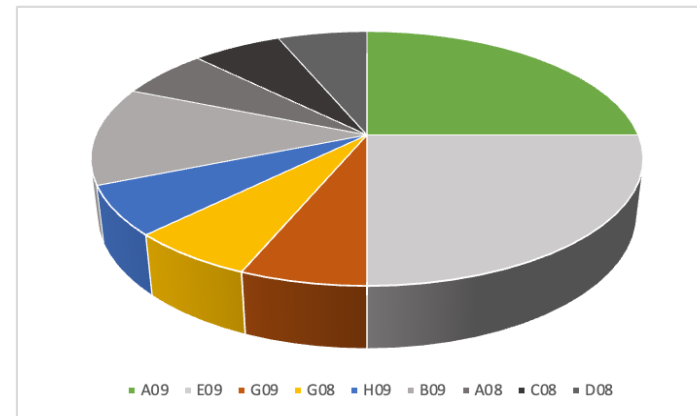
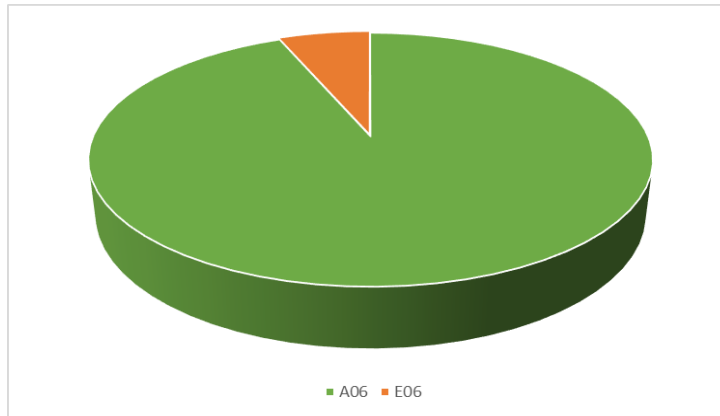


Comparison of Yeast Populations at the End of Fermentation With and Without BioProtective Yeast

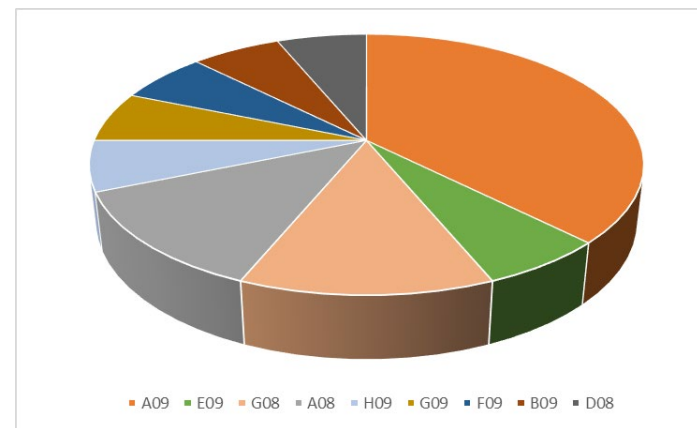
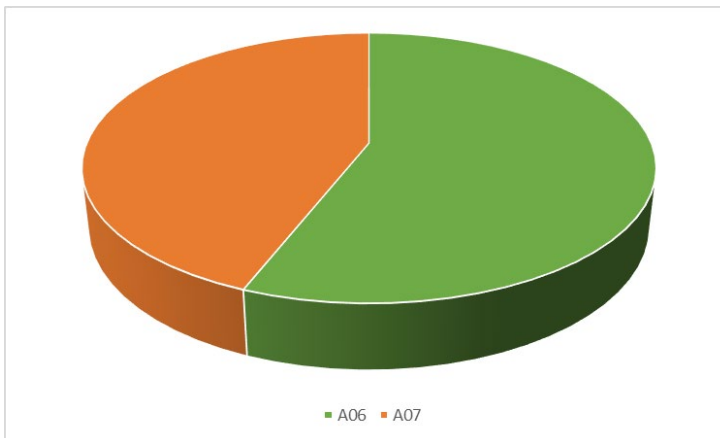
Yeast Population with BioProtection, End Ferment

Yeast Population with No BioProtection, End Ferment

Cold Soak Trial 1



Cold Soak Trial 2

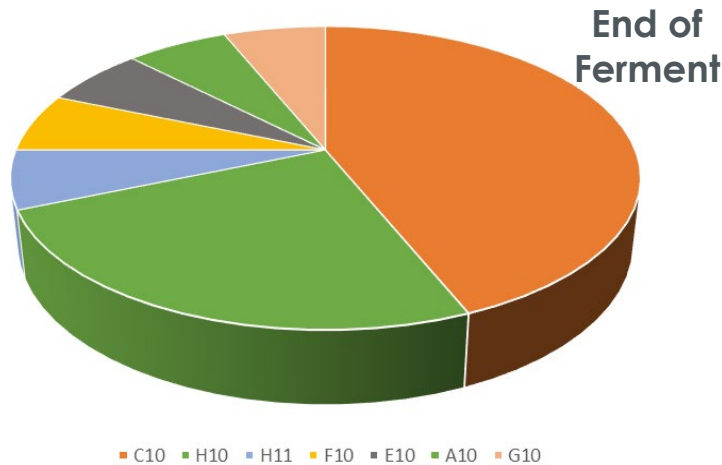
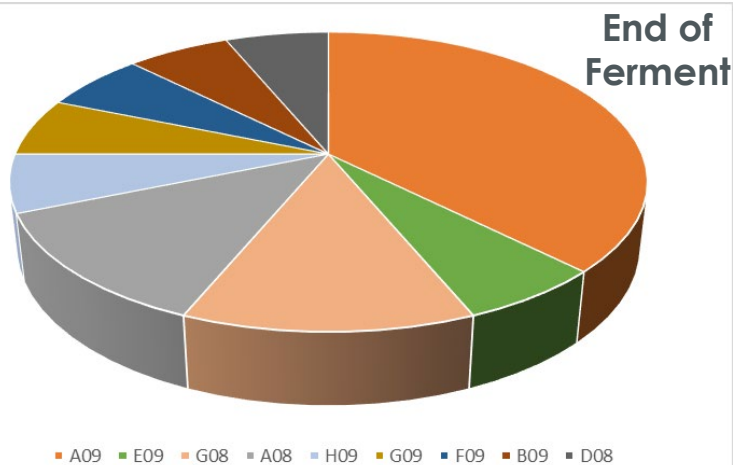
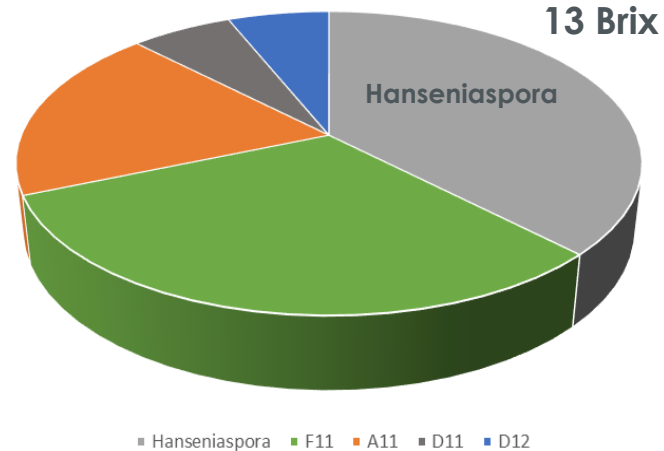
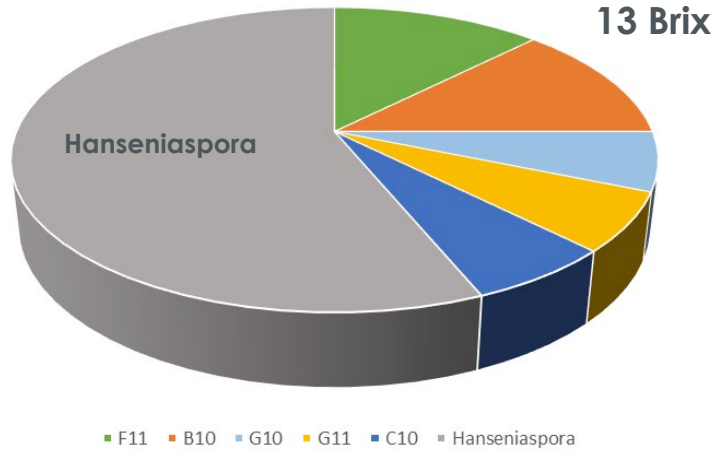


- The presence of BioProtection Yeast appears to reduce the diversity of *Saccharomyces cerevisiae* yeast in the fermentation

Comparison of Yeast Populations in Fermentations with Same Fruit: With and Without SO₂

With SO₂ No BioProtection

Cluster Microferment No SO₂ No BioProtection



- SO₂ may inhibit some strains of *Saccharomyces cerevisiae* in the early stages of fermentation
- No major differences between end of fermentation populations, likely more dependent on the yeast strains present than the SO₂ addition

Conclusions

- Addition of BioProtection yeast to the cold soak has a significant impact on the microbial populations coming in on the grapes, and at different stages of fermentation
- Populations of Non-Saccharomyces yeast, such as *Hanseniaspora* species are reduced in the presence of BioProtection yeast
- Populations of some bacteria, for example, *Tatumella ptyseos* are reduced in the presence of BioProtection Yeast
- Addition of the BioProtective yeasts at the cold soak stage, results in a slight increase in fermentation rate
- It appears addition of the BioProtective yeasts results in a significant reduction in the number of *Saccharomyces cerevisiae* strains present at both the mid- and end- ferment stages of the fermentations