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WINE

Washington State Wine Commission Demonstration Research Grant Program

FINAL REPORT – SHORT TERM PROJECT 2020-21 FUNDING CYCLE

Deadline for Submission: **June 30, 2021**

Submit reports to Washington State Wine Commission: mhansen@washingtonwine.org

PROJECT TITLE: Oxygen Usage During Flotation – Nitrogen vs. Oxygen

Project Duration: 1 year

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Co-PI:

Organization:

Telephone:

Email:

Cooperators:

1. Summary:

Flotation is a technique of using compressed gas combined with fining agents (bentonite, gelatin) to clarify white wine juice. The predominant reason for using flotation is to clarify juice quickly (2-3 hours vs. 1-2 days) and that the clarification is done at room temperature, which creates a large energy savings over the refrigeration used in cold settling.

Post fermentation, wine was analyzed via- ETS Labs for:

- Basic wine chemistry: pH, titratable acidity, volatile acidity, ethanol, free and total sulfur dioxide.
- Wine phenolic chemistry: caffeic acid, caftaric acid, catechin, gallic acid, quercetin glycosides, tannin, astilbin, grape reaction product. quercetin aglycone.

2. Objectives and Experiments Conducted to Meet Stated Objectives:

Flotation was done to observe modifications the phenolic makeup of a given white wine. Use of fining agents, along with an inert gas vs oxidative gas, can affect the phenolic makeup of the grape juice and subsequent wine. This investigated the way in which these different techniques can influence the makeup of grape juice and subsequent wine prior to fermentation.

Procedures to Accomplish Objectives:

Fruit was hand harvested from Sagemoor Vineyards in Pasco Washington.

Juice was separated into 3 treatments:

1. Control: Riesling was cold settled using enzymes then racked for fermentation
2. Treatment 1: Flotation using nitrogen as the compressed gas then racked for fermentation.
3. Treatment 2 Flotation using oxygen as the compressed gas then racked for fermentation.

Was accomplished with QA-23 yeast and nutrient supplemented with di-ammonium phosphate at a rate of 1/g/L to add 220mg/L of nitrogen to the fermentation.

Brix and temperature were monitored daily.

3. Major Research Accomplishments and Results by Objective:

It was noted that there were differences in wine chemistry and phenolic makeup between all treatments, additionally, there was a pronounced sensory difference between the wines. This trial gives a multifaceted set of data to winemakers who are considering using floatation as a tool to modify their wines, and/or energy and time savings associated.

4. Research Presentations: See attached.

5. Research Success Statements:

Project demonstrated:

- Flotation is a valuable tool for efficiency and time savings
- Flotation combined with nitrogen or oxygen may be used to modify the phenolic makeup of a wine
- Flotation combined with nitrogen or oxygen may be used to alter the sensory properties of the wine.

6. Funds Status: Include a general summary of how funds were spent. – See attached.

Please submit the report to the Washington State Wine Commission's Research Program Director, Melissa Hansen, at: mhansen@washingtonwine.org by June 30 of the end of the research funding year. Future research funding will be contingent on timely reporting.

Oxygen usage during Flotation

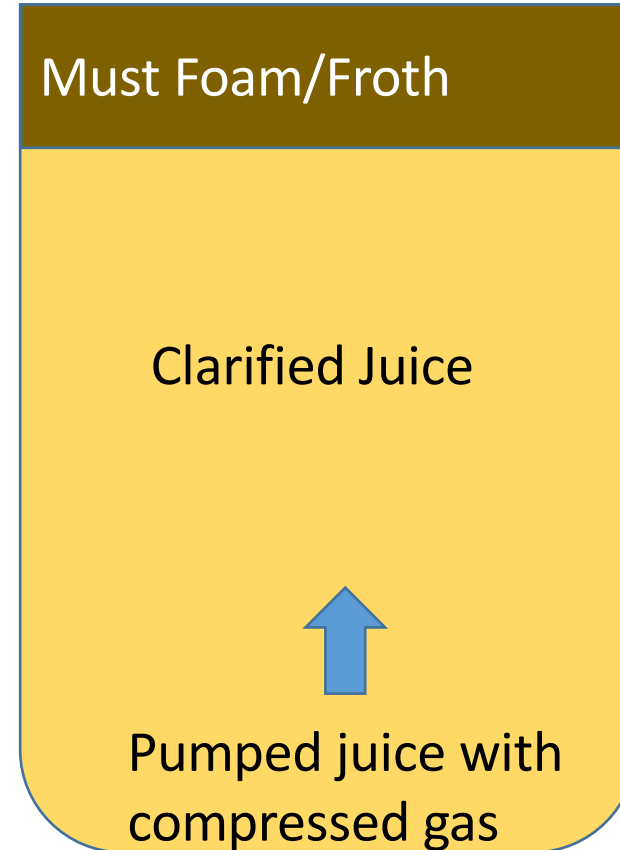
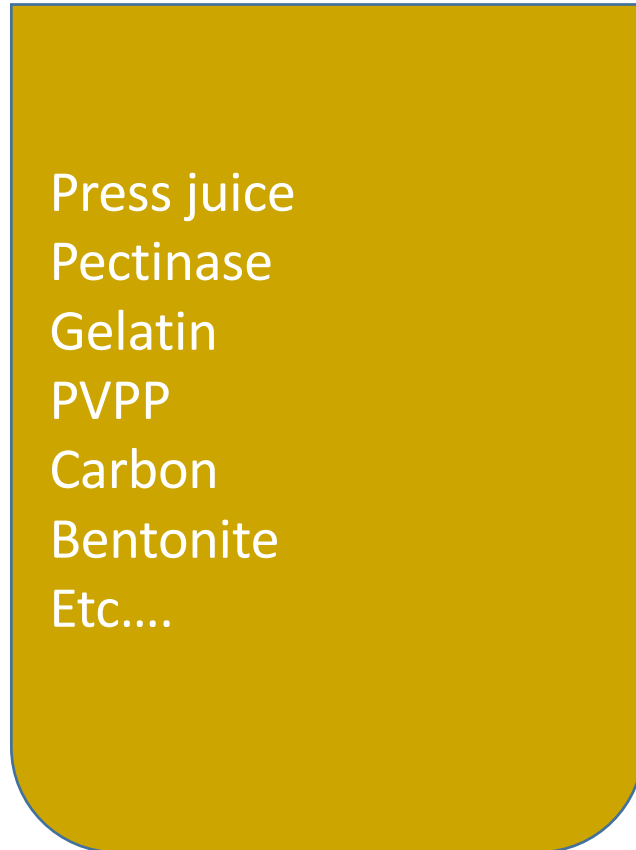
Nitrogen vs Oxygen on 2020 Sagemoor Riesling

Final Report for the Washington State Wine Commission Mini-Grant Program

Flotation - Mechanics
Pump
Compressed gas
Diffusion stone
Expansion chamber

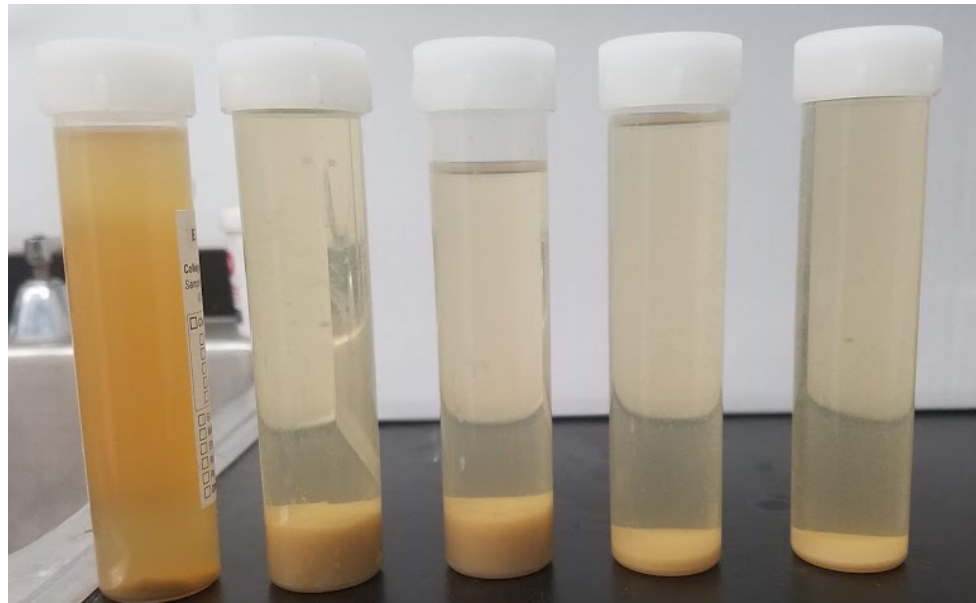


Fining in the juice phase



Visuals

Press, 20, 40, 60, 90 minutes



Nitrogen vs Oxygen



2020 Sagemoor Riesling

Control

- Cinn-Free Enzyme @ 40ml/HL
- Divergan F (PVPP) @ 10g/HL
- GECOLL Supra @ 20ml/HL
- Let settle

Nitrogen Flotation

- Cinn-Free Enzyme @ 40ml/HL
- Divergan F (PVPP) @ 10g/HL
- GECOLL Supra @ 20ml/HL
- Flotation for 90 minutes to 50 NTU with Nitrogen (inert)

Oxygen Flotation

- Cinn-Free Enzyme @ 40ml/HL
- Divergan F (PVPP) @ 10g/HL
- GECOLL Supra @ 20ml/HL
- Flotation for 90 minutes to 50 NTU with Oxygen (Oxidizer)

Wine Chem: Ethanol

RIESLING ETHANOL

Control Nitrogen Float Oxygen Float

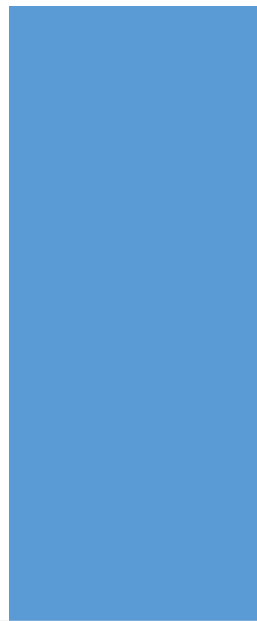
CONCENTRATION (% BY VOL)

13.06

14.13

14.06

ETHANOL



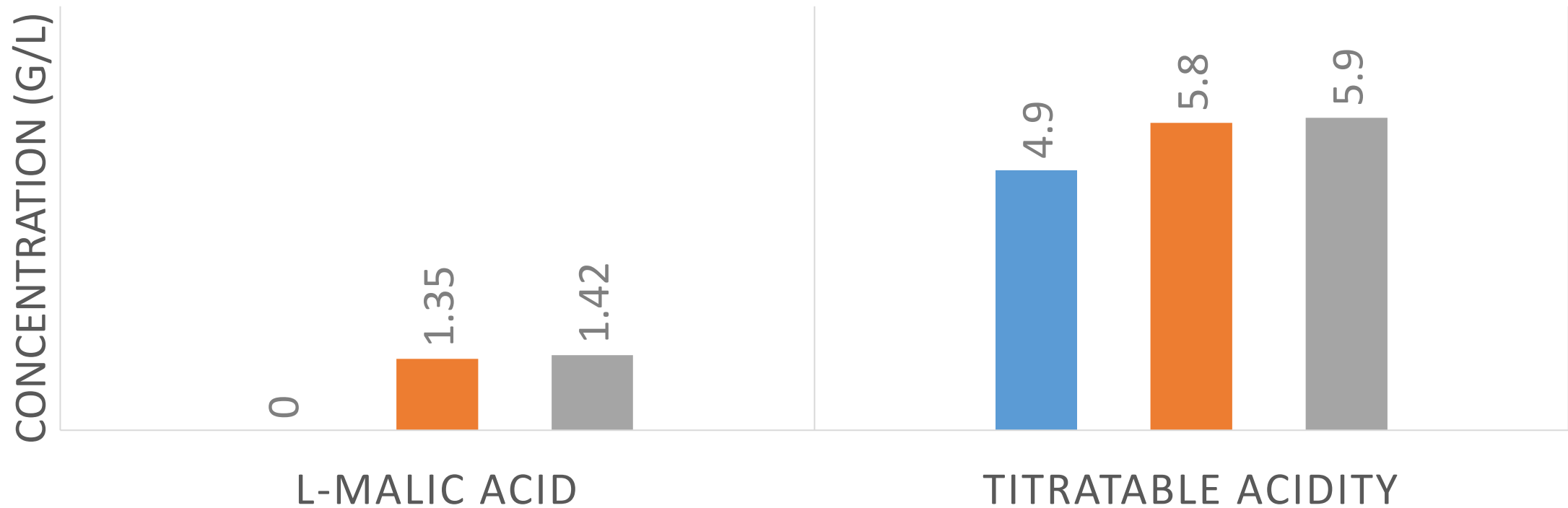
Notes on Ethanol

- Low SO₂ usage led to a spontaneous MLF in the control treatment.
- Given the low pH it did not cause a rise in volatile acidity, as glu/fru is converted to lactic acid <pH 3.6

Wine Chem - Acid

RIESLING ACIDITY

Control Nitrogen Float Oxygen Float



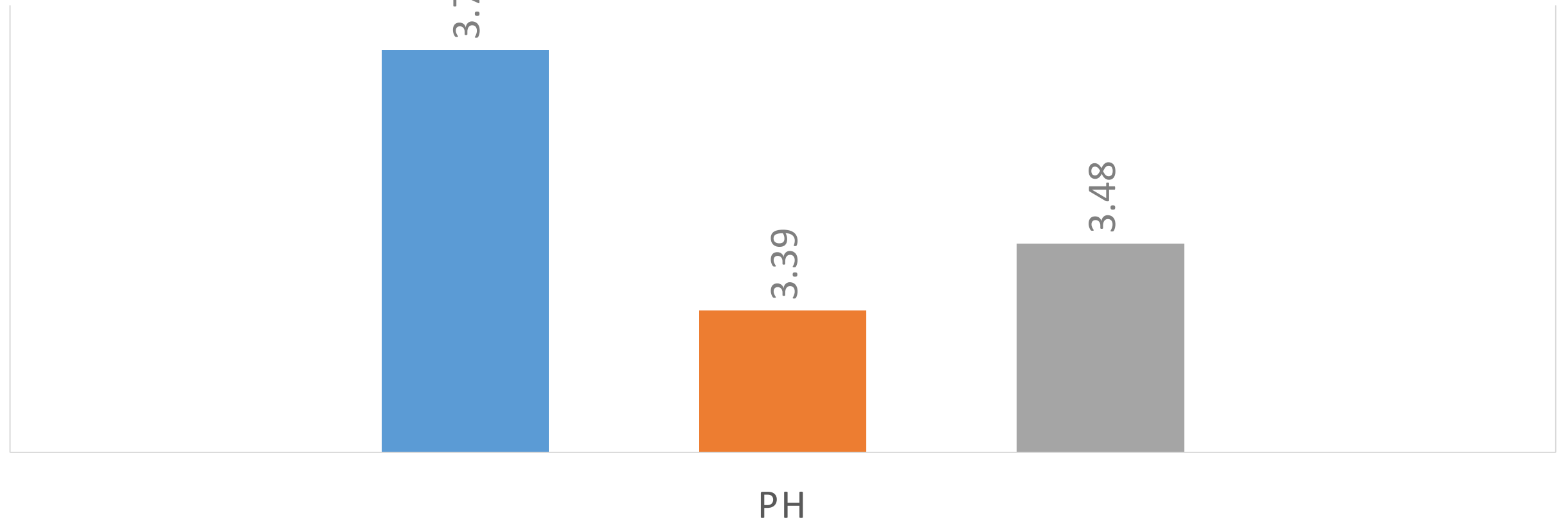
Notes on Acidity

- The control has significantly lower acidity due to the spontaneous ML fermentation
- However not much of a difference between the O and N treatments.

Wine Chem: Riesling pH

RIESLING PH

Control Nitrogen Float Oxygen Float



Notes on PH

- The control is much higher, due to spontaneous MLF (Seeing a trend here?)
- Why would the N be lower?

Riesling Juice Phenolics

RIESLING PHENOLICS

Control Nitrogen Float Oxygen Float

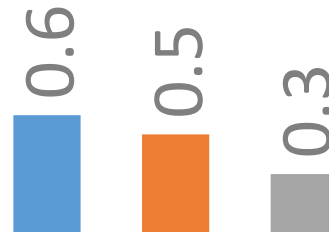
QUERCETIN
AGLYCONE



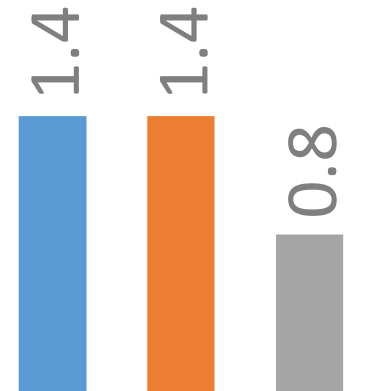
QUERCETIN
GLYCOSIDES



ASTILBIN



GALLIC ACID



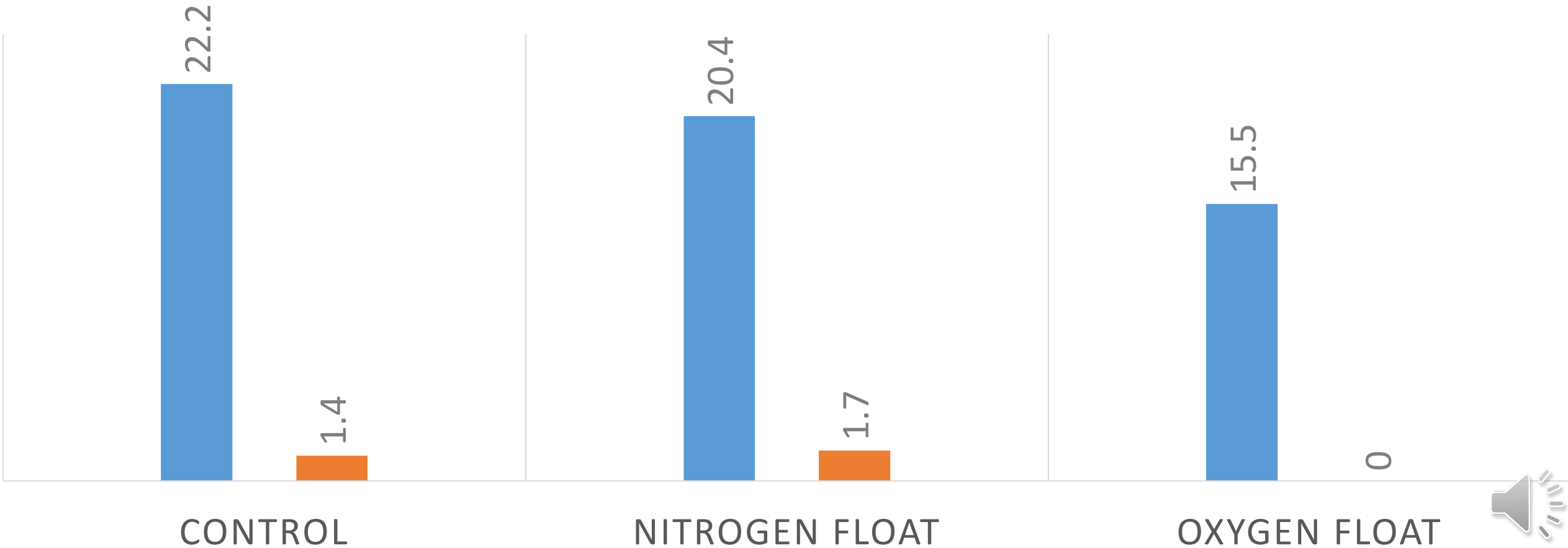
Notes on phenolics

- Both treatment wines were lower in phenolic material
- The N treatment may be lower due to addition of fining agents & extra circulation?
- The O treatment may lower due to fining agents as well as oxidation

Riesling Wine Phenolics

CHART TITLE

tannin catechin

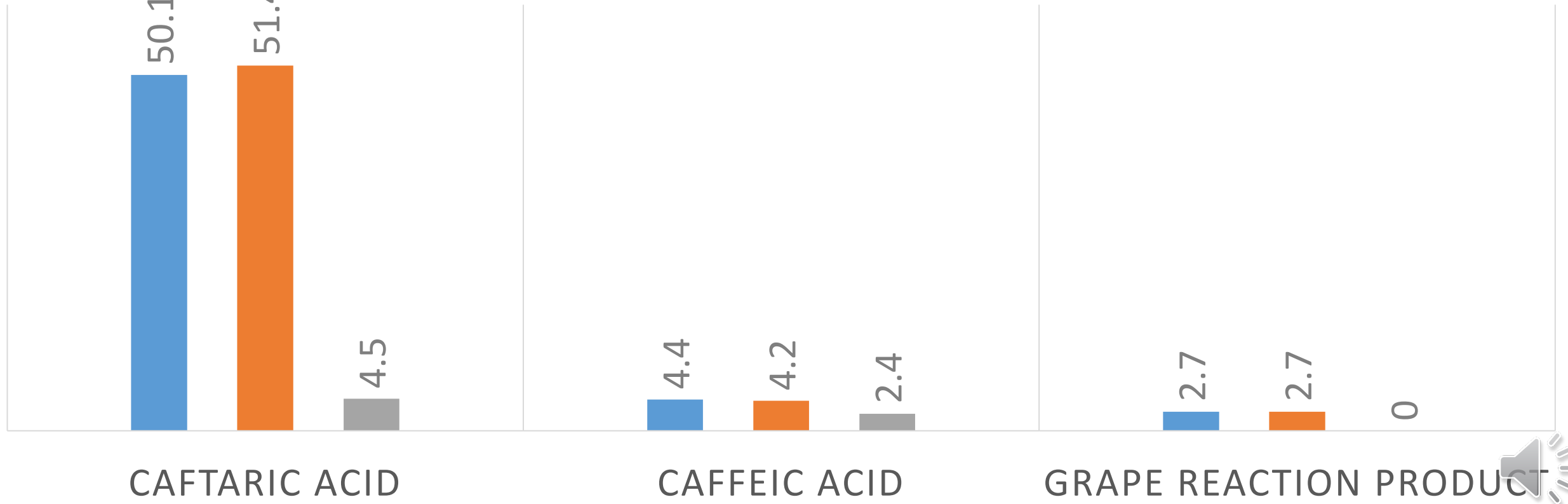


Notes on overall tannin

- The fining agents & extended circulation from flotation had an impact on reduction of tannin.
- In this case, it appears that the oxygen treatment also caused some flocculation and precipitation of tannin.

CHART TITLE

Control Nitrogen Float Oxygen Float



Notes on Caftaric, Caffeic, and GRP

- Caftaric acid degradation is a sign of oxidation, this certainly shows that.
- Interesting note: there should be an increase in GRP due to oxidation. Did it just go so far that it precipitated? Interesting

Student Sensory Notes

| Control | Nitrogen | Oxygen |
|------------------|-------------------------------|--------------------------------------|
| Honey | Floral | Honeysuckle |
| Butter | Banana | Tropical |
| Creamy | Peach | Lemon |
| Oily | Apple | Citrus |
| *Least Preferred | *Most preferred for aromatics | *Second most preferred for aromatics |
| | *Second for “mouthfeel” | *Most preferred for “mouthfeel” |

Flotation conclusions

- Flotation is very useful in reducing phenolic material up front.
- Oxygen may be useful in conversion of certain phenolics and it definitely has an effect on mouthfeel and aroma. Good or bad?
- Winemakers can use flotation combined with inert gas to modify the aromatic profile and mouthfeel of a wine.
- Overall another tool to use to make great wine.