Use of specialized nutrient (Stimula Chardonnay) to increase aromatic expression in barrel fermented Chardonnay (2020)

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Summary

Like many Virginia wineries, Delaplane produces multiple Chardonnay products: an aromatic, fruity expression of the variety with no new oak influence and a full-bodied expression with new oak and full malolactic fermentation. The purpose of this experiment was to determine if use of different yeast nutrient products, Fermaid O vs. Stimula Chardonnay (Scottlabs) led to differences in aromatic expression in Chardonnay. Manufacturer's guidelines were followed for goals of "fermentation security" and "optimization of esters". There were no notable differences in fermentation kinetics or chemistry of the finished wine. The wines were also not significantly different in a triangle test.

Introduction

Like many Virginia wineries, Delaplane produces multiple Chardonnay products: an aromatic, fruity expression of the variety with no new oak influence and a full-bodied expression with new oak and full malolactic fermentation. Specialized yeast nutrient products such as Stimula Chardonnay (Scottlabs) advertise the ability to boost yeast aromatic expression, specifically ester production, that may be useful in differentiating Chardonnay wine style.

Esters are fermentation-derived compounds that contribute to the aromatic intensity and complexity of wine[1,2]. They are predominantly formed during fermentation by the condensation products of other components of the wine matrix. Esters contribute significantly to the fruity and floral bouquet of young wines[2]. Most esters are not formed in grapes, but rather during fermentation by the action of yeast enzymes, therefore yeast selection and fermentation factors including yeast nutrients can have a significant effect on ester formation[2].

According to the manufacturer (Scottlabs), Stimula Chardonnay is 100% yeast autolysate "formulated to supply the optimal levels of amino acids, sterols, vitamins and minerals known to optimize the aromatic yeast metabolism."[3] Internal research studies in Spanish Chardonnay comparing the use of Stimula Chardonnay vs. DAP showed increased levels of several aromatic esters including ethyl hexanoate (fruity, green apple, strawberry), ethyl octanoate (sweet, fruity, sour apple, burned beer), ethyl decanoate (oil, fruity, floral, soap) and 2-phyenylethyl acetate (flowery, rosey, fruity), leading to sensory increases in aromatic complexity, intensity, and freshness[3]. The purpose of this experiment was to determine if use of different yeast nutrient products led to differences in aromatic expression in Chardonnay. There were two treatments:

- nutrient additions to "fermentation security" (Fermaid O)
- nutrient additions to "production of esters" (Stimula Chardonnay)

Methods

Grapes were hand harvested on 9/18/20, chilled overnight, then whole cluster pressed to tank with the addition of 0.16 mL/L Color Pro in the press and 30 mg/L SO_2, 30 g/hL Glutastar, and 40 g/hL Bactiless in the tank. Dry ice was used to blanket the juices during crush. Cuvée only (no press fraction) was used for this trial. A juice sample was sent to the Virginia Tech Enology Services Lab at the time of racking to determine YAN. The tank was racked off lees to a separate tank, then mixed to ensure homogeneity before transfer to barrels of comparable cooperage and age for fermentation. Juice was inoculated with 25 g/hL CY3079 yeast rehydrated in 30 g/hL GoFerm.

Nutrient additions were made according to the targets shown in Appendix A. The control wine followed instructions for "fermentation security" (30 g/hL Fermaid O at 1/3 sugar depletion) while the treatment followed instructions for "optimization of esters" (40 g/hL Stimula Chardonnay at 1/3 sugar depletion). All nutrient additions were done on 9/26. Barrels were placed in a cool cellar with a goal of keeping the temperature of the fermentation cool. At the completion of fermentation, barrels were racked with the addition of 66 mg/L SO_2.

Sensory analysis was completed by a panel of 32 wine producers. Due to restrictions put in place during COVID-19, sensory analysis was completed using shipped samples. Each wine producer received three wines in identical bottles, filled on the same day, each coded with random numbers. Two of the bottles contained the same wine while the third bottle contained the different wine. Participants were asked to identify which wine was different (a triangle test). There were four tasting groups with the unique wine in the triangle test balanced among the groups. Participants were then asked to score each wine on a scale of 0 to 10 for overall aromatic intensity, fruit intensity, floral intensity, and chardonnay varietal character. Participants were also given open ended questions to describe the wines. Results for the triangle test were analyzed using a one-tailed Z test. Descriptive scores were analyzed using repeated measures ANOVA. Scores for descriptive characteristics were analyzed only from participants who were able to distinguish the two wines (those who answered correctly in the triangle test).

Results

To determine the amount of nutrient to be added, a post-settling juice sample was sent to the Virginia Tech Enology Services Lab. The YAN was measured to be 210 mg/L (Table 1). The yeast strain, CY3079, is listed as having high nutrient requirements in the Scottlabs catalogue. According to the fermentation management guidelines provided by Scottlabs (Appendix A), 250 ppm of nitrogen is recommended for a fermentation beginning at 20°Brix with a yeast with high nutrient requirements. Accordingly, a small addition of nitrogen was planned to supplement. Using the charts provided in the Scottlabs Fermentation Management guidelines (Appendix A), a 30 g/hL Fermaid O addition was used for the control (fermentation security) while a 40 g/hL

Stimula Chardonnay addition was used for the treatment (to optimize esters). Both additions were planned for approximately 1/3 sugar drop.

Fermentation kinetics were very similar for both treatments (Figure 1) and the finished wine chemistry was also very similar (Table 2). Both fermentations finished with no measurable residual sugar or lactic acid (data not shown) and comparable amounts of residual nitrogen (Table 3). In a triangle test, 13 out of 32 respondents were able to distinguish which wine was different, indicating the wines were not significantly different (Z=0.69, p= 0.25). There were no significant differences in scores for overall aromatic intensity, fruit intensity, floral intensity, or chardonnay varietal character (Table 4).

References

(1) Oberholster, A. Fermentation and Ester Taints, n.d.

(2) Jackson, R. S. *Wine Science: Principles and Applications*, 4 edition.; Academic Press: Amsterdam, 2014.

(3) Stimula Chardonnay Technical Data Sheet. Lallemand.

Table 1: Juice analysis. Samples were frozen prior to transport, so pH and TA numbers may be somewhat different. (Virginia Tech Analytical Services Lab)

°Brix	pH	TA (g/L)	Malic Acid (g/L)	NOPA (mg/L)	Amm (mg/L)	Arg (mg/L)	YAN (mg/L)
19.3	3.51	7.07	4.73	132	61	176	210

Figure 1: Fermentation kinetics for two nutrient treatments in Chardonnay (in-house data)

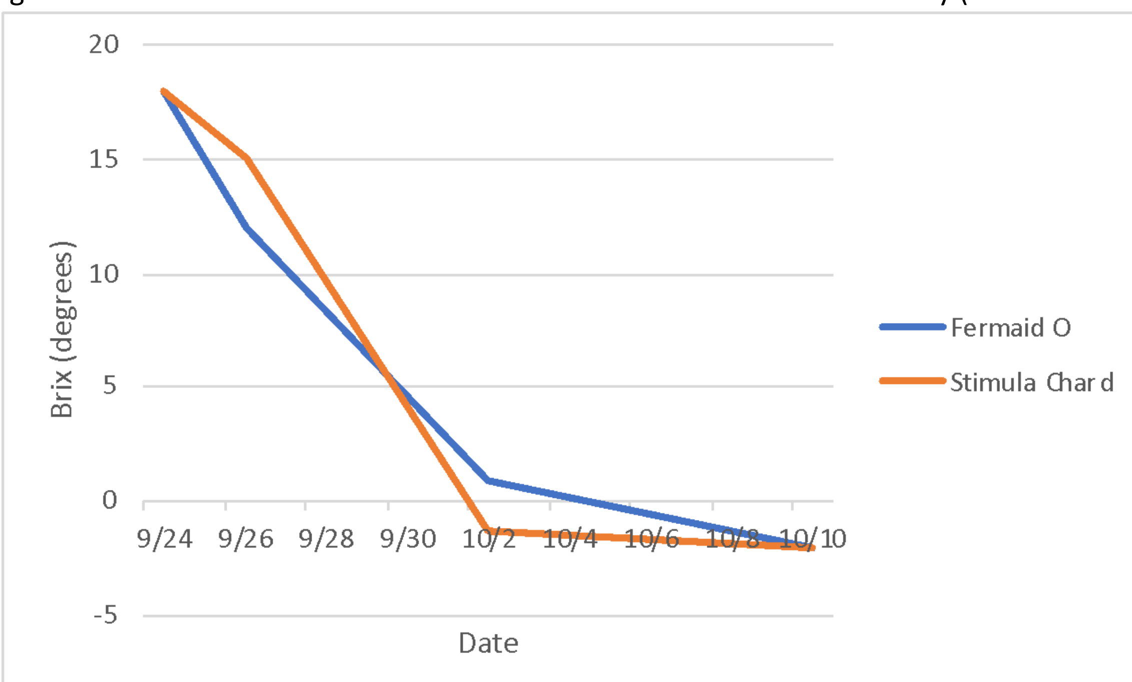

Table 2: Finished wine chemistry for two treatments of Chardonnay (ICV Labs)

	Volatile Acidity (g/L)	pH	Titratable Acidity (g/L)	Alcohol (%)	Malic Acid (g/L)
Fermaid O	0.29	3.55	6.2	11.27	4.51
Stimula Chard	0.26	3.56	6.26	11.24	4.62

Table 3: Finished wine nutrients for two treatments of Chardonnay (mg/L) (Virginia Tech)

	NOPA	Ammonia	Arginine	YAN (mg/L)
Fermaid O	29	0	53	38
Stimula Chard	33	0	17	36

Table 4: Statistical analysis for descriptive scores from blind sensory analysis of two treatments of Chardonnay

	Control		Stimula			
Descriptor	Mean	SD	Mean	SD	F	P
Overall Aromatic Intensity	5.5	1.58	5.4	1.62	0.02	0.90
Fruit Intensity	5.4	1.56	5.3	1.53	0.00	0.95
Floral Intensity	3.8	2.09	3.8	1.60	0.02	0.90
Chardonnay Varietal Character	5.2	2.04	5.4	1.72	0.28	0.60

Appendix A: Scottlabs guidelines for nutrient additions

SCOTT LABORATORIES

FERMENTATION MANAGEMENT

A FOCUS ON NUTRITION

In order to conduct a healthy and a complete fermentation, yeast need more than nitrogen. In fact, the survival factors and mineral and vitamin co-factors are essential. If limited and/or imbalanced, the yeast will struggle to complete the fermentation and the resulting wine may be slow, sluggish or stuck, and the production of negative sensory compounds may be obvious.

To calculate your additions, based on sugar, yeast strain requirements, and your fermentation goals, follow the outline below.

1. To tailor a fermentation plan to your needs, begin by calculating the theoretical nitrogen requirements based on two factors: sugar to be fermented and the yeast strain requirements.

SUGAR	YEAST STRAIN NITROGEN REQUIREMENTS		
Brix	Low	Medium	High
20	150	180	250
22	165	200	275
24	180	220	300
26	195	240	325
28	210	260	350
30	225	280	375

Table 1

2. Calculate the supplemented nitrogen required:
   a. Juice/Must YAN – Theoretical Nitrogen required (table 1) = SUPPLEMENTED YAN

3. Determine fermentation goal:
   a. Fermentation security
   b. Fermentation security and optimization of thiols
   c. Fermentation security and optimization of esters

4. Once YAN supplementation and fermentation goal has been determined, follow one of the three protocols outlined below.
   a. The nitrogen required to secure the fermentation is supplied by the Fermaid family of complex yeast nutrients. The Go-Ferm Protect Evolution is an autolyzed yeast naturally providing the essential survival factors and vitamins to balance the nitrogen uptake and act as fermentation security co-factors. The goal of the Stimula range is to naturally supply vitamins and minerals to assist with the yeasts aromatic metabolism as well as supply nitrogen. To optimize yeast performance, all components are required and solely focusing on nitrogen management is no longer appropriate for a healthy fermentation.

GOAL: FERMENTATION SECURITY

YAN REQUIRED TO SUPPLEMENT	AT YEAST REHYDRATION PHASE	AT 2-3 BRIX SUGAR DROP	AT 1/3 SUGAR DROP
50 ppm	Go-Ferm Protect Evolution®	No addition	30 g/hL Fermaid® O
100 ppm	Go-Ferm Protect Evolution®	20 g/hL Fermaid® O	20 g/hL Fermaid® O + 12.5 g/hL Fermaid® K
150 ppm	Go-Ferm Protect Evolution®	40 g/hL Fermaid® O	30g/hL Fermaid® A

GOAL: OPTIMIZATION OF THIOLS

YAN REQUIRED TO SUPPLEMENT	AT YEAST REHYDRATION PHASE	AT 2-3 BRIX SUGAR DROP	AT 1/3 SUGAR DROP
50 ppm	Go-Ferm Protect Evolution®	Stimula Sauvignon Blanc™ 40 g/hL	10 g/hL Fermaid® O
100 ppm	Go-Ferm Protect Evolution®	Stimula Sauvignon Blanc™ 40 g/hL	20 g/hL Fermaid® O
150 ppm	Go-Ferm Protect Evolution®	Stimula Sauvignon Blanc™ 40 g/hL	40 g/hL Fermaid® O

GOAL: OPTIMIZATION OF ESTERS

YAN REQUIRED TO SUPPLEMENT	AT YEAST REHYDRATION PHASE	AT 2 - 3 BRIX SUGAR DROP	AT 1/3 SUGAR DROP
50 ppm	Go-Ferm Protect Evolution®	No addition	Stimula Chardonnay™ 40 g/hL
100 ppm	Go-Ferm Protect Evolution®	20 g/hL Fermaid® O	Stimula Chardonnay™ 40 g/hL
150 ppm	Go-Ferm Protect Evolution®	40 g/hL Fermaid® O	Stimula Chardonnay™ 40 g/hL