The Impact of Agrothermal Systems Heat Blast Treatments in Sauvignon Blanc

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Summary

Agrothermal Systems heat blast treatment is marketed to reduce the need for fungicide, controls pests, increase yields and improve wine quality by increasing phenols and antioxidants. This treatment relies on a transient dose of heat from a system pulled behind a tractor through the vineyard rows. Internal studies conducted in California and Oregon show positive impacts on powdery mildew, phenolics and antioxidant activity while another study done in Washington State Merlot shows no effects. Previous external studies and WRE studies have mixed results. The following study aims to measure the effects of heat blast treatment in Virginia Sauvignon Blanc. A single block of Sauvignon Blanc was divided to receive no heat blast vs. 10-12 treatments during the growing season. There were no significant differences in cluster weight, berry weight, or berries per cluster. Untreated grapes had higher Brix at harvest. The wines were not judged to be different in a triangle test and there were no significant differences in scores for aromatic intensity, Sauvignon Blanc varietal character, freshness or bitterness.

Introduction

In its promotional material, Agrothermal Systems claims its heat blast treatment reduces the need for fungicide, controls pests, increases yields and improves wine quality by increasing phenols and antioxidants[1]. If true, this intervention could be a valuable tool in Virginia's humid climate. However, Dr. Tony Wolf, Professor of Viticulture and Director of the Virginia Tech Agriculture and Research Center, cautions that though "there is some physiologic precedent for the 'heat-shock' treatment" including expression of systemic acquired resistance (SAR) genes and related metabolites" the question remains if the detection of metabolites in grapes in lab studies translates to a treatment that alters fruit quality and wine quality within reasonable economic parameters (personal communication).

Heat blast treatment uses "a gas-operated, hydraulic fan heater system that generates a 300°F hot air stream through the plant."[1] The heater is pulled behind a tractor at 3-4 mph and aims the hot air stream at the fruit zone. A video of the machine in action is posted on the website of the manufacturer[1]. In practice, heat is applied 10-12 times between bloom and harvest according to a proprietary schedule. When asked, two Virginia winemakers, Shai Van Gelder (Barrel Oak Winery) and Preston Thomas (Stone Tower Winery) estimated that, at a speed of 3-5 mph, treatment time ranges from 1-2.5 hours per acre depending on row spacing and length (personal communication). In a study conducted in Washington State, Gohil and Moyer, 2014)[2] found that at a tractor speed of 4 mph, heat blasted vines were exposed to hot air for 1.5 to 2 sec each, resulting in increased grape temperature of 10-20 °F for 10-20 seconds.

Grapes returned to initial temperature within 60 seconds. This study found no significant differences in fruit set, timing of veraison, pH, TA, or Brix in either Merlot or Syrah.

The Agrothermal Systems website and internal documents indicate that cellular responses to "instantaneous heat shock" induced by heat blast treatment "activate the plant self-defense system and increase its production of phenol and antioxidants – the main flavonoids in wine. The resulting wine exhibits enhanced flavor profiles, increased aromatic definition, and smoother texture."[1] Other studies of short term heat shock[3,4] indicate that heat shock in general shifts gene expression away from ripening (sugar accumulation, production of phenolics) to the production of heat shock proteins, thus delaying or even inhibiting maturation. In addition, the changes in heat seen with early morning heat blast are less than would be expected for grapes during the heat of an average day.[2]

All previously published field work has been done in dry climate areas (California and Eastern Washington). In a WRE trial conducted in 2018 at Barrel Oak Winery in Delaplane, Virginia, a single block of Petit Manseng was split into treated and untreated subplots[5]. There were no obvious differences in fruit sampling parameters in replicate plots (berry weight, Brix, pH, TA). At harvest, control fruit had higher Brix and pH while heat blast treated grapes were harvested with higher levels of tannin. In a blind triangle test, wine produced from these grapes was perceived as different, with treatment wine receiving higher descriptive scores for bitterness. No objective measurement of disease incidence or yield parameters were done in the Petit Manseng study. The following study aims to measure the effects of heat blast treatment in Virginia Sauvignon Blanc.

Methods

A single block of Sauvignon Blanc in VSP trellising was divided into two sections with similar topology. Both sections were farmed identically with regard to hedging, leaf pulling, sucker removal, foliar nutrients, cluster exposure and netting. Both control and treatment blocks had identical chemical spray regimes.

The treatment block received heat blast delivery to the canopy and fruiting zones using a proprietary protocol set forth by the manufacturer. Treatments were applied during bloom, veraison, and ripening, and varied in frequency depending on vine physiology and weather events. There were approximately 10-12 treatments for each treatment block. Treatments started pre-dawn in order to finish the application before ambient temperatures reached 80-85° Fahrenheit. The propane tank was 60 gallons and could theoretically make applications to 20 acres of vines in one tank, however usage was variable and depended heavily on ambient temperature (lower ambient temperatures required more heat to reach the desire application temperature). The applications were done at 3 miles per hour, which translated to 2.5 hours per acre for blocks at 7 foot spacing.

Grapes were harvested on the same day and refrigerated overnight prior to processing. Grapes were whole cluster pressed with the addition of 40 ppm SO_2 and dry ice pellets in the press pan. Juice was clarified overnight at 2°C with addition of 3 g/hL lafazyme Thiols and 20 g/hL Bentogran. Clarified juice (NTU<100) was racked off heavy lees the following day and transferred to barrels for fermentation. Barrels of comparable size and cooperage were used for the study. Juice was inoculated for fermentation with 20 g/hL Alchemy I yeast rehydrated in 25 g/hL GoFerm Protect Evolution. Fermentation was monitored for density and temperature daily with an addition of 12.5 g/L sugar at 1/3 Brix depletion. Nutrients were added to a target YAN of 150 mg/L, with the addition of 10 g/hL Fermaid K at the end of lag phase and at 1/3 Brix depletion. Fresh Arom (20 g/L) was also added at 1/3 Brix depletion. After wines were fermented to drynes, 6 g/hL Extralyse and 50 ppm SO_2 were added. Wine was racked off heavy lees at 6 weeks post alcoholic fermentation and aged in barrel with monthly analysis of pH, VA, free and total SO_2.

Sensory analysis was completed by a panel of 28 wine producers. Wines were presented blind in randomly numbered glasses. Tasters were presented with three wines, two of one type and one of another, and asked to identify which wine was different (a triangle test). There were three tasting groups with the unique wine in the triangle test balanced between groups. Tasters were then asked to score each wine on a scale of 0 to 10 for aromatic intensity, Sauvignon Blanc varietal character, freshness and bitterness. They 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.

Results

There were no significant differences in cluster weight, berries per cluster, or berry weight between treated and untreated vines (Figure 1). The untreated grapes had higher Brix and lower TA than the treated grapes at harvest (Table 1). Both lots underwent a robust fermentation (Figure 2). Juice from treated fermented slightly faster than the control lot, but with similar temperature. Both fermented to dryness (RS=0, ICV labs). Wine from the untreated grapes had slightly higher alcohol, as would be expected from higher initial Brix (Table 2). There were not notable differences in final wine chemistry. Heat blast treatment did not diminish malic acid.

In a triangle test of control and heat blast treated wines, 10 out of 28 respondents were able to distinguish which wine was different, indicating the wines were not significantly different ($Z=0.0668$, $p= 0.49$). There were also no significant differences in scores for aromatic intensity, Sauvignon Blanc varietal character, freshness or bitterness.

Figure 1: Fruit metrics for two treatments of Sauvignon Blanc (in-house data)

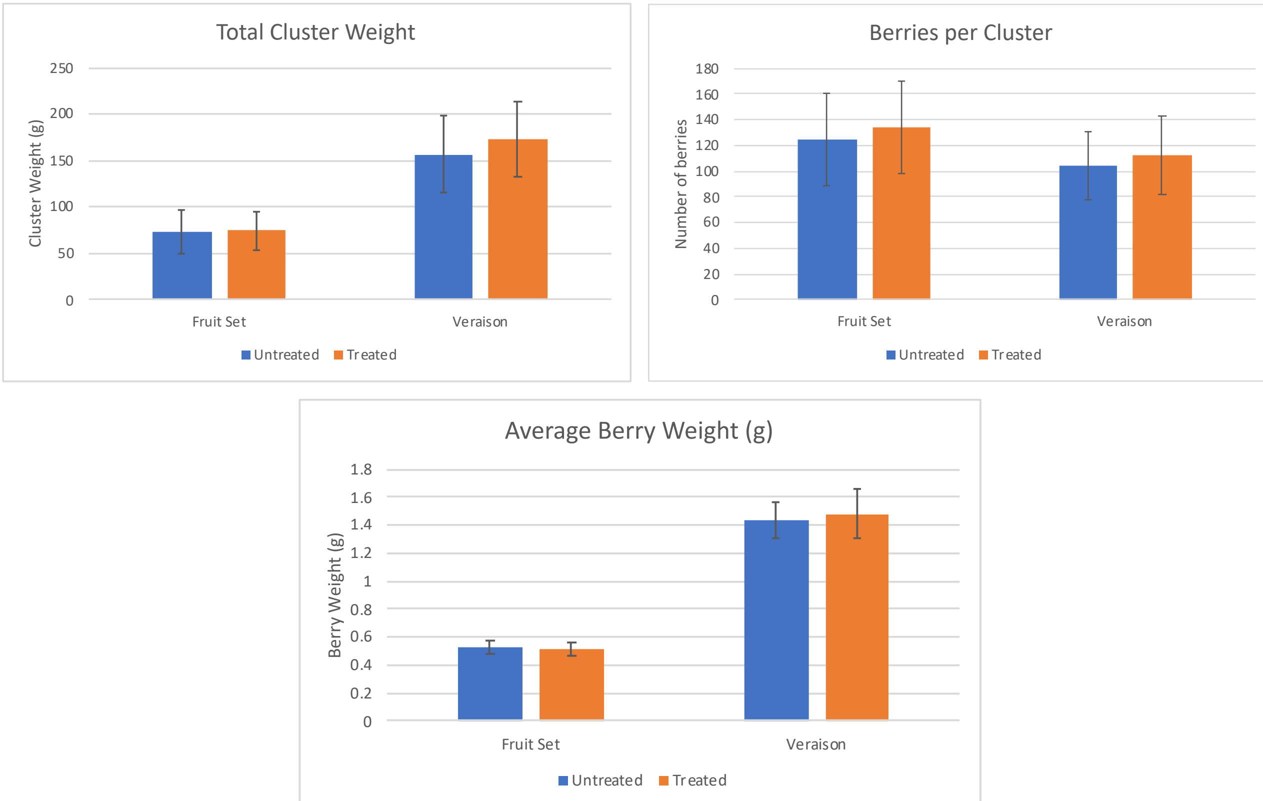

Table 1: Juice chemistry for two treatments of Sauvignon Blanc (in-house data)

	Brix	pH	TA (g/L)
Untreated	21.4	3.34	5.63
Treated	20.8	3.35	6.3

Figure 2: Fermentation kinetics for two treatments of Sauvignon Blanc (in-house data)

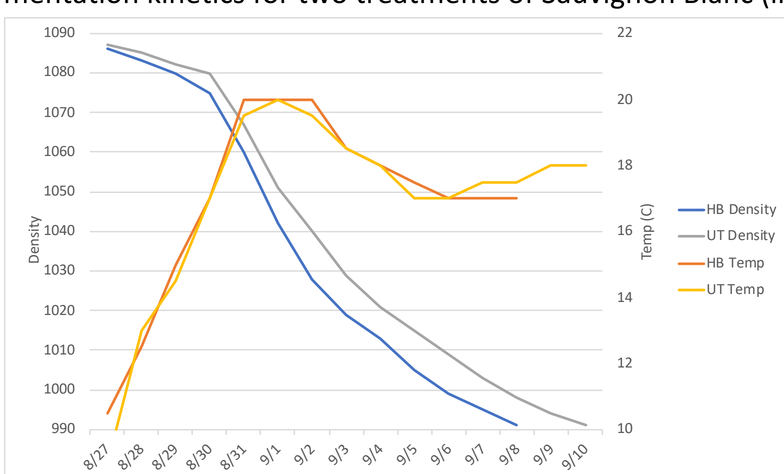

Table 2: Wine Chemistry for two treatments of Sauvignon Blanc (ICV Labs)

	Alcohol (%)	pH	TA (g/L)	Malic Acid (g/L)	VA (g/L)
Untreated	13.97	3.37	5.6	1.78	0.59
Treated	13.44	3.39	5.79	2.12	0.53

References

(1) Agrothermal Systems Case Studies. https://agrothermalsystems.com/case-studies/

(2) Gohil, H.; Moyer, M. Evaluation of Transient, in-Season Applied Heat to “Merlot” and “Syrah” Wine Grapes in Eastern Washington. *HortTechnology* 2014, *24* (6), 736 – 742.

(3) Reinth, M.; Torregrossa, L.; Luchaire, N.; Chatbanyong, R.; Lecourieux, D.; Kelly, M.; Romieu, C. Day and Night Heat Stress Trigger Different Trascriptomic Responses in Green and Ripening Grapevine (Vitis Vinifera) Fruit. *BMC Plant Biology* 2014, *14*.

(4) Carbonnel-Bejerano, P.; Santa Maria, E.; Torres-Perez, R.; Royo, C.; Lijavetzky, D.; Bravo, G.; Aguirreolea, J.; Sanchez-Diaz, M.; Antolin, M. C.; Martinez-Zaptar, J. M. Thermotolerance Responses in Ripening Berries of Vitis Vinifera L. Cv. Muscat Hamburg. *Plant and Cell Physiology* 2013, *54* (7), 1200–1216.

(5) Ting, J. The Impact of Repeated Years of Agrothermal Systems Heat Blast Treatments on Grape Ripening, Wine Chemistry, and Wine Quality in Petit Manseng (2018). *Winemakers Research Exchange*, 2019. http://www.winemakersresearchexchange.com