NGWB GRANT FINAL REPORT

Contract Number

18-13-216

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Issue of Interest

This study investigated the feasibility of eliminating/reducing chemical usage in disease control via the usage of ozone technology, thereby enhancing sustainability, reducing environmental carbon footprint, enhancing the positive image of the Nebraska industry and protecting the consumer. Ozone technology and engineering have reached levels which enable commercial application in vineyards to be researched. Therefore, the purpose of this project is to evaluate the efficacy of using ozone to reduce usage of pesticides to control disease on grape vines.

Approach to Problem

Sample: One cultivar (Vignoles) was selected for study. This cultivar was then divided into four groups: Control Group (no spray, N=60); Treatment Group 1 (normal chemical spray as per JAV usual spray program, N=60); Treatment Group 2 (Ozone spray applied at the same schedule as the normal chemical spray program at JAV, N=60); Treatment Group 3 (Ozone spray approximately every other chemical spray, i.e., approx.. in 20 day intervals, N=60). Sample groups were systematically selected by row blocks, i.e., three rows for each group with the Control Group in between the two Treatment Groups. This was done to minimize drift/overlap between Tx1, Tx2 and Tx3. Sample vines which were evaluated were selected from the two outside most rows, again to minimize any drift overlap. All vines were managed in a manner consistent with normal growing season care for commercial vineyards (i.e., pruning, canopy management, irrigation, etc.) prior to and during any treatment.

Procedures: Tx1 group was sprayed with chemical pesticide sprays in accordance with the vineyard's normal and customary practices (i.e., sprayed approximately every 10 days beginning in May; 25 gallons/acre rate of application using an air blast mist sprayer. Pesticides were alternated with no pesticide being used twice in a row. Normal spray schedules were adhered to.

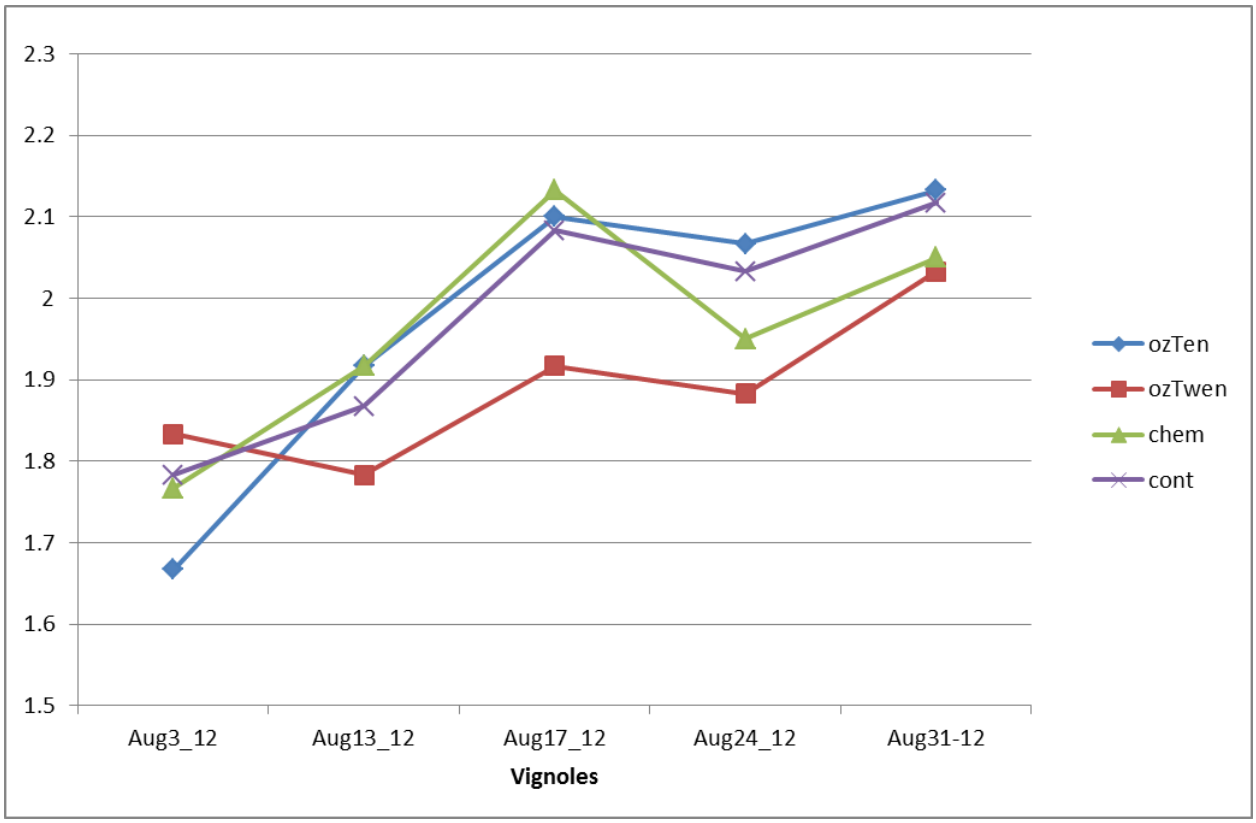
Ozone spraying was done in the exact same manner, but due to delay in equipment set up, ozone spraying did not begin until July, i.e., same day as pesticide spraying, same equipment and identical rate of application, and only the Vignoles cultivar was selected by the vineyard manager to be included in the study at that late date.

Vines were evaluated using a 5-point scale (1=no observable disease, 3= moderate disease pressure; 5= near lethal disease pressure). A research assistant (who remained blind to group assignment of vines) was trained to rate disease pressure. Vines were evaluated weekly and a total of five weeks of data are reported.

Goals/Achievement of Goals

Goal #1: To investigate the efficacy of ozone application to control disease in a commercial vineyard application, i.e., is there a difference in disease control among groups when comparing the Control Group to Tx1 to Tx2 to Tx3.

Results, Conclusions, Lessons Learned



Data points (Aug 13, 17, 24 and 31) on the graph represents statistically significant differences between ozone Twenty group and controls, and, between ozone Twenty group and pesticide group;, i.e., significantly less disease.

1) Tx3 (ozone Twenty) vines were consistently rated as having significantly less observable disease than Control (no treatment group).
2) Tx3 (ozone Twenty) vines were consistently rated as having significantly less observable disease than Tx1 (pesticide sprayed) vines.
3) Tx3 (ozone Twenty) vines were consistently rated as having significantly less observable disease than Tx2 (ozone Ten) vines.
4) No significant difference was found when comparing Tx2 (ozone Ten) to Controls, or Tx1 (pesticide sprayed) vines.

Summary

These results are inconsistent at best. No effect was found when spraying ozone at regular intervals (approximately every 10 days ,i.e., the same as pesticide application). This is inconsistent with findings in other ozone studies conducted at this same time (Mac's Creek). However, JAV does represent a micro-climate different than that in the central part of the state (i.e., Mac's Creek). Humidity levels and moisture tend to be much higher. Moreover, while data from these other studies do suggest ozone effectively controlling Downy Mildew, the primary disease pressure on the JAV Vignoles study was Black Rot. Perhaps this could explain why ozone application every twenty days was found to effectively control this disease. More study is definitely warranted to further investigate these questions.

Progress Achieved According to Outcome Measures

a) Move more closely to organic production: With the potential elimination or reduction of the use of chemicals in the production of the food product (grapes) the winery will move more closely to an "organic" method of production.

b) Safer raw product. The industry has done a good job of training/informing growers such that hopefully all products being used are labeled for usage with grapes and the application of the products are within safety and legal parameters. However, even with these safeguards in place, there is an ever-increasing concern with potential harmful impact on the raw product, environmental impact, and, potential public/consumer impact resulting from the continued and increasing usage of these practices. Considering the number of grape acres in Nebraska (Grape Board Survey, 2009) this concern will only continue to increase.

c) Flexibility for disease control at the time of harvest: Each of the pesticides used recommend "harvest intervals", i.e., the amount of time the grower must wait after application until the fruit can be safely harvested. When the disease pressure is heavy, this can result in diseased fruit being harvested, which can lower production and potentially even result in fruit that is rejected by the winery because of poor quality, or, diseased fruit is taken by the winery resulting in poor quality wine production. The other

possible outcome is that the fruit is sprayed and must be left hanging until the harvest interval has passed which again can result in poor fruit quality and poor wine quality (e.g., wait too long to harvest and the grape ph is too high/acidity too low, etc.). Using ozone could mean that spraying or disease control can be done immediately prior to harvest with no harvest interval being necessary.

d) Improved food product safety for the consumer could directly also significantly impact the marketing/sales of the Nebraska wine product.

e) Reduced exposure of workers to restricted use pesticides.

Benefits to the Ecology could be equally as positive and significant. These benefits could include:

a) Reduced build-up of disease resistance to chemicals. The build-up of disease resistance to currently used chemicals is a major problem today in production agriculture. Even with recommended alternating of the usage of different pesticides, resistance continues to build up including herbicides, fungicides, and insecticides. The use of ozone will not result in any such known build-up of resistance.

b) Reduced usage of toxic chemicals

c) Reduced negative environmental impact and chemical residual build up in soil and/or water supply.

d) Increased consumer safety. This study could result in improved food product safety for the consumer.

Therefore, major strides could be taken via this project to enhance sustainability of the viticulture industry all across Nebraska while also enhancing the Growers' stewardship of the environment

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Financial Report

Grant expenditures aligned with projected budget and were expended as follows:

Ozone Consultant	$2500
Research Assistant	1395
Statistical Analysis	1500
Research Consultant	500
Site Coordinator	500
Total:	$6395