NGWB GRANT FINAL REPORT

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ISSUE OF INTEREST

The Grape/Wine industry is burgeoning in the state of Nebraska. As such, viticulture practices must be scrutinized closely to assure the industry is sustainable while minimizing environmental impact. 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.

Potential Impact

Current viticulture practice within the state of Nebraska typically includes the usage of a variety of fungicides for the control of disease. The industry has done a good job of training/informing growers such that hopefully all products used have been 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 environmental impact, and, potential public/consumer impact resulting from the continued and increasing usage of these practices. With the number of grape acres in Nebraska (Grape Board Survey, 2009) this concern will only continue to increase.

Should it be determined that disease control could be realized with chemical free or chemically reduced processes (via the use of ozone technology) the impact could be huge and far reaching. The use of fungicides varies, from nearly non-existent (due to minimal disease pressure) in the western areas of Nebraska, to nearly weekly usage (due to heavy/constant disease pressure) in the eastern areas of our state. Thus, this study, likely will impact every grape grower in Nebraska.

Moreover, the potential cumulative environmental impact could be perhaps even more significant. As stewards of our environment, it is the responsibility of each grape grower to minimize /eliminate adverse effects on our environment and to aspire to move our industry toward sustainability with reduced carbon footprints.

Lastly, the impact upon the consumer could be two-fold. First, when used as prescribed by the label, the products currently being used should be considered safe to the consumer. Reduction or elimination of the usage of these chemicals could only move in the direction of increased safety to the consumer. Second, while actual safety should be of paramount importance to our industry, so too should the increased "image of safety" of our industry in the eyes of our consumers. This impact of positive "image" can be seen with the increase in interest in organic grape growing in other parts of the U.S.

Project Purpose

This study investigated the feasibility of eliminating/reducing chemical usage in disease control via the usage of ozone technology, thereby enhancing sustainability and enhancing the positive image of the Nebraska industry as well as protecting the consumer. Ozone technology and engineering have reached levels which enable commercial application in vineyards to be researched. This is a continuation study fro the previous year. Preliminary data show inconsistent results depending upon cultivar and microclimate. Therefore, the purpose of this project is to continue this investigation and evaluate the efficacy of using ozone to reduce usage of pesticides to control disease on grape vines.

APPROACH TO THE PROBLEM

Sample: Two cultivars were initially selected for study, those being Edelweiss and Brianna. However, catastrophic herbicide drift was encountered in this vineyard and the health of the Edelweiss was such that they were not able to be used in the research. Therefore, Marechal Foch were used in their place. Three groups of vines were identified within each of the two cultivars; Control Group (no treatment); Treatment Group #1 (Tx1) (received chemical/pesticide spray); and Treatment Group #2 (Tx2) (received ozone spray). Sample groups were systematically selected by row blocks. These data were collected in the 2013 growing season.

Procedures: Tx1 groups were 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 a highly similar manner i.e., within two days of when the pesticide spraying was done and approximate same rate of application.

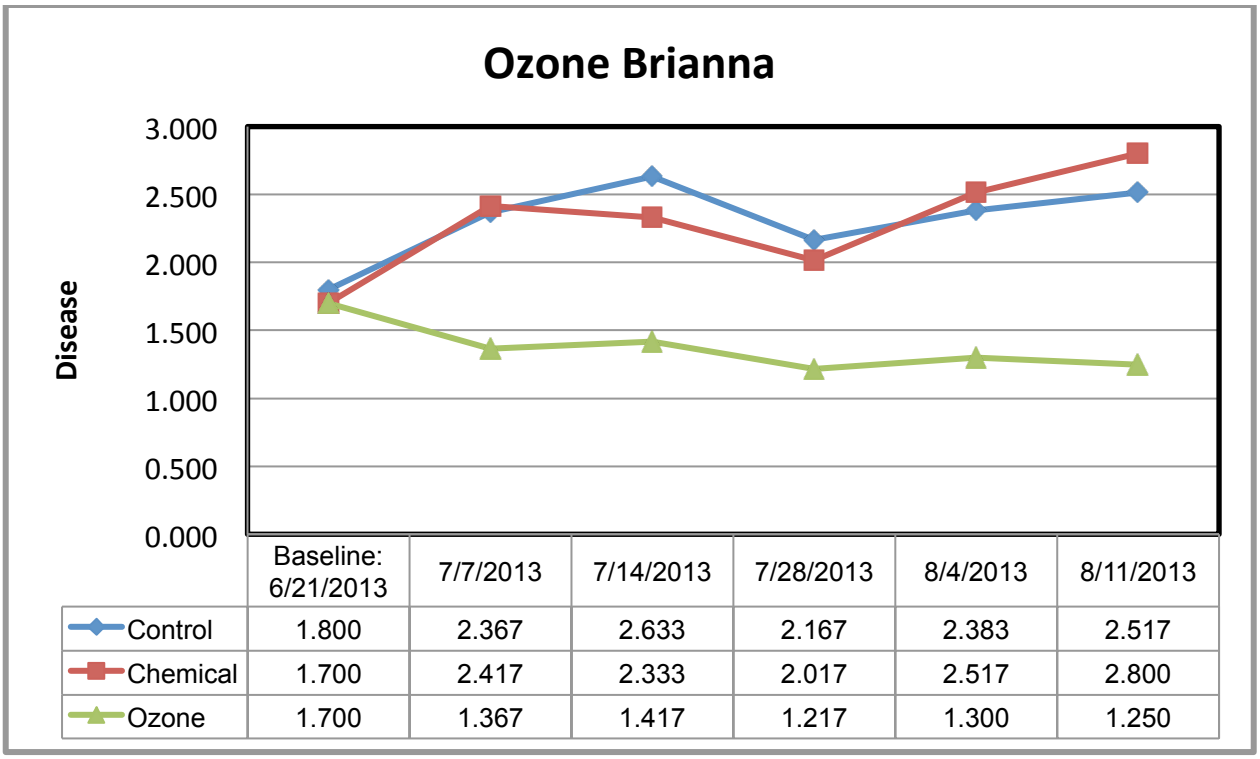
Vines were evaluated using a 5-point scale (1=no observable disease, 3= moderate disease pressure; 5= near lethal disease pressure). Approximately 10% of the vines were randomly selected for independent evaluation by the research consultant for reliability checks. Adequate inter-rater agreement was maintained r>.90. Vines were evaluated weekly and a total of six weeks of data are reported.

GOALS/ACHIEVEMENT OF GOALS

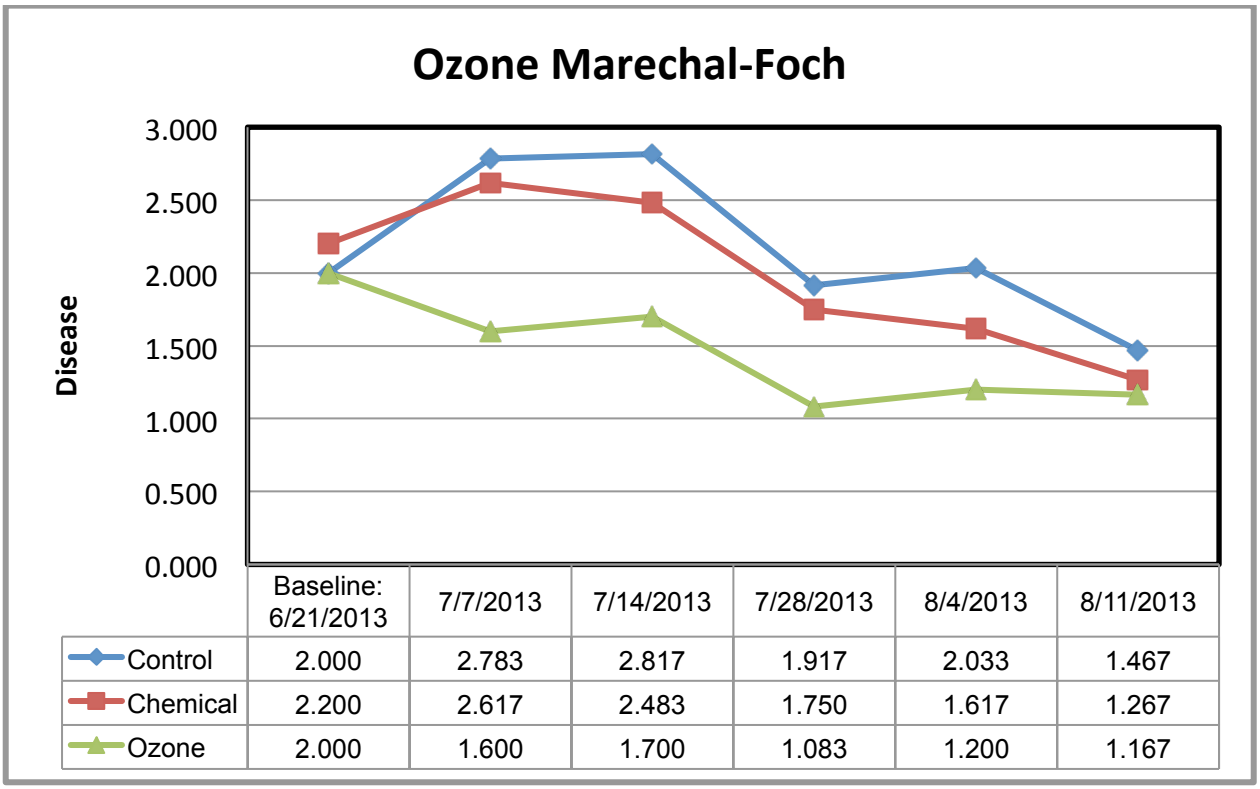
Goal #1: To investigate the efficacy of ozone application to control disease in a commercial vineyard application.

RESULTS, CONCLUSIONS, LESSONS LEARNED

Average ratings on all vines within each of the three groups (Control, Tx1,Tx2) for each of the two cultivars (Brianna and Marechal Foch) were analyzed (ANOVA3-1R) and compared weekly (see graphs below).



	Baseline: 6/21/2013	7/7/2013	7/14/2013	7/28/2013	8/4/2013	8/11/2013
Control	1.800	2.367	2.633	2.167	2.383	2.517
Chemical	1.700	2.417	2.333	2.017	2.517	2.800
Ozone	1.700	1.367	1.417	1.217	1.300	1.250



	Baseline: 6/21/2013	7/7/2013	7/14/2013	7/28/2013	8/4/2013	8/11/2013
Control	2.000	2.783	2.817	1.917	2.033	1.467
Chemical	2.200	2.617	2.483	1.750	1.617	1.267
Ozone	2.000	1.600	1.700	1.083	1.200	1.167

1) Tx2 (ozone) vines were consistently rated as having significantly less observable disease than Control (no treatment group).

2) Tx2 (ozone) vines were consistently rated as having significantly less observable disease than Tx1 (pesticide sprayed) vines.

3) No differences in ratings were found between Control (no treatment groups) and Tx1 (pesticide sprayed) vines.

PROGRESS ACHIEVED ACCORDING TO OUTCOME MEASURSE

These data should continue to be considered as preliminary at best. That said, these results are extremely encouraging. Ozone treatment consistently, i.e., in each of the six weeks rated , document significantly less disease pressure than do the untreated controls and, the vines sprayed with pesticides. Even during the time span of the most observable disease pressure (July) as observed with both the Controls and Tx1 (pesticide treated) vines, the ozone treated vines continued to exhibit minimal presence of disease ranging from no disease to very low disease pressure. These data are again consistent with previous two years' research in showing positive effects on disease control (primarily downy mildew).

An additional and somewhat alarming finding suggests that across the rating periods, pesticides show little if any effect as measured by rater's observation of disease pressure, i.e., disease pressure being rated at levels equal to the Control group which received no treatment at all.

While the cumulative results across three years are profound, additional research is necessary to replicate these findings across multiple years (i.e., differing weather conditions from summer to summer), multiple vineyard sites (and thus microclimates throughout Nebraska), and across multiple cultivars. Moreover, while the methodology in this study controlled for variability of application of pesticides and ozone (i.e., comparable volume applied per acre, spraying at exact same time /days and intervals), research is needed to investigate varying volumes of application and intervals to incur equal disease control.

These results are also significant in terms of potential impact on the grape wine industry. Benefits could be wide ranging and include the following:

Benefits to Nebraska Vineyards and Wineries

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.

FINANCIAL REPORT

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

Equipment Rental = $4000

Consultation & Project Coordination =$500

Data Collection & Entry = $900

Data Analyst = $500

Site Coordination/Manager = $500