NGWB GRANT FINAL REPORT

CONTRACT#: #18-13-060 (year 5)

CONTACT INFORMATION

Mac's Creek Winery
Seth McFarland
43315 Rd 757
Lexington, NE 68850
(308) 324-0440
seth@macscreekvineyards.com

ISSUE OF INTEREST

Finding techniques that can be effective on our cultivars in Nebraska could make the difference between devastating damage, which negates any profitability and a consistent, quality wine and grape industry. Nebraska winters can be harsh, even brutal, and are certainly damaging to grapevines. This damage can result from several reasons, which are noted below:

- Ambient temperatures can be among the coldest in the country. While average winter temperatures are above zero degrees Fahrenheit (F), ambient temperatures can consistently fall into the sub-zero range. It is not unusual for temperatures in our vineyard to plummet to the -10°F to -25°F range for one night to one week. Obviously, damage to grapevines can occur at these temperatures; however, if growers carefully select appropriate cultivars for these temperatures, damage can be minimized or avoided (e.g., Frontenac, Lacrosse, Brianna, etc.). Thus, ambient temperatures do not have to be a serious problem for Nebraska vineyards.
- Volatile temperatures frequently cause, heretofore, unavoidable damage. While many appreciate the January or March early thaw, it is the last thing grape growers wish to see for our vines. An early thaw can lead to an early break of dormancy and an early push of buds, which are only to be followed by deadly plunges in temperatures. The winter of 2004 was no exception. The winter saw 50 – 60°F for two weeks in late March, followed by 19°F in mid-April. Damage to primary buds during this period was extensive.

- Late frosts/freezes are a way of life in central Nebraska and they annually take their toll on row crops, such as corn and grape crops. Such frosts are expected in early and even mid-May. However, the late-May freeze, which occurred during the third week of the month, and its extent at 22°F, was devastating. This event resulted in grape crop loss in our vineyard at over 95 percent loss with primary, secondary, and tertiary bud loss, as well as approximately ten-percent loss of plants.

Thus, the problem is not one of a lack of cultivars that can withstand winter temperatures in Nebraska. The problem is one of minimizing winter damage from extensive temperature swings, which can result in an early dormancy break and early bud break, which can be accompanied by a late frost or freeze. Therefore, the purpose of this multi-year research is to evaluate techniques designed to enhance grapevine cold hardiness, specifically, effects of late winter spraying of dormant vines with products designed to delay bud break from two to four weeks.

The efficacy of spraying Amigo Oil (a vegetable oil surfactant) onto dormant grape vines in order to delay bud break has been proven repeatedly. In previous research conducted by this researcher at Mac's Creek Winery & Vineyards (2008 – 2011) data have documented that depending upon the year, and the specific cultivar, bud break has been delayed anywhere from five days to three weeks. However, minimal research, with inconclusive and equivocal results, has attempted to evaluate the number of applications necessary to maximize these results. Therefore, this project investigated the effects of single versus multiple applications of the Amigo Oil to grape vines. The results from this study could make it possible for grape growers to significantly increase profitability without having to increase the number of acres planted. Specific research questions addressed during this project include:

a. Is there a difference in the extent of bud delay when comparing single versus multiple applications in a commercial vineyard application?

b. Is there a difference in the degree of bud delay related to the number of applications?

Approach to Problem

This is the fifth year of a continuing research project.

Each of three cultivars (Marechal Foch, Brianna, and Edelweiss) were divided into four groups by row which consisted of at least 30 vines in each group: Control group (no Amigo Oil was applied), Treatment #1 (single application); Treatment #2 (three applications);

Note: a) Due to exceptionally warm spring, bud swell prevented researchers from applying 5th Amigo Oil treatments to Treatment #3.
b) Due to early hail storm, data from only Marechal Foch was able to be recorded with accuracy.

Instrumentation

A Bud Rating Form (developed by the researcher and used in the four years of previous study) was used to rate the extent of bud development. Buds were rated by a research assistant on a scale of 1 – 5 (1 = no bud swell; 5 = bud break, one leaf unfurled).

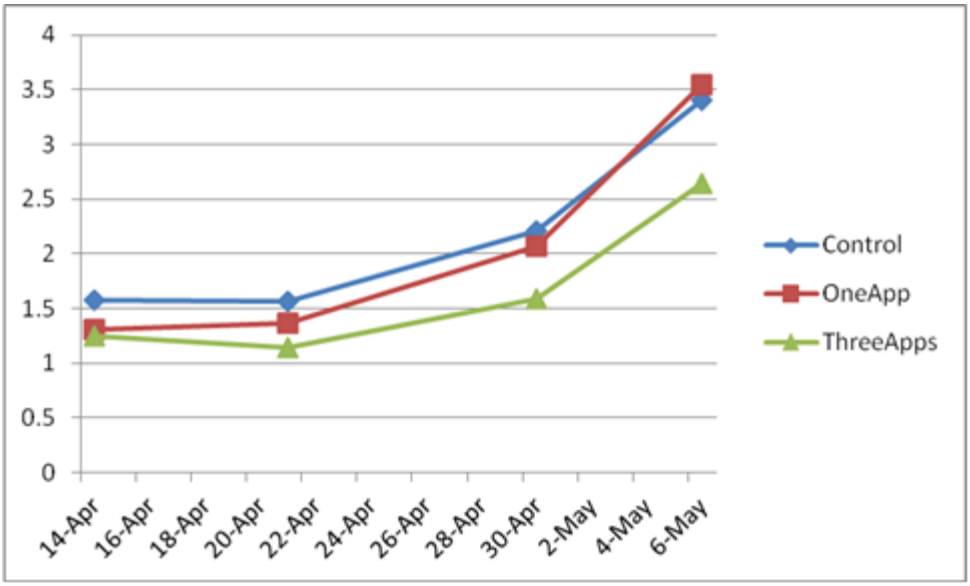
Procedure
The research assistant identified each of the four sample groups. The first Amigo Oil application was applied approximately mid to late February and subsequent applications were made approximately every two weeks until bud swell began. When bud swell began (approximately early/mid- April), the research assistant rated buds every week until all most all buds were rated at "5" (approximately four to five weeks) , or, until hail removed opening buds.

Goals/Achievement of Goals

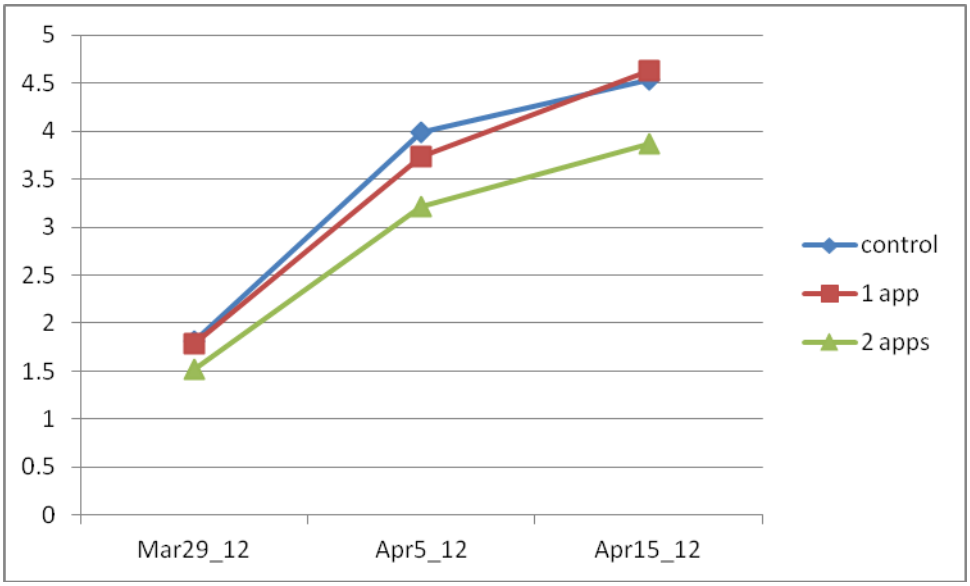
a. Is there a difference in the extent of bud delay when comparing single versus multiple applications in a commercial vineyard application? No significant effect was found for a single application when compared to controls.

b. Is there a difference in the degree of bud delay related to the number of applications? Yes, while no effect was found for a single application, significant effect was found for two applications and three applications when compared to controls.

Results, Conclusions, Lessons Learned



(Approximate 6-8 day delay)



(Approximate 10-12 day delay)

No significant bud delay was observed with a single application of Amigo Oil during these trial. However, significant delay ranging from 6-8 days to 10-12 days was observed with two or three applications. These findings are significant in that prior to this study, it was assumed that "the more applications the better" when it come to bud delay. These preliminary results, however, suggest that perhaps equal positive benefit may result from many fewer applications.

Progress Achieved According to Outcome Measures

The efficacy of spraying Amigo Oil (a vegetable oil surfactant) onto dormant grape vines in order to delay bud break has been proven repeatedly. In previous research conducted by this researcher at Mac's Creek Winery & Vineyards (2008 – 2011) data have documented that depending upon the year, and the specific cultivar, bud break has been delayed anywhere from five days to three weeks. Delays of this magnitude can mean the difference between harvesting a full crop on primary buds or reduced or even no crop at all. It is hypothesized that perhaps one factor that may account for the variability of amount of delay from year to year in addition to the weather, may be the number of applications of Amigo Oil that are applied to the vines. For example, in one given year, five applications were made while during another year (due to weather constraints) only three applications were possible. A review of the literature has found no studies that have systematically investigated this question.

These results suggest positive effect with fewer applications. This could result in significant cost savings (see Year 4 report) when considering the cost of the Amigo Oil, time, labor , application costs, etc. Thus, significant increase in productivity/quality (i.e.,

harvesting on primary buds instead of secondary or tertiary), increase sustainability of the industry state-wide, without having to increase acreage.

As previous research has shown (McFarland, 2008, 2009, 2010, 2011) treatment of dormant vines with Amigo Oil has resulted in bud delays ranging from five days to three weeks. The impact of these delays to Nebraska grape growers is huge, i.e., the difference between a partial crop/no crop and full crop on primary buds. At 3 tons/acre, a 25% decrease in crop due to a frost event (such as occurred in 2010) results in a loss of approximately 1500 lbs/acre or a $900 loss/acre. Avoiding that late frost damage equates to a $900/acre savings less the cost (4 gal/acre X 4 applications=16 gal/acre @ $17/gal = $272/acre plus 8 hours labor and machine costs @ $20 = $160 equals a grand total of $432/acre cost. Thus, this nets $468/acre savings X 7 acres at Mac's Creek, which results in a savings of $3276 in one year. These figures estimate a 25% loss scenario, with a 50% loss scenario the net savings doubles, or, $6552/year.

This study potentially could have an equally huge impact. Commercial application of Amigo Oil has been determined (McFarland, 2011) to cost approximately $80-$85/acre/application. Thus, four applications = $330/acre vs one application = $83/acre. Multiplied across Mac's Creek's seven acre vineyard = $580 cost/application (single) vs $2310 cost/four applications. This nets {using $900/acre savings by avoiding a 25% loss (see above); $900 - $83 = $817/acre savings vs $900 - $330 = $570/acre savings} across seven acres = $5719 savings (single application) vs $3990 savings (four applications), or a net difference in profitability of $1729 per year. If a grower could obtain equally positive effects (sustainably) with one to three fewer applications (see above estimated costs from Year 4 study), a significant increase in profitability could be incurred.

Moreover, these results were presented at the VitiNord Conference (International Cold Climate Conference) in Germany. German researchers are also investigating the questions of single vs multiple applications of vegetable oil. Their findings (reported at the conference) suggested that a single application did result in significant effect of bud delay. The ensuing discussion resulted in the discovery that perhaps the timing of this single application is predictive. In this Nebraska trial, the single application occurred in early March. In the German trials, the single application occurred in late March. Further research is needed to further investigate these hypotheses.

Financial Report

This project was funded in the amount of $5500. These funds were spent as follows: Supplies = 2325; Equipment Leasing = 1000; Labor = 375; Research Assistant = 800; Research Consultant = 1000.