NGWB GRANT FINAL REPORT

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ISSUE OF INTEREST

The efficacy of spraying dormant vines with Amigo Oil in order to delay bud break and thus avoid considerable damage due to frost/freeze events has been proven repeatedly (McFarland, 2008, 2009, 2010, 2011). However, minimal research with inconclusive and equivocal results has attempted to evaluate the number of applications necessary to maximize these efficacious results. Year 1 Pilot study (McFarland & McFarland, 2012) results indicate that a 14-day delay can be attained with two applications while no significant delay resulted from a single application. While these results are valid, with the unusual weather conditions of the winter/spring 2012, it is impossible to yet determine whether these results can be replicated and expected in more "normal" years. This project will investigate the effects of single application vs multiple applications. Results of this study potentially could have significant impact upon the profitability of the entire grape growing industry in the state of Nebraska. Based upon 350+ acres of grapes planted in Nebraska, the difference between single vs three applications of Amigo Oil could result in an increase in profitability of nearly $100,000 per year for the grape growers. Thus, these results could make it possible for grape growers to significantly increase profitability without having to increase acres planted.

APPROACH TO THE PROBLEM

This is a continuation study from the previous year. Preliminary (2013) data suggest significant delay, even with one application but it seems to depend on the timing of the single application (early March vs early April). Moreover, research results provided by our research partner from the Bavarian region of southern Germany indicate significant delay in bud break from single late application as well.

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.

Mac's Creek has just completed a Year 1 Pilot Study which investigated this issue. Preliminary results suggest that one application resulted in no significant bud delay. Due to the weather constraints, only two

applications were possible. However, two applications resulted in significant bud delay when compared to Controls (no treatment), and significant bud delay when compared to the one application group. This delay was found to be an approximate 14-day delay. Moreover, anecdotal findings (non-research based) reported from a single application of Amigo Oil in Minnesota in the spring of 2012 suggested significant delay in bud break on that site. Given the profound significance of these findings combined with the extremely unusual winter/spring weather (resulting in one of the cultivars budding out a full month earlier than ever recorded at this site), it is recommended that this study be replicated for at least a second year in order to determine whether such results can be replicated across differing winters/springs in central Nebraska.

Project design and methodology is as follows:

Sample

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

Instrumentation

A Bud Rating Form (developed by the researcher and used in the five 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). Reliability checks were conducted with a second rater to assure inter-rater reliability was maintained at r>.90.

Procedure

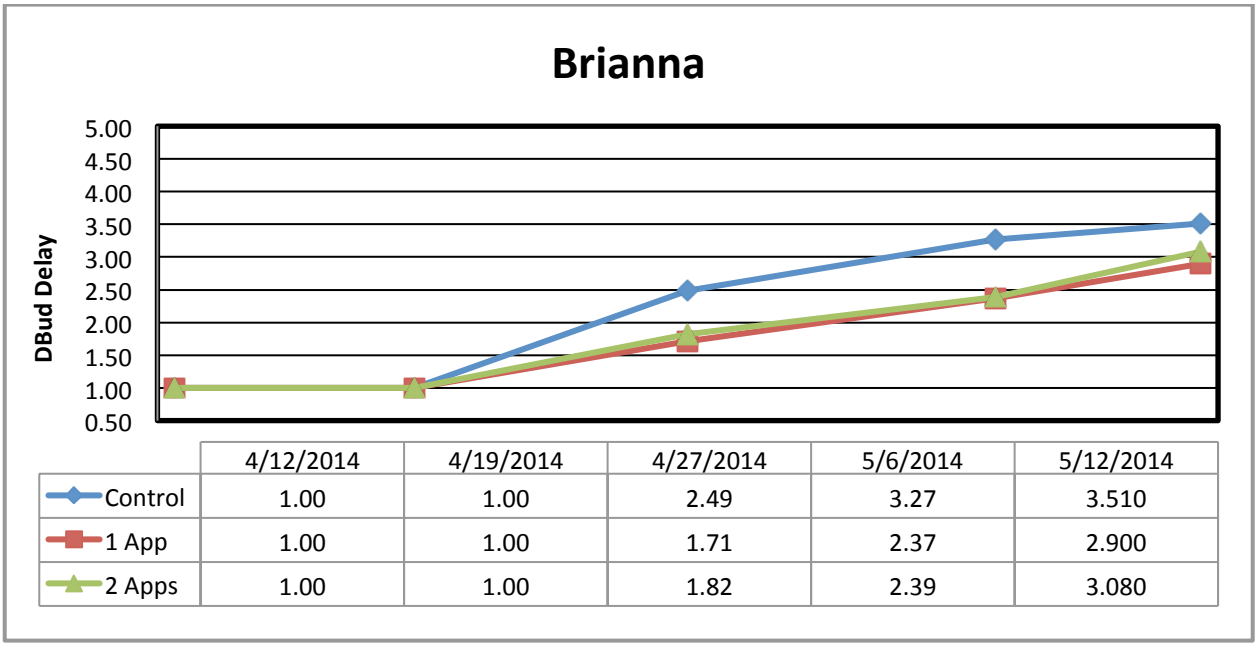
The research assistant identified each of the three sample groups. The first Amigo Oil application was applied March 14, 2014 and the second application was made April 4, 2014 . Once bud swell began (approximately late April), the research assistant rated buds every week until most all buds were rated at “5” (approximately four weeks).

GOALS/ACHIEVEMENT OF GOALS

1. Is there a difference in the extent of bud delay when comparing single application vs multiple applications within each of the five cultivars investigated (i.e. Marechal Foch, Brianna, Edelweiss, Frontenac and deChaunac).

RESULTS, CONCLUSIONS, LESSONS LEARNED

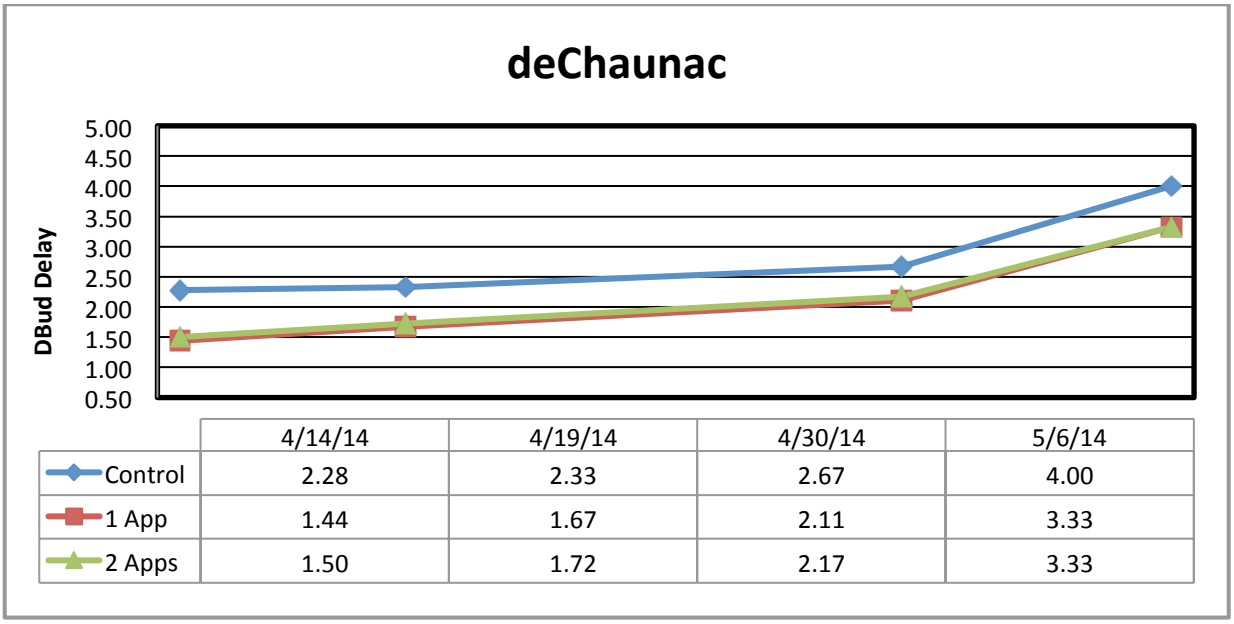
Brianna: Mean bud development for the data recording dates for Brianna are plotted (see Figure 1). As shown in Figure 1, extrapolated mean bud development for the Amigo Oil group (single application) reaches bud break on May 19 (*M* = 4.0) whereas the mean development for the Control Group reached bud break on May 12 (*M* = 4.0). Thus, it can be determined that bud development has been delayed by at least 7 days. There is no difference in delay when comparing single vs two applications.



	4/12/2014	4/19/2014	4/27/2014	5/6/2014	5/12/2014
Control	1.00	1.00	2.49	3.27	3.510
1 App	1.00	1.00	1.71	2.37	2.900
2 Apps	1.00	1.00	1.82	2.39	3.080

Figure 1. Mean bud development for Brianna grapevines.

deChaunac: Mean bud development for the data recording dates for deChaunac are plotted (see Figure 2). As shown in Figure 2, extrapolated mean bud development for the Amigo Oil group (single application) reaches bud break on May 13 (*M* = 4.0) whereas the mean development for the Control Group reached bud break on May 6 (*M* = 4.0). Thus, it can be determined that bud development has been delayed by at least 7 days. There is no difference in delay when comparing single vs two applications.

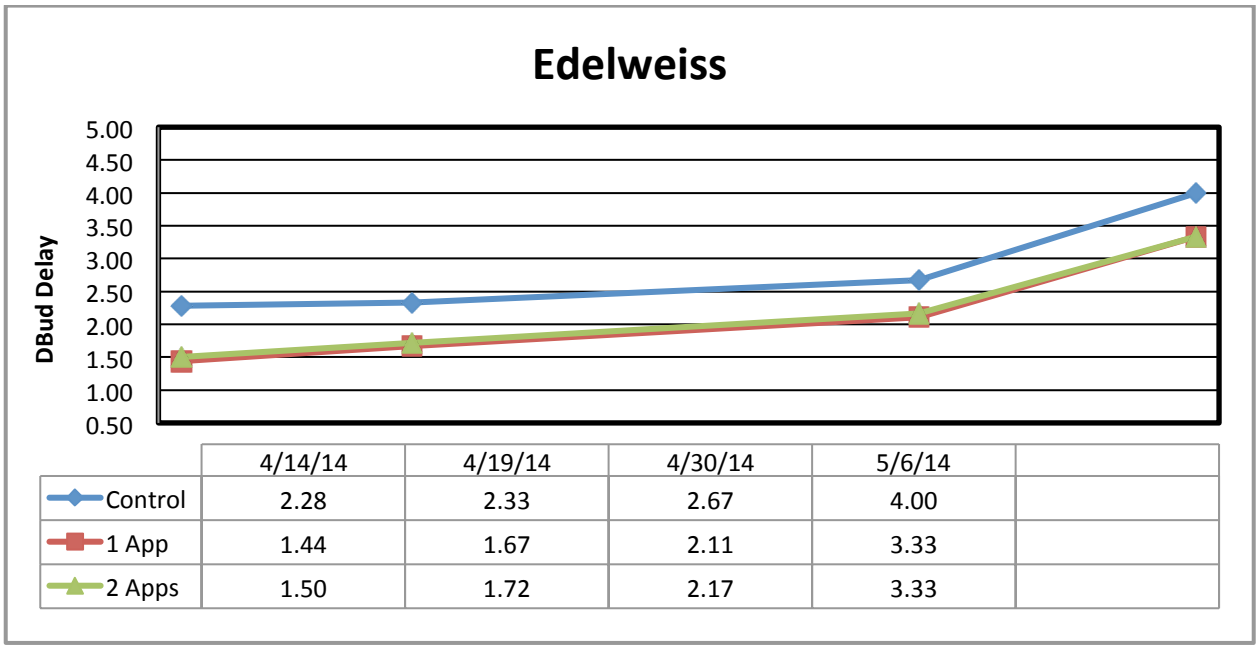


	4/14/14	4/19/14	4/30/14	5/6/14
Control	2.28	2.33	2.67	4.00
1 App	1.44	1.67	2.11	3.33
2 Apps	1.50	1.72	2.17	3.33

Figure 2. Mean bud development for deChaunac grapevines.

Edelweiss: Mean bud development for the data recording dates for Edelweiss are plotted (see Figure 3). As shown in Figure 3, extrapolated mean bud development for the Amigo Oil group (single application)

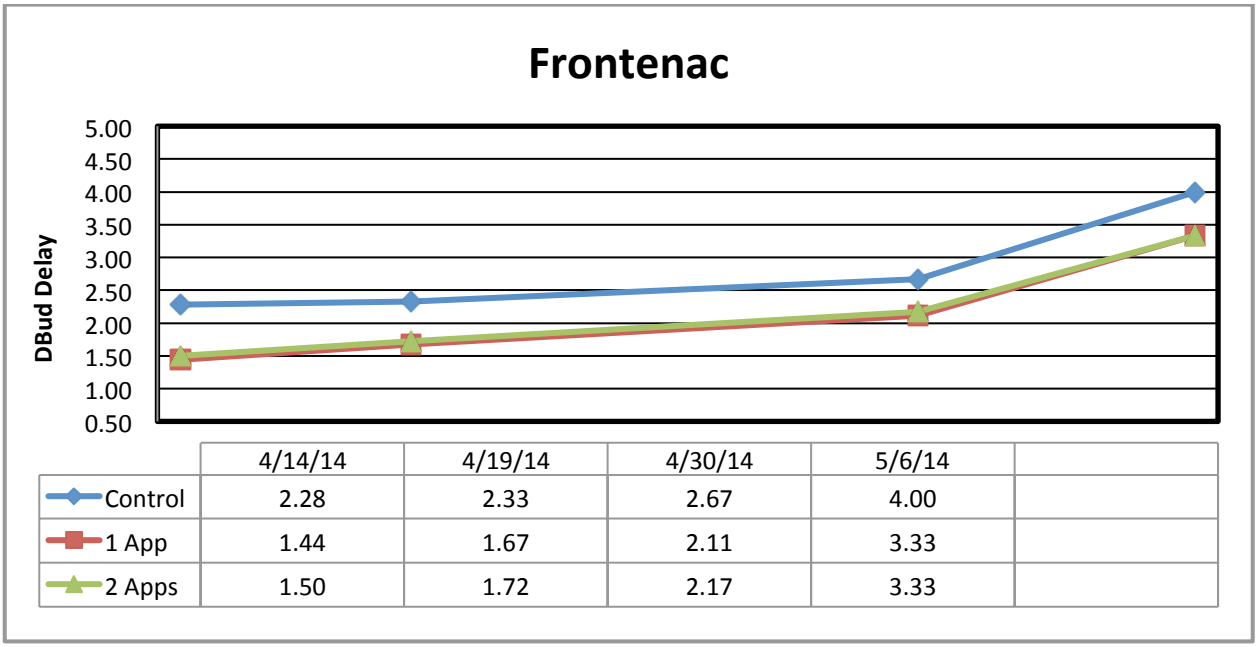
reaches bud break on May 13 (*M* = 4.0) whereas the mean development for the Control Group reached bud break on May 6 (*M* = 4.0). Thus, it can be determined that bud development has been delayed by at least 7 days. There is no difference in delay when comparing single vs two applications.



	4/14/14	4/19/14	4/30/14	5/6/14	
Control	2.28	2.33	2.67	4.00	
1 App	1.44	1.67	2.11	3.33	
2 Apps	1.50	1.72	2.17	3.33	

Figure 3. Mean bud development for Edelweiss grapevines.

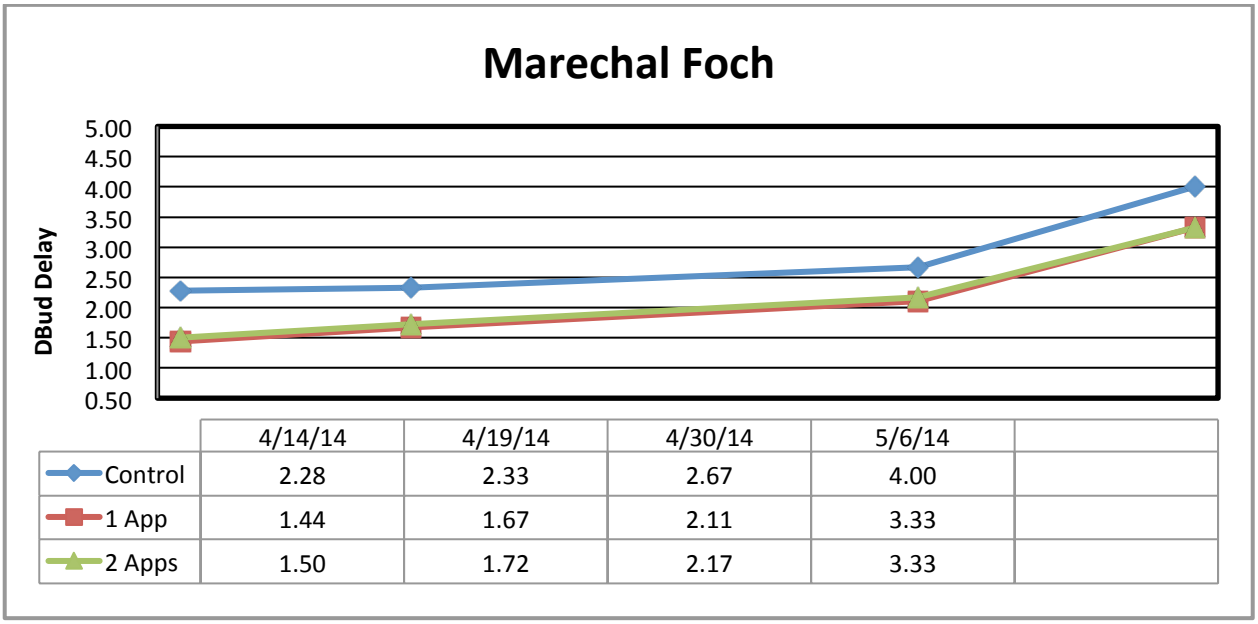
Frontenac: Mean bud development for the data recording dates for Frontenac are plotted (see Figure 4). As shown in Figure 4, extrapolated mean bud development for the Amigo Oil group (single application) reaches bud break on May 20 (*M* = 4.0) whereas the mean development for the Control Group reached bud break on May 13 (*M* = 4.0). Thus, it can be determined that bud development has been delayed by at least 7 days. There is no difference in delay when comparing single vs two applications.



	4/14/14	4/19/14	4/30/14	5/6/14	
Control	2.28	2.33	2.67	4.00	
1 App	1.44	1.67	2.11	3.33	
2 Apps	1.50	1.72	2.17	3.33	

Figure 4. Mean bud development for Frontenac grapevines.

Marechal Foch: Mean bud development for the data recording dates for Marechal Foch are plotted (see Figure 5). As shown in Figure 5, extrapolated mean bud development for the Amigo Oil group (single application) reaches bud break on May 13 (*M* = 4.0) whereas the mean development for the Control Group reached bud break on May 6 (*M* = 4.0). Thus, it can be determined that bud development has been delayed by at least 7 days. There is no difference in delay when comparing single vs two applications.



	4/14/14	4/19/14	4/30/14	5/6/14	
Control	2.28	2.33	2.67	4.00	
1 App	1.44	1.67	2.11	3.33	
2 Apps	1.50	1.72	2.17	3.33	

Figure 5. Mean bud development for Marechal Foch grapevines.

PROGRESS ACHIEVED ACCORDING TO OUTCOME MEASURES

It can be seen across the past six years of study that the efficacy of applying Amigo Oil to dormant plants is significant and unequivocal. Each year studied yielded significant delay when compared to controls. Moreover, these results are quite impressive considering that the delays are documented across multiple winters/springs in Nebraska (no two of which are the same). These winters/springs range from mild to bitterly cold, early spring thaw to no early spring thaw, to extremely early spring thaw resulting in bud break occurring 30 days earlier than ever recorded in this vineyard.

Perhaps even more interesting is the extent of delay ranges, i.e., delays ranging from 4 days (Marechal Foch) to 21 days (Marechal Foch and St. Croix). Thus, depending on the year and the specific cultivar, delays of one to three weeks are quite common.

The most recent two studies have now documented that two applications are equally as effective as four to five applications (McFarland & McFarland, 2011-2012) and, now with this study, that one application is equally as effective as two applications. This could result in not only an increase in yield and economic benefit (as documented in McFarland & McFarland, 2011-2012), but doing so at half of the cost (or less) of Amigo Oil application. Moreover, these results are consistent with the results of similar research being conducted in the Bavarian region of Germany, i.e., that a single application, depending on timing, can be as effective as multiple applications (i.e., 2-5 applications).

The above benefits have described only the monetary benefits based on yield production. . With more cultivars producing on primary buds, additional benefits can be realized, including uniformity of ripening of fruit and most certainly enhanced quality of fruit. Additional intangible loss from frost damage i.e., consistency of crop quality (i.e., ripeness, maturity of vines, length of growing season being hampered by late bud break of tertiary buds) is even more profoundly felt by the winemaker trying to produce quality wine from questionable grapes.

Further, countless additional vineyard management hours are incurred in retraining new shoots, trellis positioning, weed control, etc., as many of these plants come back from the roots after 100% bud kill on the trellis. Finding techniques that can be effective on our cultivars and in our part of the country could make the difference between devastating damage which negates any profitability and, a consistent, quality, profitable wine/grape industry which is sustainable.

FINANCIAL REPORT

Grant expenditures aligned with projected budget and were expended as follows:
Supplies = $2000
Equipment Leasing = $1000
Labor = $300
Research Consultant = $800
Data Analyst = $500
Site Coordinator = $500