NGWB GRANT FINAL REPORT
Contract #: 18-13-060

CONTACT INFORMATION

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

ISSUE OF INTEREST

Volatile temperatures frequently cause unavoidable damage. While we appreciate the January or March "early thaw," it is the last thing viticulturists want to see for the vines (i.e., early break of dormancy and early push of buds only to be followed by deadly plunges in temperatures). The winter of 2004 was no exception (e.g., 50°F to 60°F temperatures for two weeks in late March followed by 19°F temperatures in mid- May). Damage to primary buds was extensive.

Late frosts or freezes are a way of life in central Nebraska, and they annually take their toll on row crops (e.g., corn) and now, grape crops. Such frosts are expected in early and even mid-May. However, the late-May freeze (third week) and extent of the freeze [19°F] were devastating. Grape crop loss was documented at approximately 95% with primary, secondary, and tertiary bud loss, as well as an approximate 10% loss of plants (McFarland, Personal Communication).

Thus, the problem is not one of a lack of cultivars that can withstand Nebraska winter temperatures; the problem is one of minimizing winter damage from extensive temperature swings resulting in an early dormancy break and early bud break accompanied by a late frost or freeze. Therefore, the purpose of this study is to evaluate treatment techniques designed to enhance grapevines cold hardiness, specifically, and the effects of late winter spraying of dormant vines with products designed to delay bud break from one to two weeks.

This is the third year of a continuing research project which is investigating the effectiveness of multiple applications of Amigo Oil at three vineyard sites representing three very different microclimates. Also, unlike the previous two years, this year's project expanded the application of this treatment to an additional cultivar heretofore not investigated, that being the Edelweiss cultivar.

As such, the goals of this year's project are to:

1. Replicate second year investigation results using air blast sprayer application techniques.
2. Expand the investigation of the effectiveness of the treatment when applied to vineyards located in the eastern (Eric Nelson near Lincoln) and west/central (Kim Rhone near Cozad) regions of the state, each representing different microclimates.
3. Expand the application of the treatment to the Edelweiss vines to determine its impact on this cultivar.

APPROACH TO THE PROBLEM

Three groups of vines were identified within each of three cultivars (Marechal Foch, Brianna and Edelweiss) at Mac's Creek Vineyards near Lexington and Rhone Reno Ridge Vineyard near Cozad and two cultivars (Lacrosse and Edelweiss) at the Eric Nelson vineyard near Lincoln. They included a Control Group (no treatment), Treatment 1 (sprayed with Amigo Oil via air blast sprayer) and Treatment 2 (sprayed with Amigo Oil via a backpack sprayer). Treatment groups were sprayed with Amigo Oil beginning in March with continued spraying approximately every two weeks with four total applications.

Bud development was evaluated weekly using a 5-point scale (1= no bud swell; 5=bud break with one leaf completely unfurled). All raters at all sites were trained to a level of r>.80 inter-rater agreement.

GOALS/ACHIEVEMENT OF GOALS

Benefits to Nebraska viticulture could be quite significant. Using the example of one small vineyard (McFarland, 2004) with 2,000 vines, suffering a 95% loss, (estimated crop loss of approximately 10-12 tons) the one year crop income loss was estimated at $10,000 - $12,000, given the average grape price for that year. Perhaps even more important is the longer term loss, as 50% to 75% of these vines continued to under-produce for at least one additional year with an estimated loss of $5,000 - $8,000. Finally, the loss of 10% of the vines resulted in a three- to four-year loss (i.e., 200 vines @ 20lbs./vine = 2 tons over 4 years = 8 tons/$8,000). Thus, total crop loss translates to $23,000 - $28,000.

Additional intangible loss, such as consistency of crop quality (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.

Furthermore, countless additional vineyard management hours are incurred in retraining new shoots, trellis positioning, weed control, and other tasks, as many of these plants come back from the roots after 100% bud kill on the trellis. Finding techniques that can be effective on cold hardy cultivars in the Midwest could make the difference between devastating damage, which negates any profitability, not to mention a sustainable, quality wine and grape industry.

RESULTS, CONCLUSIONS, LESSONS LEARNED

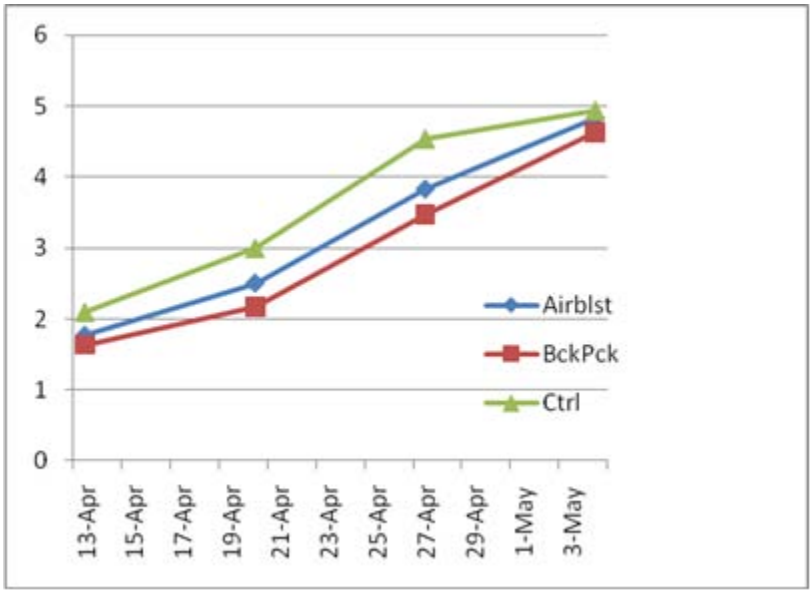
Delayed Bud Break Counts

Is there a difference in delayed bud break counts when comparing groups (C, Tx1, and Tx2)? To address this question, the sets of data were analyzed using a two-way analysis of variance with repeated measures on one factor (Anova2r1). Independent variables were Tx groups (Control, Tx1, and Tx2) and dates of data collection. The dependent variable was bud development rating using a scale of 1-5.

The Anova2r1 was computed separately for each of the cultivars (Marechal Foch, Brianna, Lacrosse, and Edelweiss). The results were similar for each, that is, a significant difference among the experimental and control groups in delayed bud development, $p < .05$ (see following graphs).

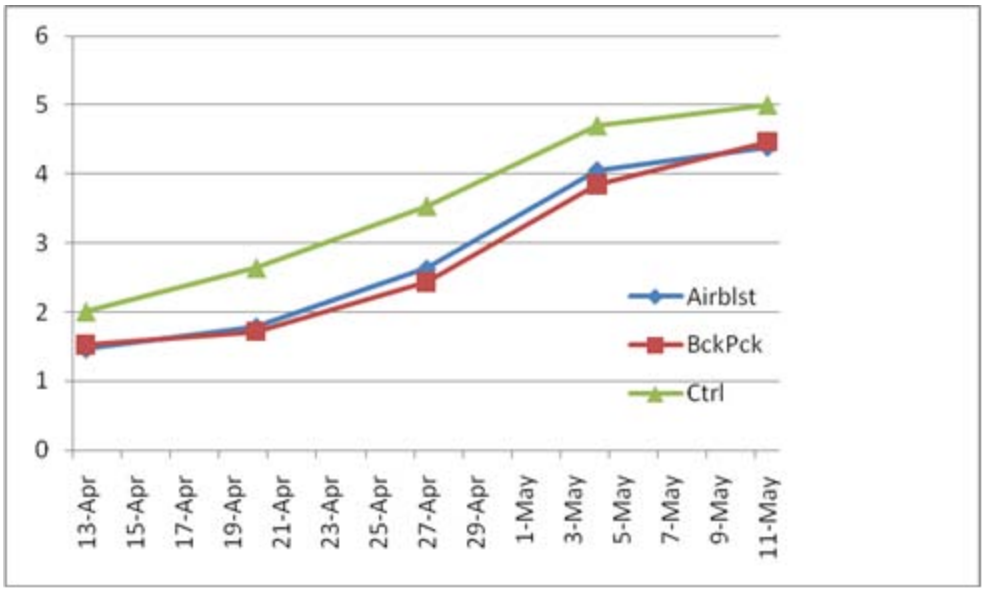
Mac's Creek Site:

Marechal Foch:



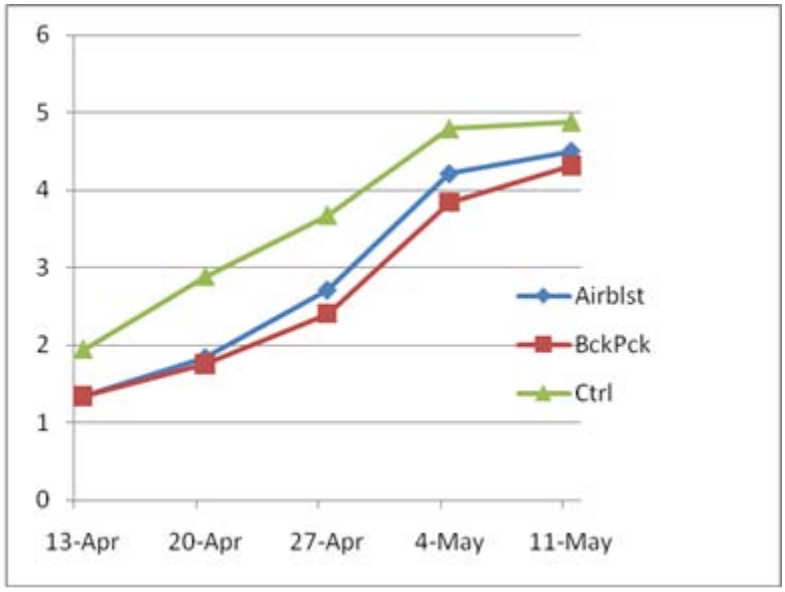
(Note: 4-7 day delay in bud break)

Brianna:



(Note: Approx. 5 day delay in bud break)

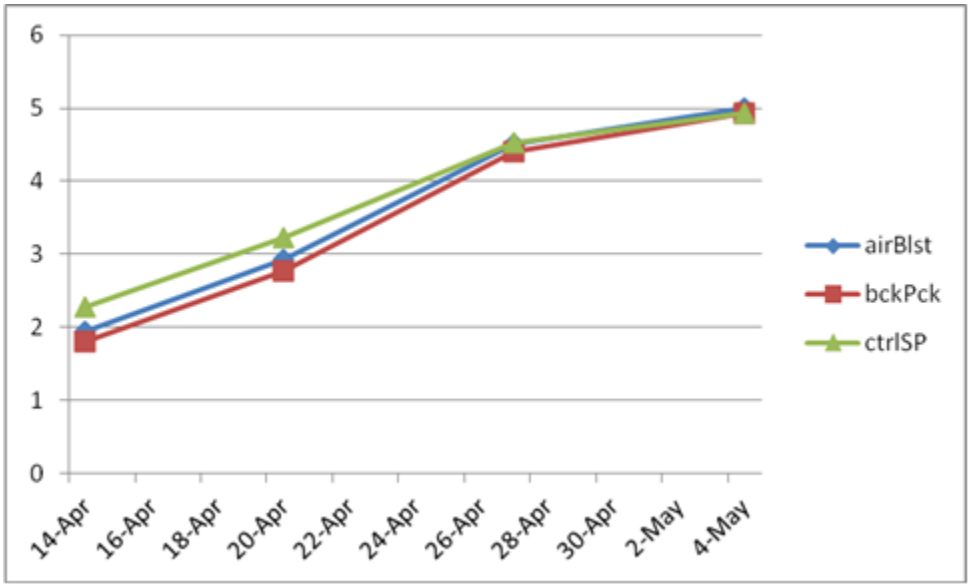
Edelweiss:



(Note: Approx. 6 day delay in bud break)

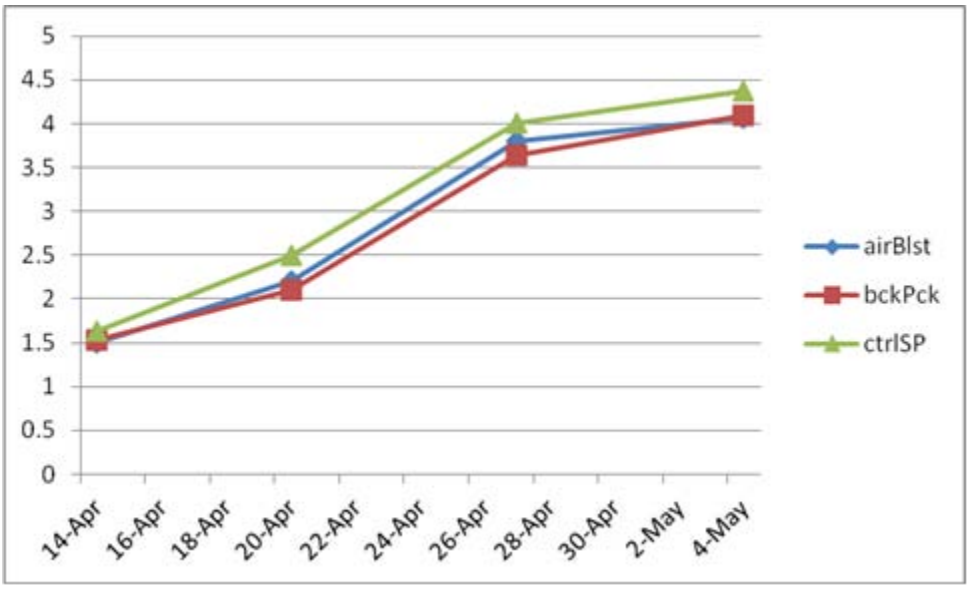
Reno Ridge Site: (10 miles from Mac's Creek)

Marechal Foch



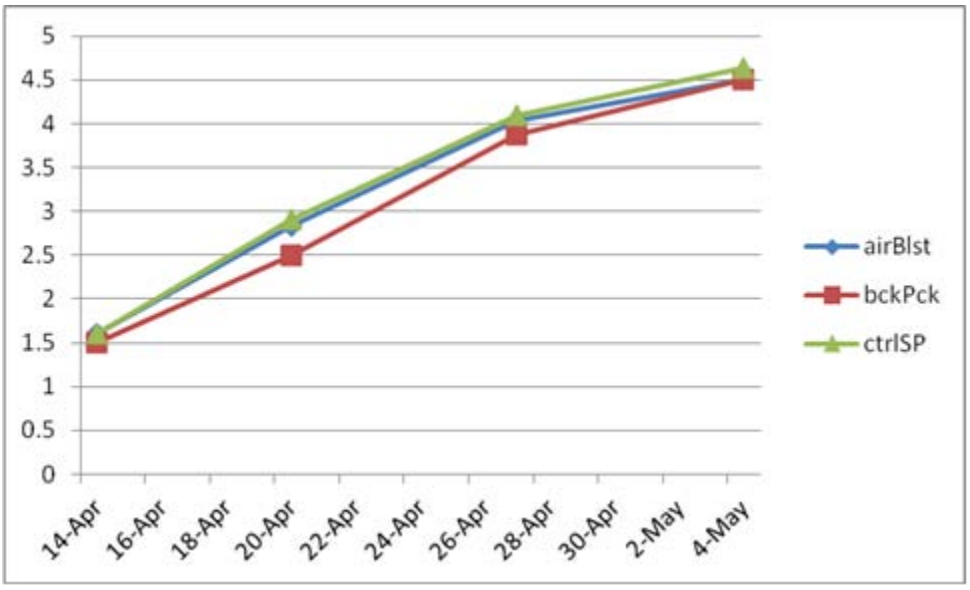
(Note: Approx. 2 day delay in bud break)

Brianna



(Note: Approx. 4 day delay in bud break)

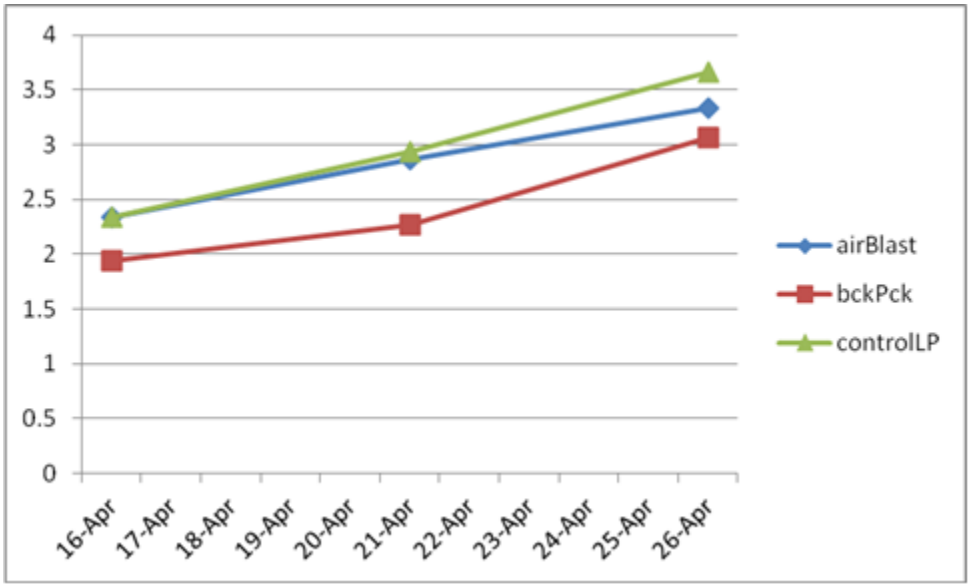
Edelweiss



(Note: Approx. 3 day delay in bud break)

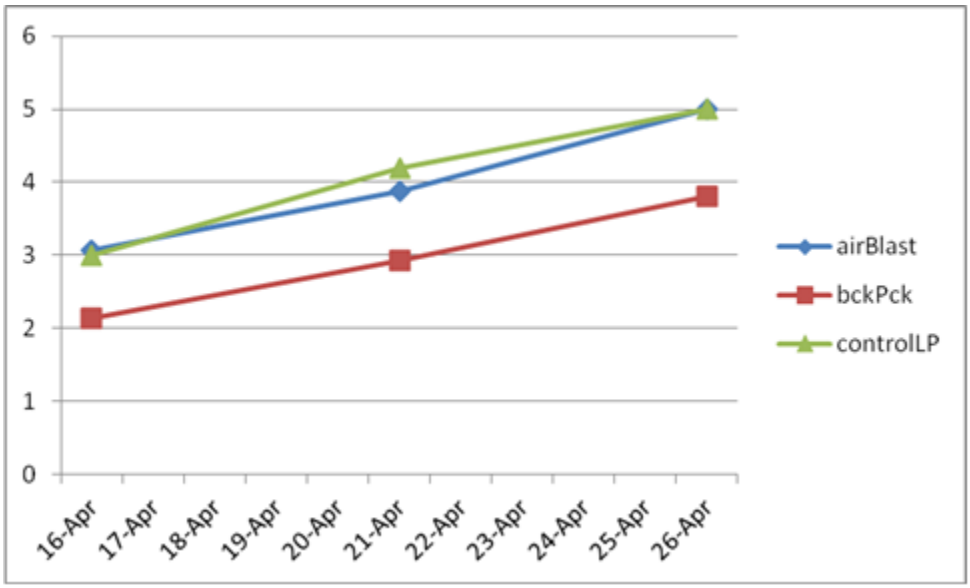
Nelson Site: (Eastern NE-north of Lincoln)

Lacrosse



(Note: Approx. 5-6 day delay in bud break)

Edelweiss



(Note: Approx. 6 day delay with back pack sprayer; approx. 2 day delay with air blast; approx.. 4-5 day delay of bud break with backpack delayed significantly compared to air blast.)

PROGRESS ACHIEVED ACCORDING TO OUTCOME MEASURES

Goal #1: Replicate second year investigation results using air blast sprayer application techniques.

Again, similar to the Year 2 data, the air blast application resulted in significant bud delay as compared to controls. So too did the backpack spray application. Even though both applications were calibrated to be approximately equal (40 – 45 gallons/acre) the backpack, in several cases, resulted in significantly greater bud delay when compared to the air blast application. It is hypothesized that this may have to do with the difference in the size of droplet (backpack) versus mist (air blast) and will require further investigation.

Goal #2: Expand the investigation of the effectiveness of the treatment when applied to vineyards located in the eastern (Eric Nelson near Lincoln) and west/central (Kim Rhone near Cozad) parts of the state, each representing different microclimates.

As can be seen in the above graphs, significant bud delay has been accomplished across three different locations and with four cultivars. Extent of bud delay ranges from 4 – 7 days (Mac's Creek) to 5 – 6 days (Eric Nelson) to 2 – 4 days (Reno Ridge).

Goal #3: Expand the application of the treatment to the Edelweiss vines to determine its impact on this cultivar.

As can be seen in the above graphs, significant bud delay has been accomplished with the Edelweiss cultivar in each of the three locations. Extent of bud delay for Edelweiss ranges from approximately 3 days to 6 days.

The results of this study are quite interesting. The results from the previous two years have not only been replicated, but also have been generalized to two separate locations/microclimates. Three independent raters of bud development were used, all with similar results. Moreover, these significant delays in bud break have now been documented with the Marechal Foch, Lacrosse, Brianna, St. Croix and Edelweiss cultivars with no observable negative impact.

Thus, the results in this "climate harsh" state are profound. With the average last frost date of approximately May 20th for this site, a delay of a few days , to a two-to three-week delay in bud break can mean the difference between minimal and bountiful harvest, and avoidance of most of the last frost damage. 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.

Such treatments may enable viticulturists to work with Mother Nature rather than relying on minimally or non-effective and costly attempts to warm the vineyard in order to minimize damage from the inevitable frost. With future research, it would be helpful to investigate the differential effectiveness of single versus multiple applications of Amigo Oil.

FINANCIAL REPORT

Chemicals	25 gals @ $20.00	=	$ 500.00
Labor	{Chemical application and Data Collection Including Mac's Creek and External sites Kim Rhone and Eric Nelson)}	=	2100.00
Training Consultant		=	540.00
Research Consultant		=	600.00
Data Entry and Data Analysis		=	200.00
Total Due		=	$3,940.00