

# Preventing Spring Freeze Injury with Amigo Oil

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Special thanks to: Dr. Paul Read, Dr. Ellen Papparozzi, Dr. Erin Blankenship, Steve Gamet, Dr. Christina Bavougian, Dr. Issam Qrunfleh, James Arthur Vineyards



# Agenda

- Background
  - Why delay bud break?
  - What is Amigo Oil?

University of Nebraska Viticulture Program research using Amigo Oil and NAA to delay bud break on 'Edelweiss' vines

- Objectives
- Methods
- Results
- Important additional Research
  - Dami and Beam (2004)
  - Qrunfleh and Read (2010)
  - McFarland (2012)
- Useful References



# Why Delay Bud Break in Grapes

- Spring freeze/frost events can cause severe bud damage and economic loss in the vineyard
- Primary buds produce 300-400% more fruit with clusters 135 to 190% larger than those produced by secondary buds ([Wiggans, 1926](#))
- Bud damage from freeze/frost events can still be realized one or two years after the incident





## What is Amigo Oil?

- Soybean based oil (93% oil and 7% emulsifier)
- Amigo Oil was first used on peach trees in the late 1960's and delayed bud break up to 5 days.
- Phytotoxicity was noticed at concentrations greater than 20%





## Amigo®

**VEGETABLE OIL CONCENTRATE  
SURFACTANT**

<b>Principal Functioning Agents:</b>	
Vegetable Oil.....	93%
Constituents ineffective as spray adjuvant.....	7%
<b>TOTAL.....</b>	<b>100%</b>

CA Reg. No. 34704-50028; WA Reg No. 34704-04002

**KEEP OUT OF REACH OF CHILDREN**



**WARNING**

**Precautionary Statements:** Causes eye irritation. Causes mild skin irritation. Wash hands thoroughly after handling. Wear protective gloves/ eye protection/ face protection. **Environmental Precautions:** Prevent further leakage or spillage if safe to do so. Do not contaminate water. Do not allow to enter drains, sewers, or watercourses.

**NET CONTENTS:**

5 U.S. GALLONS (18.925 L)

275 U.S. GALLONS (1040.875 L)

\_\_\_\_\_ GALLONS ( \_\_\_\_\_ LITRES)



**Loveland  
PRODUCTS**

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**Personal Protective Equipment:** Wear protective gloves/eye protection/face protection.

**First Aid: If Swallowed:** Immediately call a poison control center or doctor. Do not induce vomiting unless told to do so by a poison control center or doctor. Do not give any liquid to the person. Do not give anything by mouth to an unconscious person. **If in Eyes:** Hold eye open and rinse slowly and gently with water for 15-20 minutes. Remove contact lenses, if present, after the first 5 minutes, then continue rinsing eye. Call a poison control center or doctor for treatment advice. **If on Skin or Clothing:** Take off contaminated clothing. Rinse skin immediately with plenty of water for 15-20 minutes. Call a poison control center or doctor for treatment advice. **If Inhaled:** Move person to fresh air. If person is not breathing, call 911 or an ambulance, then give artificial respiration, preferably by mouth-to-mouth, if possible. Call a poison control center or doctor for further treatment advice.

**FOR A MEDICAL EMERGENCY INVOLVING THIS PRODUCT CALL: 1-866-944-8565.**

Have the product container or label with you when calling a poison control center or doctor, or going for treatment.

**GENERAL:** AMIGO® is specially formulated to increase the coverage of pesticides on plant surfaces after application. AMIGO is compatible with a wide variety of herbicides, fungicides, insecticides, plant growth regulators and foliar nutrients. For tank mix compatibility concerns, conduct a jar test of the proposed mixture to ensure compatibility of all components. Mix components in the same ratio as the proposed tank mix.

**DIRECTIONS FOR USE:** AMIGO should be tested for compatibility prior to batch mixing. Some pesticides have stated adjuvant use rates. In all cases, the pesticide manufacturer's label should be consulted regarding specific adjuvant use recommendations and the label rate is followed. **Not for aquatic use in Washington.**

**SUGGESTED USE RATES**

**Ultra-Low Volume Applications (ULV) -** Use 1 quart per acre. No water is necessary.

**Low Volume Applications (2 gallons of water or less per acre) -** Use 1 quart per acre.

**Normal Volume Applications (5 to 20 gallons water per acre) -** Use 2 quarts per acre.

**Citrus Sprays (100 to 500 gallons per acre) -** Use 1% of the total amount of water.

**Dormant Orchard Sprays (100 to 500 gallons per acre) -** Use 1 to 2% of the total amount of water.

**For controlled droplet applications (CDA) where no water is added -** Use 3 to 5 pints per acre.

**For CDA with water -** Use 15% of the total liquid. Do not exceed 2 quarts per acre.

**STORAGE AND DISPOSAL**

**STORAGE:** Store in cool, dry place. Store in original container. Keep container tightly closed. Do not reuse empty container.

**DISPOSAL:** Do not contaminate water, food, or feed by storage or disposal. Dispose of contents/container on-site or at an approved waste disposal facility. Triple rinse (or equivalent) adding rinse water to spray tank. Offer container for recycling or dispose of container in sanitary landfill, or by other procedures approved by appropriate authorities. Recycling decontaminated containers is the best option of container disposal. The Agricultural Container Recycling Council (ACRC) operates the national recycling program. To contact your state and local ACRC recycler, visit the ACRC web page at [www.acrcycle.org](http://www.acrcycle.org). For help with any spill, leak, fire or exposure involving this material, call day or night CHEMTREC 1-800-424-9300.

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**BEFORE BUYING OR USING THIS PRODUCT,** read the Directions for Use and the following Conditions of Sale and Limitation of Warranty and Liability. By buying or using this product, the buyer or user accepts the following Conditions of Sale and Limitation of Warranty and Liability, which no employee or agent of LOVELAND PRODUCTS, INC. or the seller is authorized to vary. LOVELAND PRODUCTS, INC. warrants that this product conforms to the chemical description on the label and is reasonably fit for the purposes stated in the Directions for Use, when the product is used in accordance with such Directions for Use under normal conditions of use. LOVELAND PRODUCTS, INC. MAKES NO OTHER WARRANTY, EXPRESS OR IMPLIED, INCLUDING BUT NOT LIMITED TO MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE. THE BUYER'S OR USER'S EXCLUSIVE REMEDY FOR ANY INJURY, LOSS, OR DAMAGE RESULTING FROM THE HANDLING OR USE OF THIS PRODUCT SHALL BE LIMITED TO ONE OF THE FOLLOWING, AT THE ELECTION OF LOVELAND PRODUCTS, INC. OR THE SELLER: DIRECT DAMAGES NOT EXCEEDING THE PURCHASE PRICE OF THE PRODUCT OR REPLACEMENT OF THE PRODUCT. LOVELAND PRODUCTS, INC. AND THE SELLER SHALL NOT BE LIABLE TO THE BUYER OR USER OF THIS PRODUCT FOR ANY CONSEQUENTIAL, SPECIAL, OR INDIRECT DAMAGES, OR DAMAGES IN THE NATURE OF A PENALTY.

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## UNL Project Reference

Loseke, B. A., Read, P. E., & Blankenship, E. E. (2015). **Preventing spring freeze injury on grapevines using multiple applications of Amigo Oil and naphthaleneacetic acid.** *Scientia Horticulturae*, 193, 294-300.



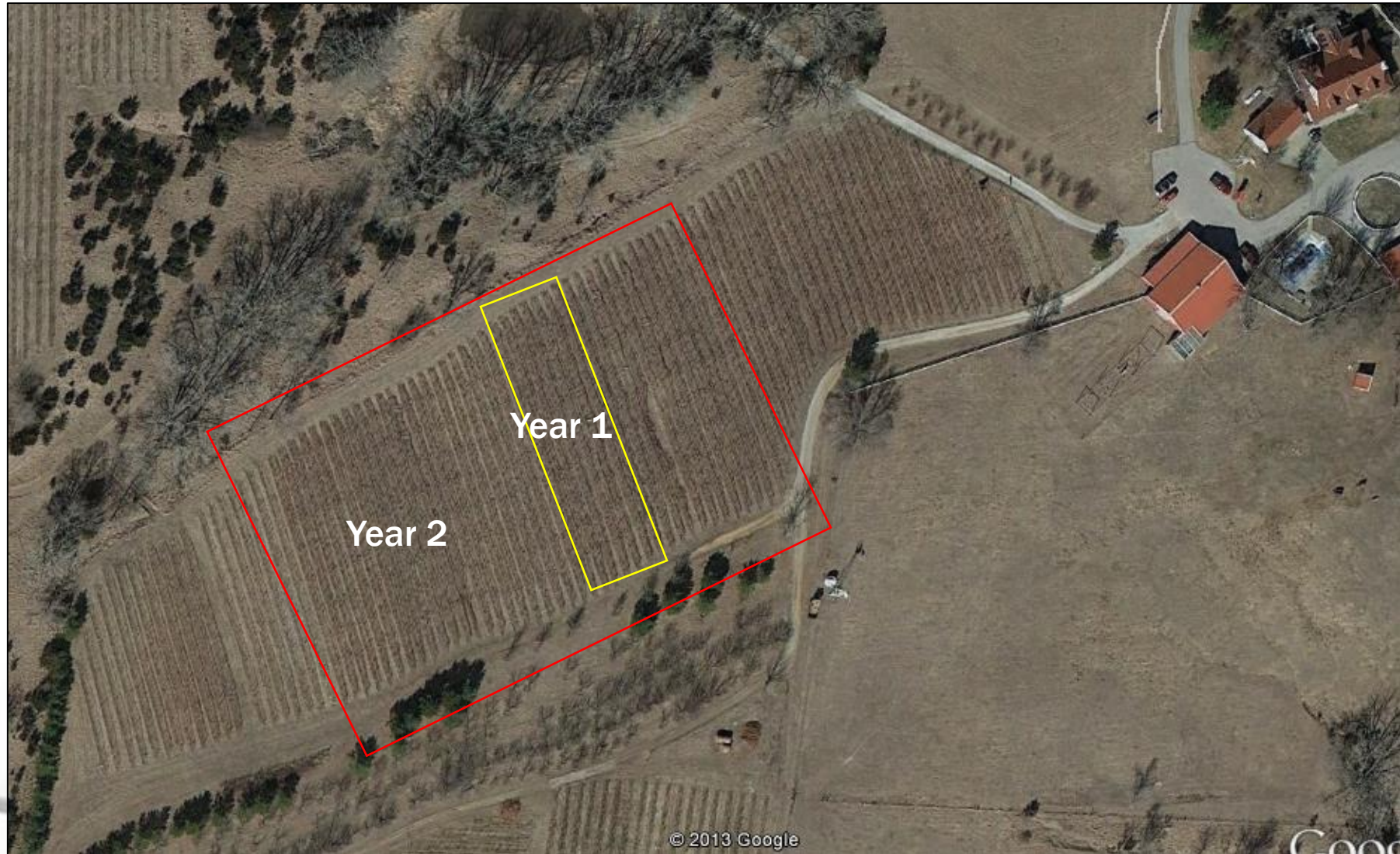


# Objectives

1. Determine if 2 or 3 applications of Amigo Oil or NAA delay bud break more than single applications.
2. Observe phytotoxic effects on dormant buds.
3. Observe effects on harvest and fruiting characteristics (total yield, cluster weight, pH, TA, ° Brix).
4. Determine the most efficient and effective method for applying oil and NAA.
5. Study the effects of the compounds on single-bud cuttings forced in a controlled laboratory environment.



# 2 Year Experiment (2012 & 2013)

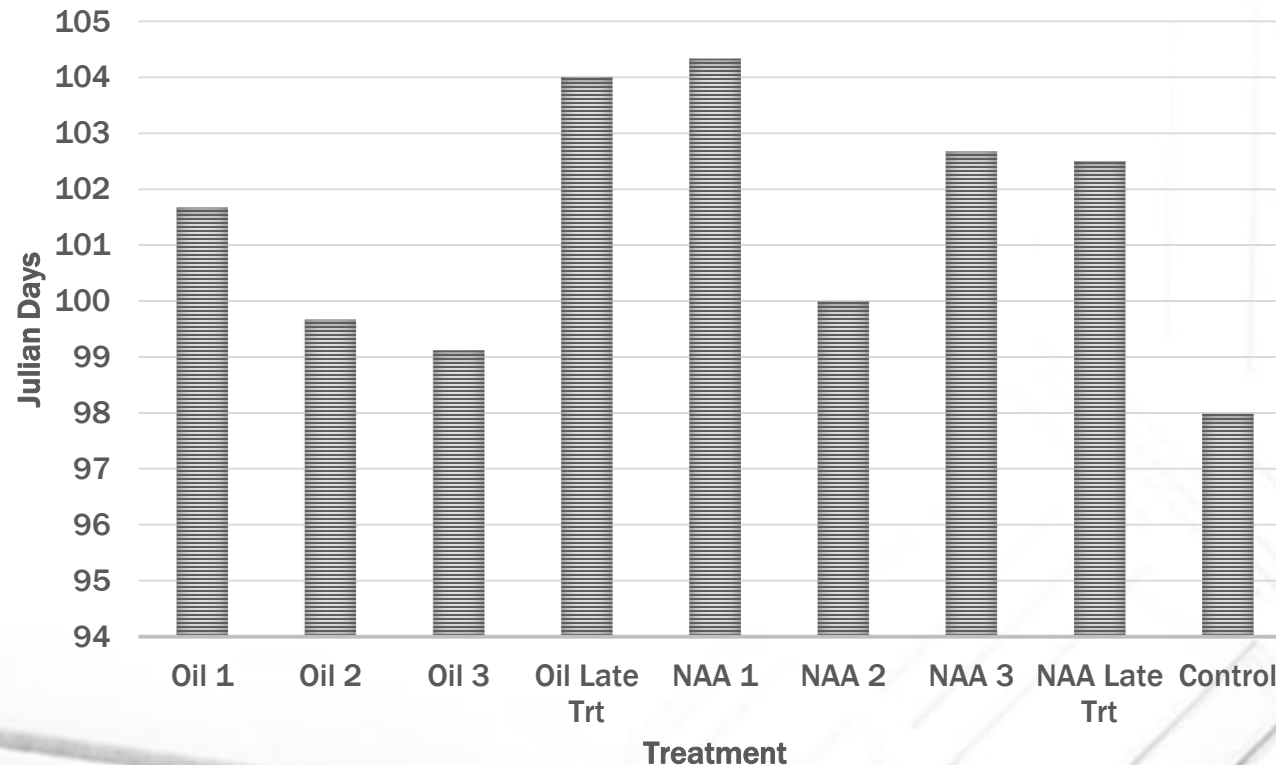




# Year 1 – Pilot Study (non-statistical results)

- Objectives

- Find a reliable variance of bud break to design following years experiment
- Fine tune Oil and NAA application techniques and data collection methods



# Key Findings in Year 1

- 1 late application (March) of NAA had the highest delay  $\approx$  6 days.
- **Small  $\frac{1}{2}$  gallon hand sprayer was not adequate for application**
- Oil tends to separate from water\*
- The abnormally warm and early spring caused the onset of early bud break (April 7)
- 95% Power Analysis was conducted to design the following years experiment



# Rate at Which Amigo Oil Separates from Water

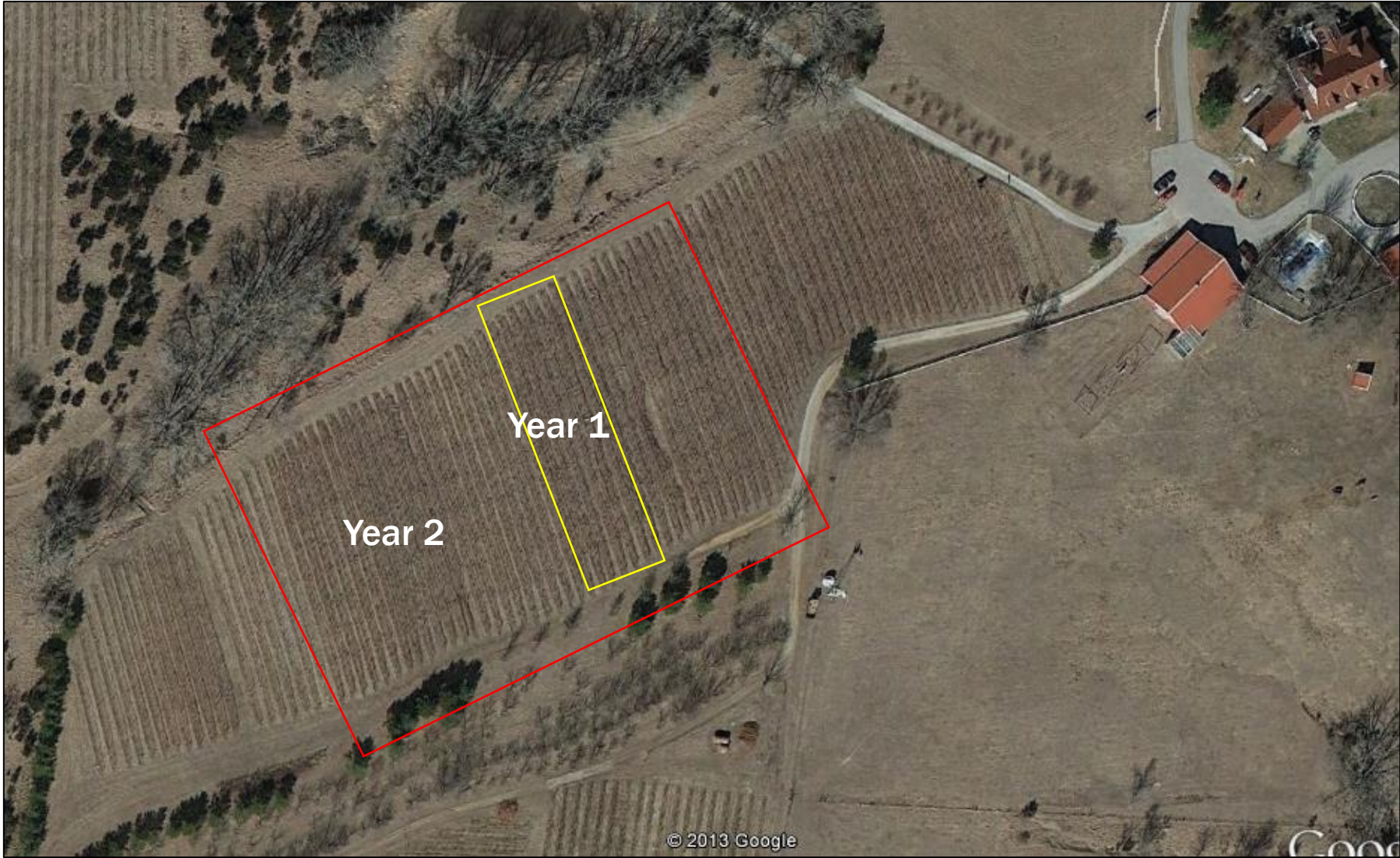


# Year 2 (Full Statistical Experiment)

- Major scaling up
- 7 treatments
  - 1 application of Amigo Oil and NAA
  - 2 applications of Amigo Oil and NAA
  - 3 applications of Amigo Oil and NAA
  - Control (sprayed with water)
- 12 reps/treatment
- >500 vines
- Application Dates = **Jan. 4, Feb. 7 & Mar. 7**
- Developed custom sprayer mounted on ATV to increase spray penetration and coverage consistency + tank agitator







# Methods of Application

- 1 experimental unit (E.U.) = block of 4 vines and data was collected from center two vines
- 4 canes were preselected from the 2 vine E.U. on either side of the row for data collection
- Vineyard was sprayed on 3 predetermined dates with new sprayer prior to pruning



# Methods of Application

- Sprayed NAA first
- Dissolved the NAA in Sodium Hydroxide (NaOH) in the lab and then mixed with water on site
- Mixed up a **10% (v/v)** solution of Amigo Oil
- Vines were on GDC trellis so both sides of the row were sprayed
- Attempted to spray the 4 vine block in 20 seconds (10 seconds each side)
- 0.7 L per vine (**until runoff**)











# January Application Problems

- Temperature was  $<25^{\circ}\text{F}$
- Amigo Ice formed in the sprayer, lines, and nozzles
- Solution also froze on vines
- Unsure whether this treatment would impact bud break
- Took single bud cuttings from all January treatments & controls
- Forced cuttings in lab and observed date of bud break



# Year 2 Results

Julian days until 80% bud break of 'Edelweiss' grapevines treated with 1000 ppm NAA or 10% (v/v) Amigo Oil in each of the three Youden Squares and the mean of the three squares.

Treatment	Youden square 1	Youden square 2	Youden square 3	Squares combined
Control	135 a	136 ace	134 a	135 a
NAA 1	136 a	135 ae	135 a	135 ac
NAA 2	135 a	137 ade	135 a	136 ac
NAA 3	136 a	134 a	138 acd	136 ad
Oil 1	136 a	142 e	138 aef	139 bcd
Oil 2	139 a	143 cbdf	140 bdeg	141 b
Oil 3	139 a	145 b	142 cfg	142 b

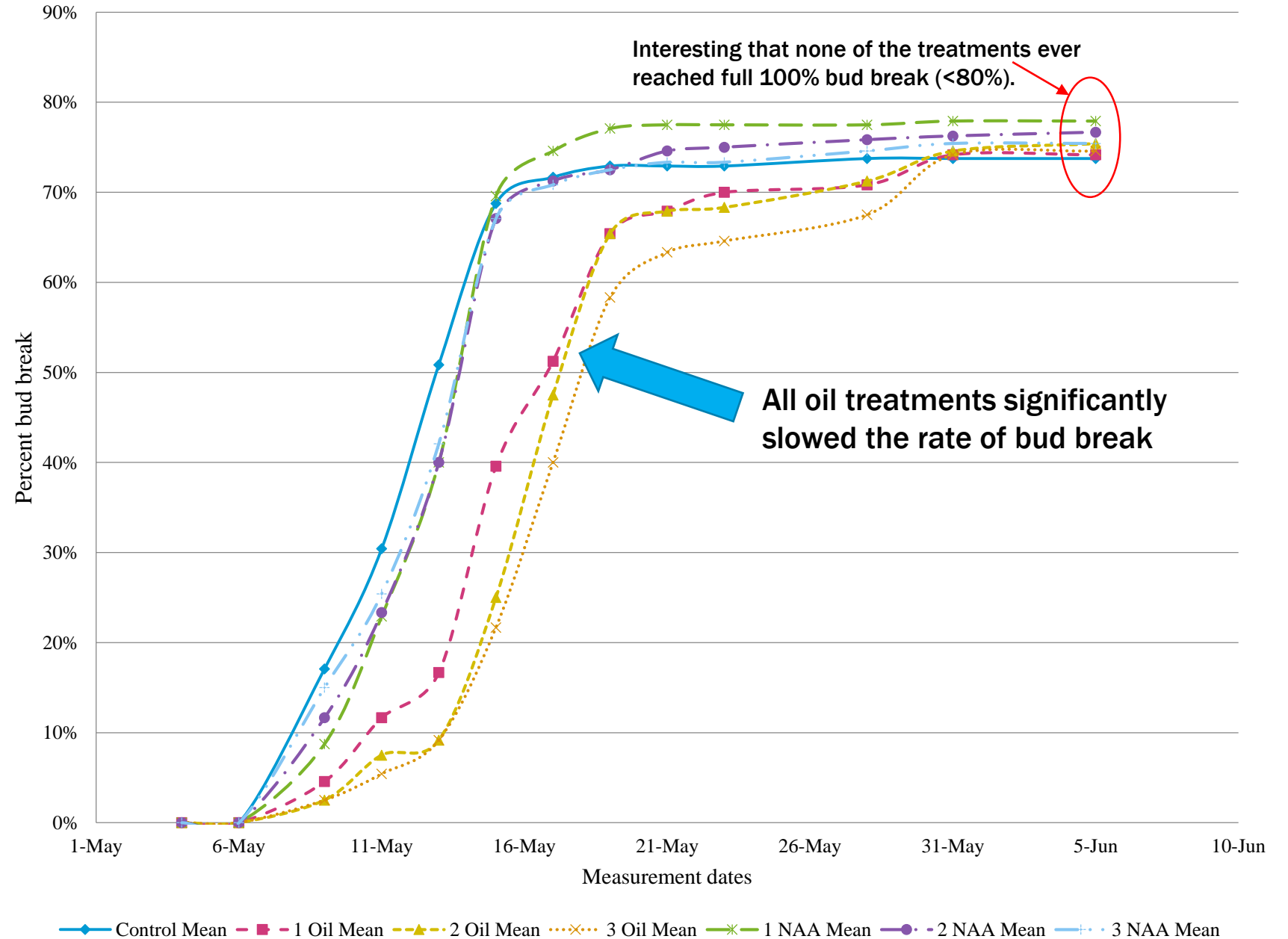
\*1, 2, and 3 corresponds to the number of treatments of NAA or Amigo Oil applied in January, January and February, or January, February and March, respectively.

\*Means with the same letters in same columns are not significantly different at  $p \leq 0.05$



# Results

Plot showing the rate of bud break of one, two or three applications of 1000 ppm NAA or 10% (v/v) Amigo Oil at each measurement date. The buds of the three oil treatments developed significantly slower than that of the control and NAA treated buds.



# Harvest Results

	Treatments						
	Control	1 Oil	2 Oil	3 Oil	1 NAA	2 NAA	3 NAA
Total cluster number	19.56 a	20.36 a	18.60 a	16.15 a	22.10 a	23.69 a	18.78 a
Mean cluster number per shoot	2.20 a	2.54 a	2.31 a	2.04 a	2.78 a	2.97 a	2.33 a
Total cluster weight (kg)	3.28 ab	3.18 ab	3.19 ab	2.11 b	3.69 ab	4.00 a	3.52 ab
Mean cluster weight (kg)	0.15 ab	0.19 ab	0.16 a	0.13 b	0.17 ab	0.16 ab	0.19 ab

	Treatments						
	Control	1 Oil	2 Oil	3 Oil	1 NAA	2 NAA	3 NAA
pH	3.28 a	3.14 ab	3.19 ab	3.12 b	3.18 ab	3.19 ab	3.19 ab
TSS (°Brix)	12.87 a	13.33 a	13.51 a	13.42 a	12.97 a	13.51 a	13.14 a
TA (g/L)	12.02 ab	12.76 ab	13.21 ab	13.76 a	12.36 ab	11.58 ab	12.30 b





3 applications of oil

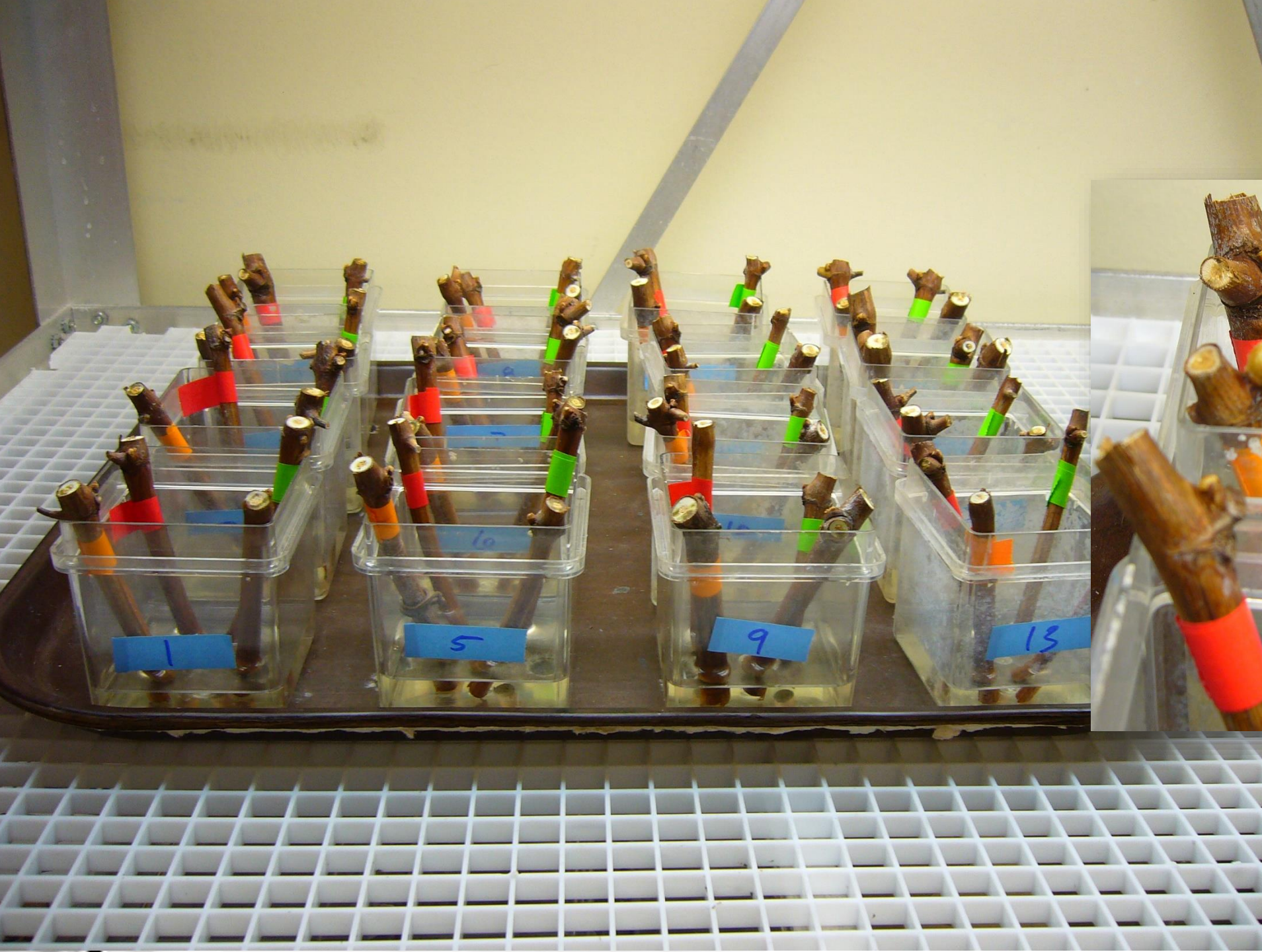


Control

May 23, 2013







# January Application Results

Treatment	Youden Square 1	Youden Square 2	Youden Square 3	Squares Combined
Control	113.13	111.88	112.19	112.40
NAA 1	116.50	116.00	109.69	114.06
Oil 1	113.88	127.96	124.13	121.99

Treatments	Estimate	Standard Error	Adjusted P-value
NAA 1 vs Control	-1.72	2.6844	0.0833
Oil 1 vs Control	-9.4513	2.6672	0.0225
NAA 1 vs Oil 1	-7.7313	2.6259	0.0501

\*1 corresponds to the number of treatments of NAA or Amigo Oil.

\*Values are significantly different at  $p < 0.05$



# **Other Important Work Using Amigo Oil and Other Methods to Delay Bud Break**

## Dami and Beam (2004)

- ‘Chancellor’, ‘Chambourcin’, ‘Chardone’
- Applied 10% (v/v) Prime Oil and Amigo Oil on 3 different dates
- Prime Oil was **phytotoxic to dormant buds** in all 3 cultivars and reduced yield
- Both treatments led to significant bud delay, **ranging from 1-20 days**
- **Amigo Oil did not affect yield or berry composition**



## Qrunfleh and Read (2010)

- 10% (v/v) Amigo Oil delayed bud break on 'Edelweiss' grapevines up to **12 days**.
- There was no decrease in yield or negative effects on fruit characteristics
- Delaying bud break in the lab using single bud cuttings was also attempted, however, oil applications appeared to hinder bud break
- 10% of single bud cuttings showed phytotoxicity using 10% oil



## McFarland (2012)

- Marechal Foch, Brianna and Edelweiss vines were treated with one and three applications of Amigo Oil
- No significant bud delay was observed with a single application of Amigo Oil.
- Significant delays ranging from **6-8 days and 10-12 days** was observed with two or three applications, respectively.
- Past Mcfarland research (2008-2011) has shown delayed bud break from 5 days to 3 weeks. Suggesting results are greatly dependent upon yearly temperature and weather conditions.



# Recommendations

- Results indicate that making two applications of 10% (v/v) Amigo Oil, with the first in January and second in February delay bud break the most.
  - Further research is needed on the exact timing of applications
- Three applications of oil also showed a significant reduction in cluster weights and bud delay was not significantly different from two applications.
- Do not use Amigo Oil at concentrations greater than 10% (v/v)
- Nothing from this experiment indicates that NAA is useful for delaying bud break.



# Useful References

- Dami I., Beam B.A. (2004) Response of grapevines to soybean oil application. *American Journal of Enology and Viticulture* 55:269-275.
- Loseke B.A., Read P.E., Blankenship E.E. (2015) Preventing spring freeze injury on grapevines using multiple applications of Amigo Oil and naphthaleneacetic acid. *Scientia Horticulturae* 193:294-300.
- McFarland S. (2012) Nebraska Grape and Wine Board Grant Final Report.
- Qrunfleh I.M. (2010) Delaying bud break in 'Edelweiss' grapevines to avoid spring frost injury by NAA and vegetable oil applications, Department of Agronomy and Horticulture, University of Nebraska, Lincoln, Nebraska. pp. 108.





**Questions**