DELAY OF BUD BREAK ON 'EDELWEISS' GRAPEVINES WITH MULTIPLE APPLICATIONS OF AMIGO OIL AND NAA

Benjamin A. Loseke

Thanks to all who contributed to this project:
Dr. Paul Read
Dr. Ellen Paparozzi
Dr. Gary Yuen
Stephen Gamet
Josh Rockemann
James Arthur Vineyards

GO BIG RED

WHY?

- Late spring freezes can destroy Midwest vineyards… >90% bud death
- ‘Edelweiss’ is one of the earliest cultivars to break bud and produces significantly higher yields on primary buds than secondary and tertiary buds

WE NEED AN EFFICIENT WAY TO PROTECT OUR VALUABLE CROP

- Methods currently used:
  - Overhead irrigation*
  - Wind machines*
  - Heaters*
  - Vegetable oils
  - KDL….

*Not usually used in smaller vineyards

MIDWEST GROWERS NEED AN ALTERNATIVE TO EXPENSIVE FROST PROTECTION METHODS

- Amigo Oil
  - Vegetable based oil
  - Proven to delay bud break on other cultivars with single applications
- Naphthaleneacetic acid (NAA)
  - Plant hormone
  - Also been used to delay bud break but exact timing and concentration is unknown

OBJECTIVE

- It has already been proven that single applications can retard bud break

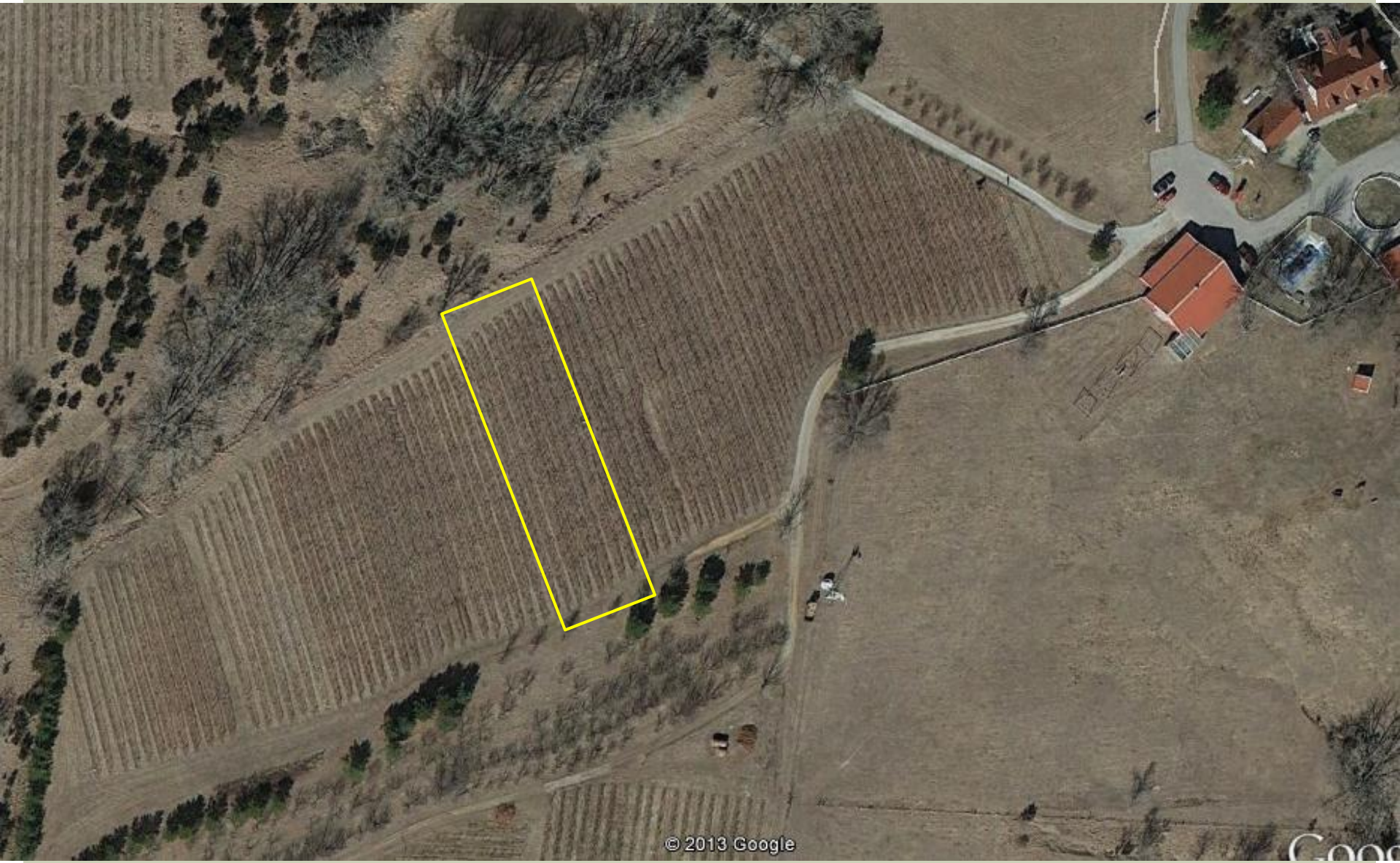
- SO…will MULTIPLE APPLICATIONS of NAA and Amigo Oil delay bud break even more? Or be phytotoxic and cause bud mortality?

OUTLINE

- Year 1 Pilot Study
  - Methods
  - Problems
  - Results
- Year 2 Experiment
  - Methods
  - Changes
  - Results
- Laboratory Trials
  - Methods
  - Results
- Conclusions

YEAR 1 (PILOT STUDY)

- Location: James Arthur Vineyards
- ‘Edelweiss’ Block
- 9 treatments
  - 10% (v/v) Amigo Oil & 1000ppm NAA
- 3 Spray Dates @ monthly intervals
- Goal was to obtain a reliable Variance of bud break to use following years study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LAYOUT OF TREATMENTS

Number of Vines treated	Treatment 1 Amigo Oil January 26, 2012	Treatment 2 Amigo Oil February 24, 2012	Treatment 3 Amigo Oil March 26, 2012
18	X		
12	X	X	
6	X	X	X
Late Treatment			X
	Treatment 1 1000ppm NAA	Treatment 2 1000ppm NAA	Treatment 3 1000ppm NAA
18	X		
12	X	X	
6	X	X	X
Late Treatment			X

METHODS OF DATA COLLECTION

- Counted the first 5 buds on every cane
- Compared total open bud count to total unopened bud count
- When 60% of buds had reached stage 4 of the EL Scale of Grapevine development the plant was considered “completely budded out”

1. Winter dormancy: Winter buds pointed to rounded, bright or dark brown according to cultivar; bud scales more or less closed according to cultivar.

2. Bud swelling: Buds expand inside the bud scales.

3. Wool stage: Brown wool clearly visible (doeskin).

5. Bud burst: Green shoot first clearly visible.

Eichhorn and Lorenz (1977)

HARVEST DATA COLLECTION

- At harvest 100 berry samples from each rep were collected and tested for:
  - °Brix
  - Titratable Acidity (TA)
  - pH

*Pruning weights and bud mortality were also collected

YEAR 1 PROBLEMS

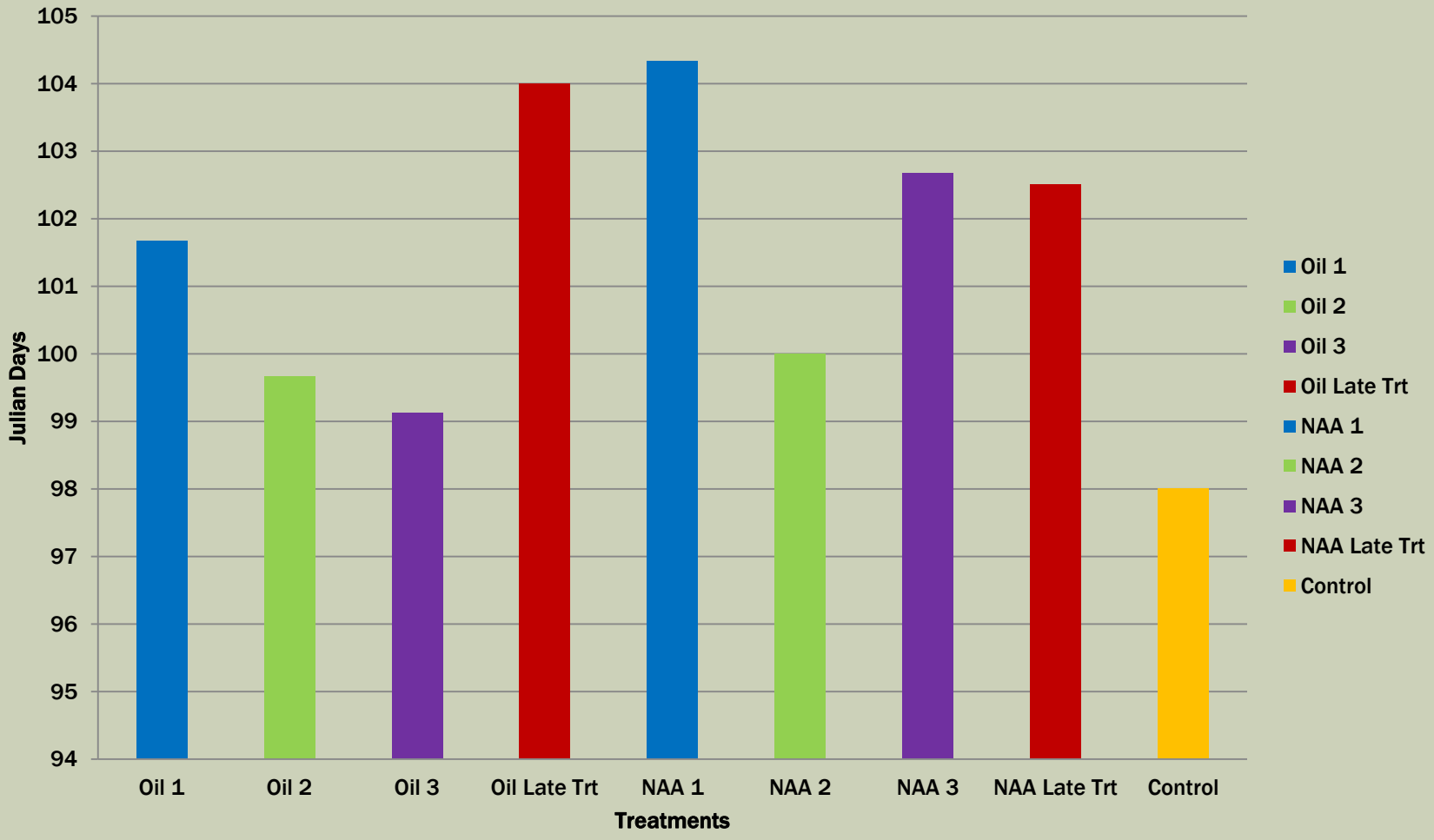
- Sprayer was not adequate for magnitude of experiment
  - Poor coverage
  - Sprayer volume was only ½ gal
  - Poor consistency
- Amigo Oil separates from water within minutes causing vines to be sprayed with either more or less than 10% oil.
- Extremely warm and early spring in 2012!

YEAR 1 RESULTS

Number of Vines treated	Treatment 1 Amigo Oil January 26, 2012	Treatment 2 Amigo Oil February 24, 2012	Treatment 3 Amigo Oil March 26, 2012
18	101.67		
12		99.67	
6			99.12
Late Treatment			104
	Treatment 1 1000ppm NAA	Treatment 2 1000ppm NAA	Treatment 3 1000ppm NAA
18	104.33		
12		100	
6			102.67
Late Treatment			102.5

- Control – 98 days
- Highest Delay – 104.33 days
- **Variance of bud break** = 9

YEAR 1 RESULTS



YEAR 2

- Location: James Arthur Vineyards Raymond, NE
- Major Scaling up
- 7 Treatments
- 12 replications per treatment
- >500 vines in experiment
- Treatment Dates: January 4, February 7, March 4 - 2013
- New sprayer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LAYOUT OF TREATMENTS

20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51	52	53	54	55	56	57	58	59	60	61	62	63	64
1		1		1		1		1		1		1		1		1		1		1		1		1		1		1		1		1		1		1		1		1		1		1
2		2		2		2		2		2		2		2		2		2		2		X		2		2		2		2		2		2		2		2		2		2		2
3		3		3		3		3		3		3		3		3		3		3		3		3		3		3		3		3		3		3		3		3		3		3
4		4		4		4		4		4		4		4		4		4		4		4		4		4		4		4		4		4		4		4	X	4		4		4
5		5		5		5		5		5		5		5		5		5		5		5		5		5		5		5		5		5		5		5		5		5	X	5
6		6		6		6		6		6		6		6		6		6		6		6		6		6		6		6		6		6		6		6		6		6		6
7		7		7		7		X		7		7		7		7		7		7		7		7		7		7		7		7		7		7		7		7		7		X
8		8				8		8		8		8		8		8		8		8		8		8		8		8		8		8		8		8		8	X	8		8		8
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12		12		12		12		12		12		X		12		12		12		12		12		12		12		12		12		12		12		12		12		12		12		12
13		13		13		13		13		13		X		13		13		13		13		13		13		13		13		13		13		13		13		13		13		13		13
14		14		14		14		14		14		X		14		14		14		14		14		14		14		14		14		14		14		14		14		14		14		14
15		15		15		15		15		15		X		X		15		15		15		15		15		15		15		15		15		15		15		15		15		15		15
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18		18		18		18		18		18		18		X		18		18		18		18		18		18		18		18		18		18		18		18		18		18		18
19		19		19		19		19		19		19		X		19		19		19		19		19		19		19		19		19		19		19		19		19	X	19		19
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- 4x7 Youden Square (x3)
- Blocking in both directions

1	1 NAA
2	2 NAA
3	3 NAA
4	1 OIL
5	2 OIL
6	3 OIL
7	CONTROL

YEAR 2 METHODS

- Built a custom sprayer, added tank agitator and mounted to an ATV
- Sprayed on predetermined dates
- 1 Experimental Unit = a block of 4 vines and data was collected from center 2 vines.
- Preselected 4 canes from the two vines on either side of the row for data collection.
- Josh pruned in March after completion of sprays

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
- Necessary to spray both sides of the row
- Attempted to spray the 4 vine block in 20 seconds (10 seconds each side)
- Volume roughly 0.7 L per vine


COUNTYLINE

JANUARY APPLICATION

- Temperature was <25°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

RESULTS

Field,
2013

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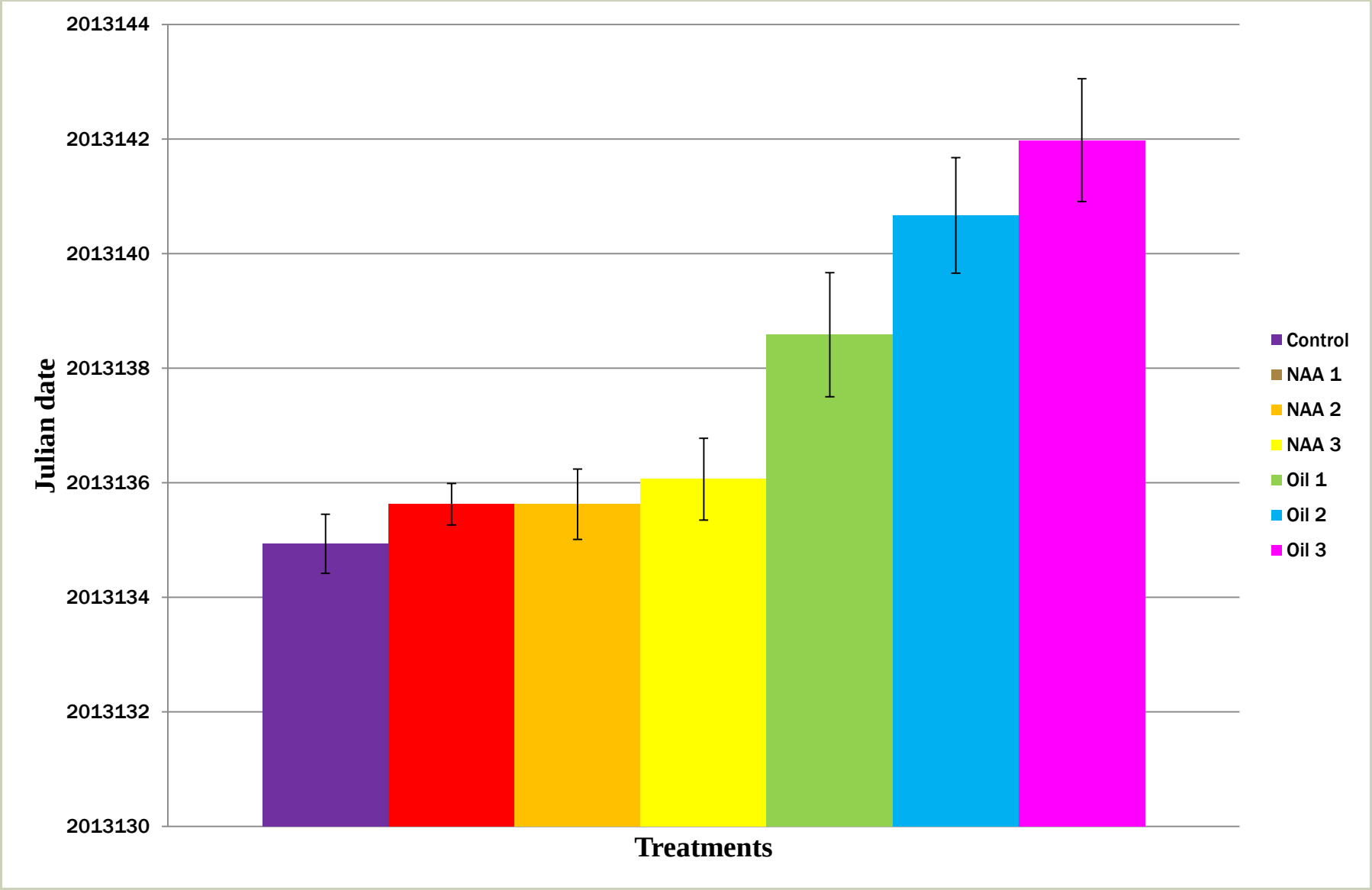
Julian days until 80% bud break of 'Edelweiss' grapevines treated with 1000 ppm NAA or 10% (v/v) Amigo Oil in each of the three Youden Squares and the mean of the three squares.

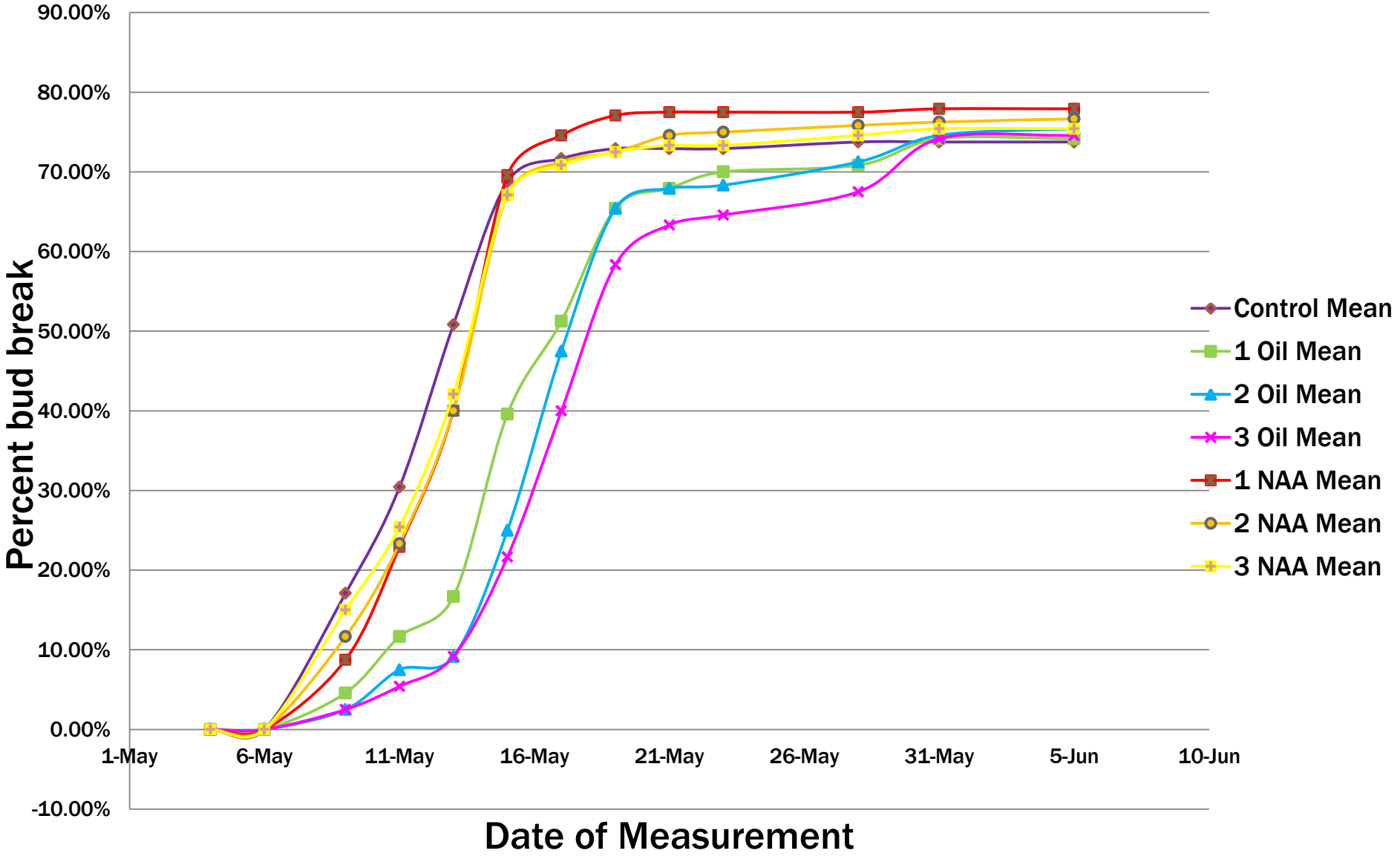
Treatment	Youden Square 1	Youden Square 2	Youden Square 3	Squares Combined
Control	135.06 a	136.50 ace	133.63 a	135.06 a
NAA 1	135.50 a	135.25 ae	135.13 a	135.29 ac
NAA 2	135.06 a	137.25 ade	134.56 a	135.63 ac
NAA 3	136.25 a	134.13 a	137.81 adc	136.06 ad
Oil 1	135.81 a	141.56 e	138.38 aef	138.58 bcd
Oil 2	139.06 a	142.81 cdfb	140.13 bdeg	140.67 b
Oil 3	139.06 a	144.56 b	142.31 cfg	141.98 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 are not significantly different at $p \leq 0.05$

Mean Julian date until 80% bud break of ‘Edelweiss’ grapevines when treated with one, two, and three applications of 1000 ppm NAA or 10% (v/v) Amigo Oil.



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.



BUD MORTALITY

Treatment	Injury (%)
Control	8.0 a
1 NAA	3.2 a
2 NAA	4.7 a
3 NAA	5.7 a
1 Oil	7.3 a
2 Oil	5.7 a
3 Oil	6.3 a

HARVEST RESULTS

	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
°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

*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.
* Values with same letters are not significantly different at $p \leq 0.05$.

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 $p < 0.05$

LABORATORY TRIALS

2013

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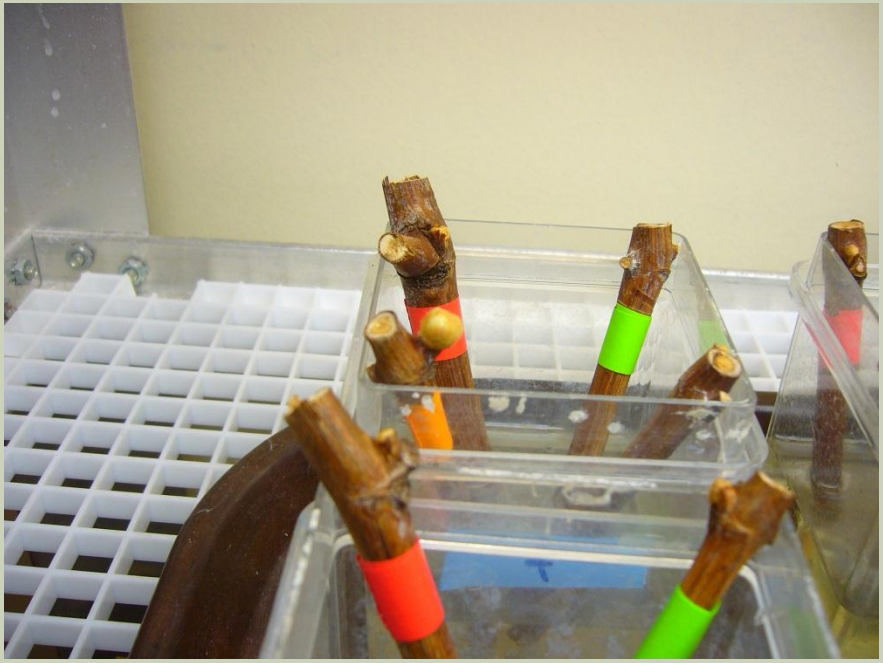
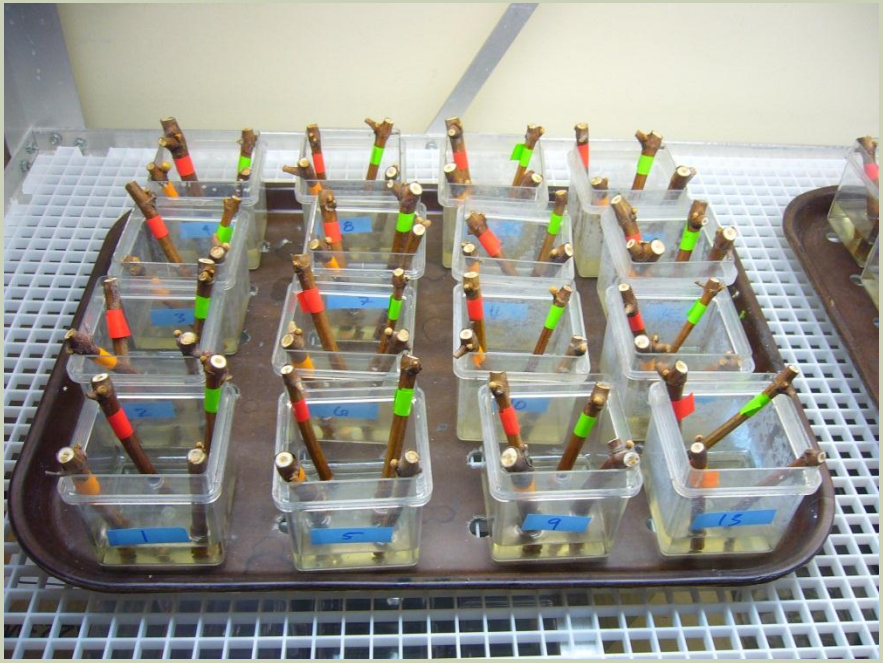
METHODS

- GOAL: Replicate field results in a controlled laboratory setting
- Took single bud cutting from same (unsprayed) 'Edelweiss' block
- Forced the single bud cutting in 200mg/L 8-hydroxquinoline citrate and 20 g/L Sucrose
- Dipped Cuttings in 10% (v/v) oil or 1000 ppm NAA (1, 2, or 3 times)

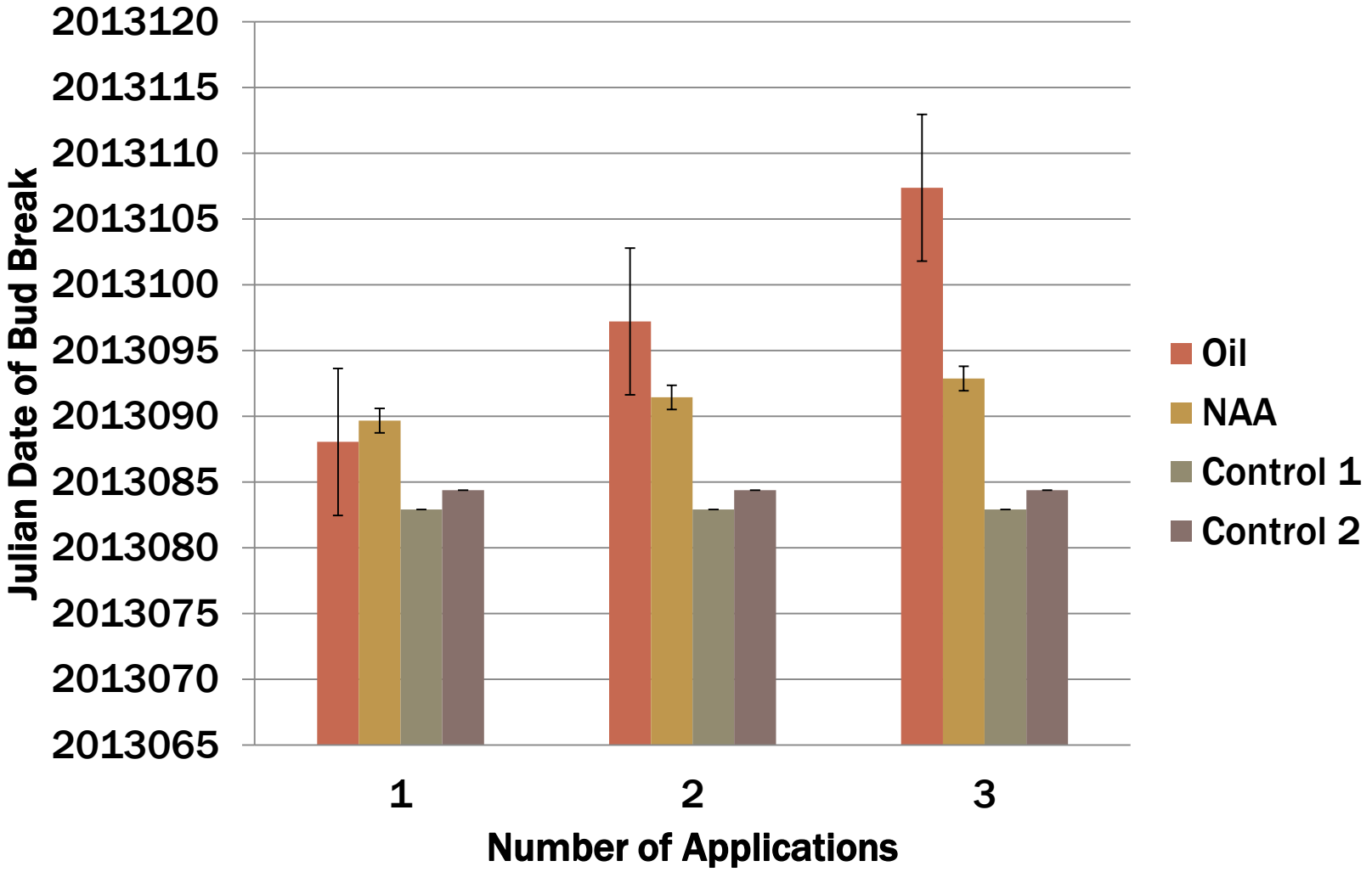




RESULTS

Lab Trials
2013

GO BIG RED



Number of Julian days until 'Edelweiss' single-bud cuttings showed bud break at bud position five and six treated with one, two or three applications of 1000 ppm NAA or 10% (v/v) Amigo Oil. Control 1 is associated with the oil treatments and control 2 is associated with the NAA treatments.

Comparison of one, two, and three applications of 1000 ppm NAA or 10% (v/v) Amigo Oil to 'Edelweiss' single bud cuttings to the control.

Treatments	Estimate	Standard Error	Adjusted P-value
Control vs NAA 1	-5.2917	1.5523	0.006
Control vs NAA 2	-7.0341	1.5698	0.0002
Control vs NAA 3	-8.5	1.5523	<.0001
Control vs Oil 1	-5.1364	3.5192	0.4689
Control vs Oil 2	-14.3066	3.57	0.0011
Control vs Oil 3	-24.2657	3.6111	<.0001

*1, 2, and 3 corresponds to the number of treatments of NAA or Amigo Oil applied at weekly intervals.

CONCLUSIONS

- The rate of bud break is more important than the final date
- Amigo Oil delayed bud break up to 11 days with three applications and the rate of bud break was significantly slower
- DON'T USE NAA!
- Build a tractor mounted sprayer! See Eric or Seth
- Multiple applications of oil overcomes the "weathering" of the oil.
- Is it worth the $$$$$? (DON'T SPRAY THE ENTIRE VINEYARD)

- APPLY AT LEAST 2 TIMES! IN MY OPINION, START IN FEBRUARY AND GET 2 SPRAYS IN….MAYBE 3 IF SPRING IS LATE.

QUESTIONS

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