New Rest-Breaking Treatments for Walnuts

Kat Jarvis-Shean, UC Cooperative Extension
Maciej Zwieniecki, UC Davis Dept of Plant Sciences
Giulia Marino, UC Cooperative Extension
Kevin Fort, Formerly UC Cooperative Extension
Mat Talton, UC Cooperative Extension

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UC CE | University of California
Agriculture and Natural Resources | Cooperative Extension

Experimental results are easy to misunderstand out of the context of an in-person presentation.

Please contact the presenter at kjarvisshean@ucanr.edu if you have questions about this presentation.

Erger and CAN-17 are not labelled for use as plant growth regulators.

Posting of these initial results here should not be construed as academic publication.

Outline of Talk

- Warmer winters – Why it matters & What we can do about it.
- Approach: Heat, peek, treat, count
- Results & Production Implications

Conclusions So Far…

Budbreak timing

- Hydrogen Cyanamide @ 4% consistently different from water, regardless of ambient/low chill.
- Erger, Hydrogen Cyanamide @ 2%, CAN-17 different from water under low chill.

Percent budbreak

- Trend, though not always statistically significant, of increased budbreak with hydrogen cyanamide (2% and 4%)

'Howard' walnuts, 3rd leaf, in Solano County, 2020.

Why is winter chill important?

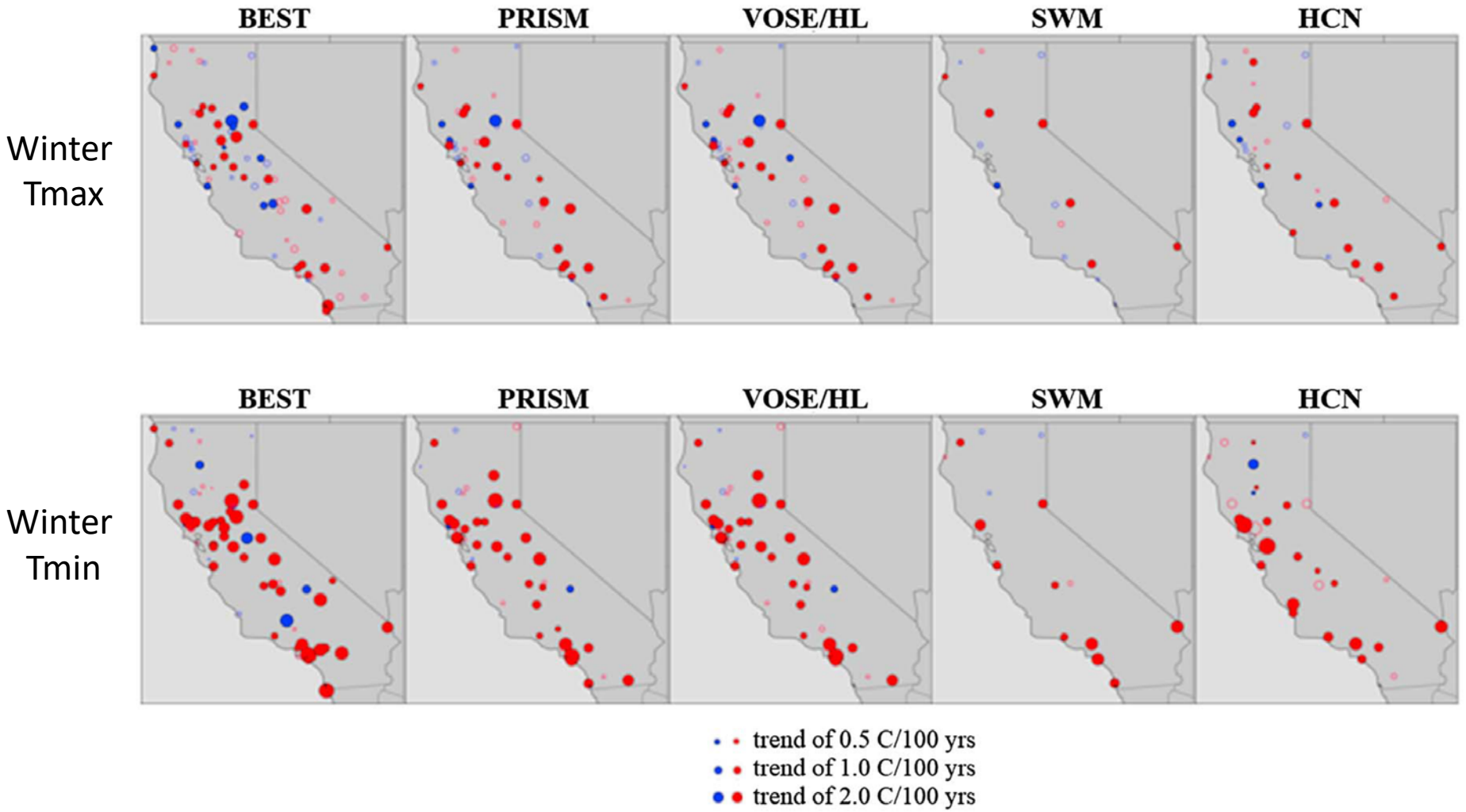
Photo: K. Jarvis-Shean

‘Chandler’ 5th leaf, April 28th, 2020, Sutter County.

Size variability, mature Howard, May 6th, Solano County. Photo: K. Jarvis-Shean

Photo: Luke Milliron

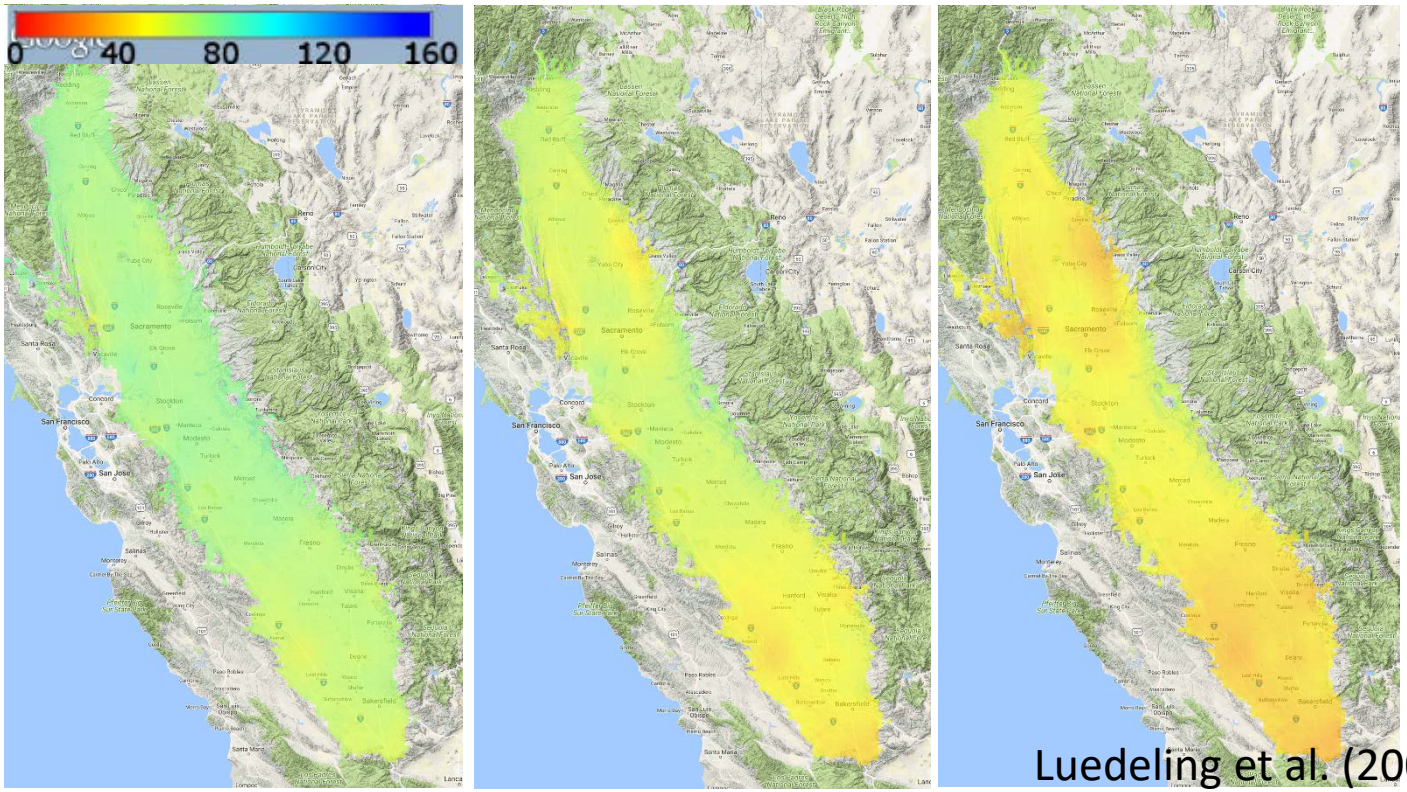
Central Valley winters have been getting warmer.



Wang et al. (2017)

Chill Projections 90% of years, for Mid, End of Century

	Turn of the Century	Mid 21st Century	End 21st Century
N. Sac Valley	71	60 (↓ 15%)	51 (↓ 28%)
S. Sac Valley	70	58 (↓ 17%)	48 (↓ 31%)
N. San Joaquin	71	61 (↓ 14%)	51 (↓ 28%)
S. San Joaquin	64	51 (↓ 20%)	42 (↓ 34%)



Luedeling et al. (2009)

If Chandler requires ~60 Chill Portions…

	Turn of the Century	Mid 21st Century	End 21st Century
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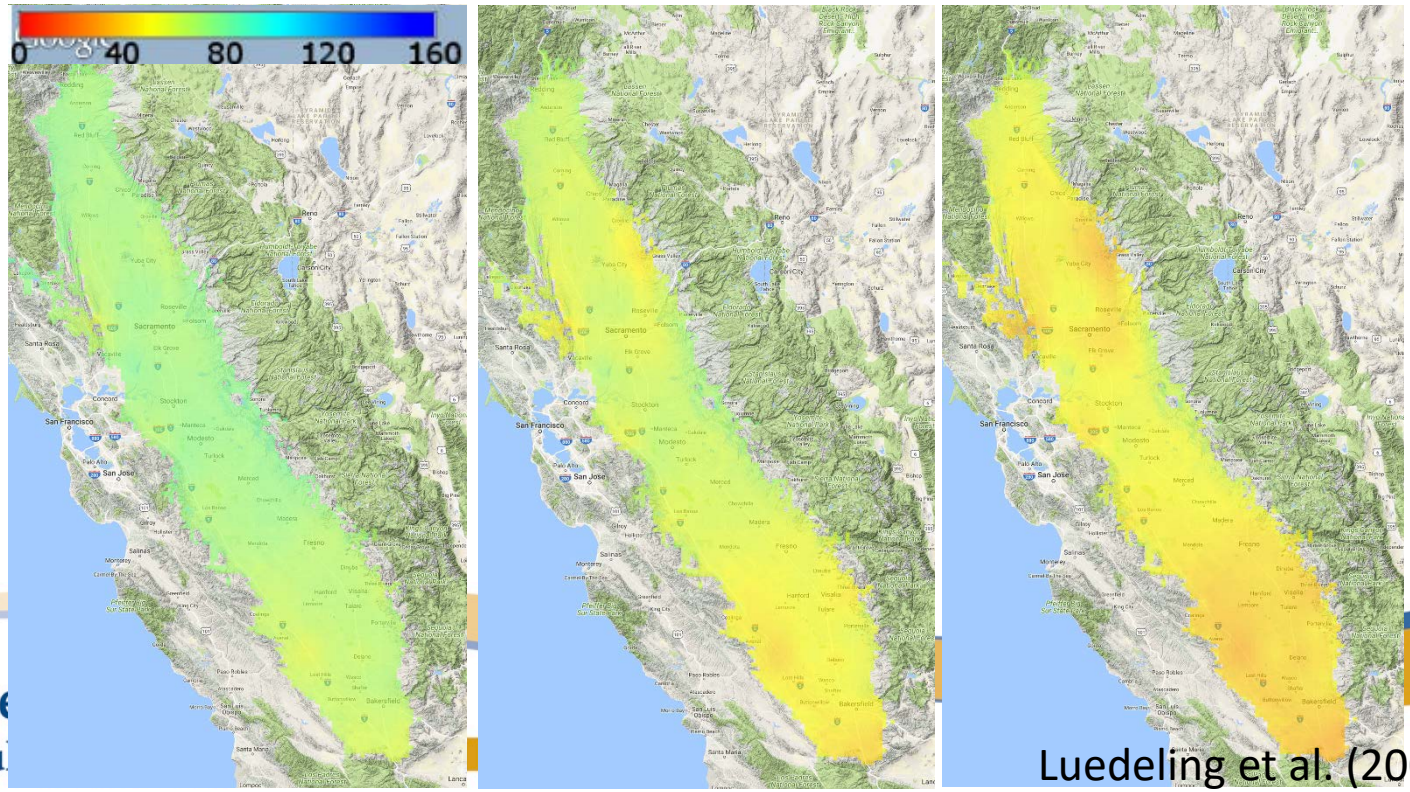
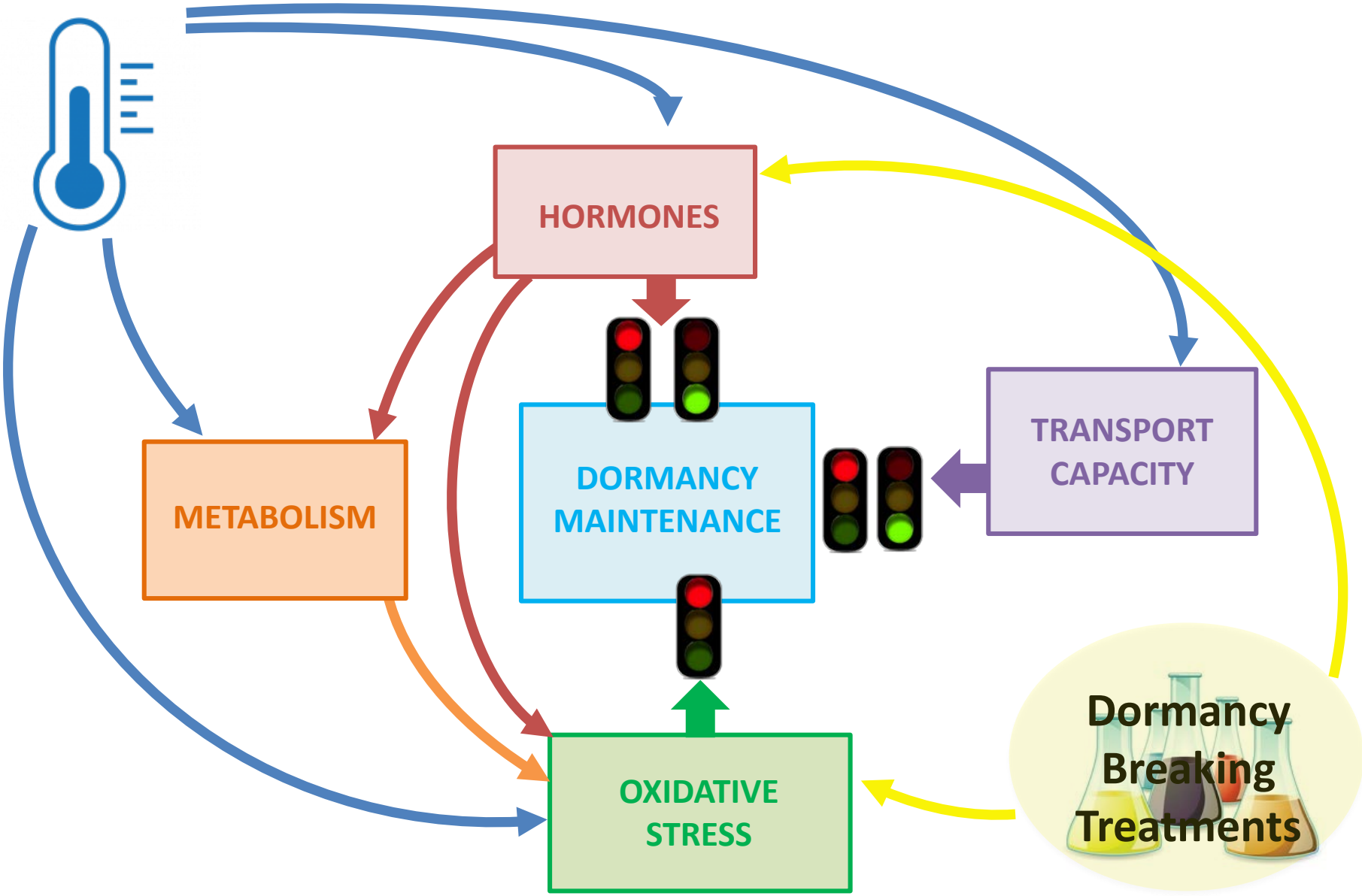


Luedeling et al. (2009)

Dormancy pathways and their interactions



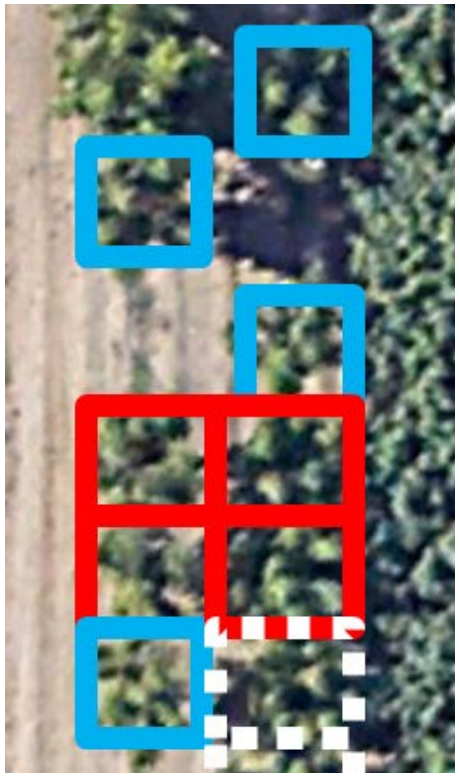
Adapted from Beauvieux et al, 2018

Outline of Talk

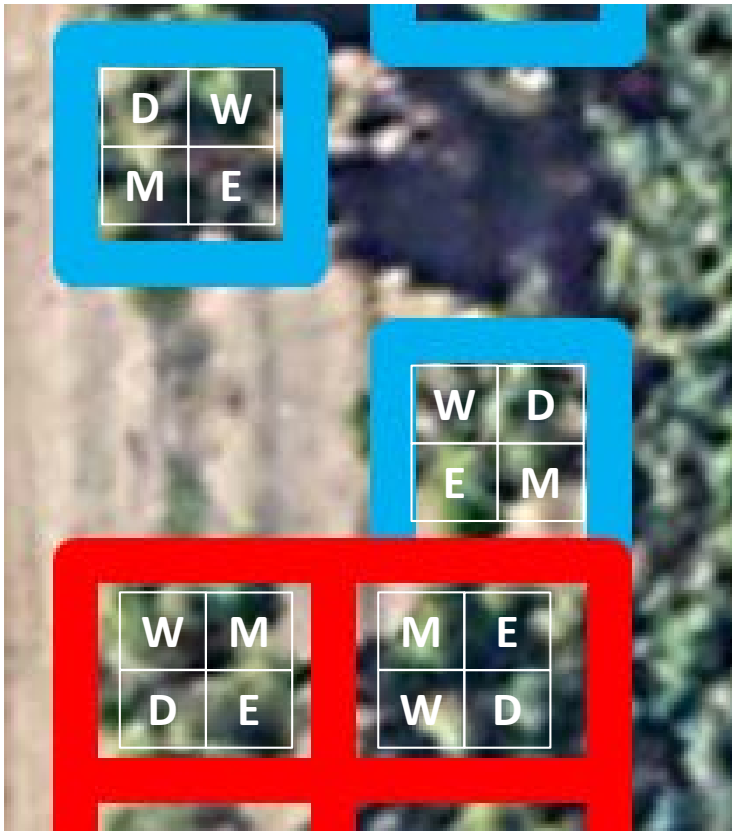
- Warmer winters – Why it matters & What we can do about it.
- Approach: Heat, peek, treat, count
- Results & Production Implications

Experimental Design: Split Plot

Main: Heat / Unheated by Tree

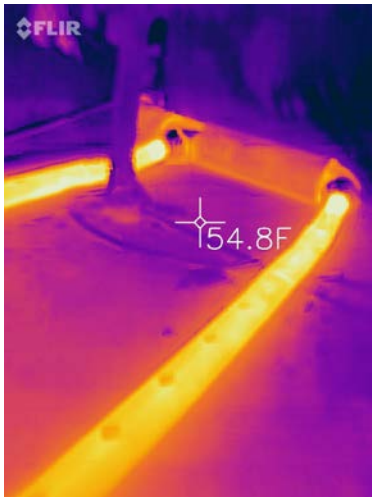


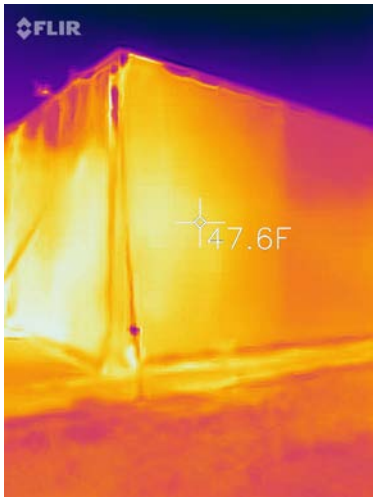
Sub: Chemical Treatment by Scaffold



Experimental Design: Heated Trees

Heated Open Top Simulated Temperature Upshift in the Field (HOT STUF).





Infrared image of heating with convection tubes in tree compartment.

Experimental Design: Rest Breakers

Split Plot Design, Rest Breakers as Sub Effect

Treatment	Rate	Adjuvant	Rate	Date
Water (Control)	n/a	n/a	n/a	3/3/2021
Mocksi® (CPPU)	15 ppm	PentraBark	0.2%	3/4/2021
Erger® (calcium (4.7%), nitric nitrogen (5.8%), ammonium nitrogen (3.1%), urea (6.1%))	6% (by vol)	Calcium nitrate (Yara Liva)	83 lb/100 gal	3/5/2021
Dormex® (Hydrogen cyanamide)	4%	Latron	0.25%	3/6/2021

BellSpray Inc R & D JR-203S CO2 backpack sprayer (3 liter bottles)
150 gallons per acre equivalent (sprayed to drip), max 538 mL per scaffold,

- 15 catkin buds
- 30 terminal buds (Veg & Female)
- 30 lateral buds (V & F)
- ~1/3 at 3 heights

- Timing 10%, 50%, 90%
- Duration 10% to 90%
- # of buds that broke
- Diff by heating, chemical
- Fruit Set

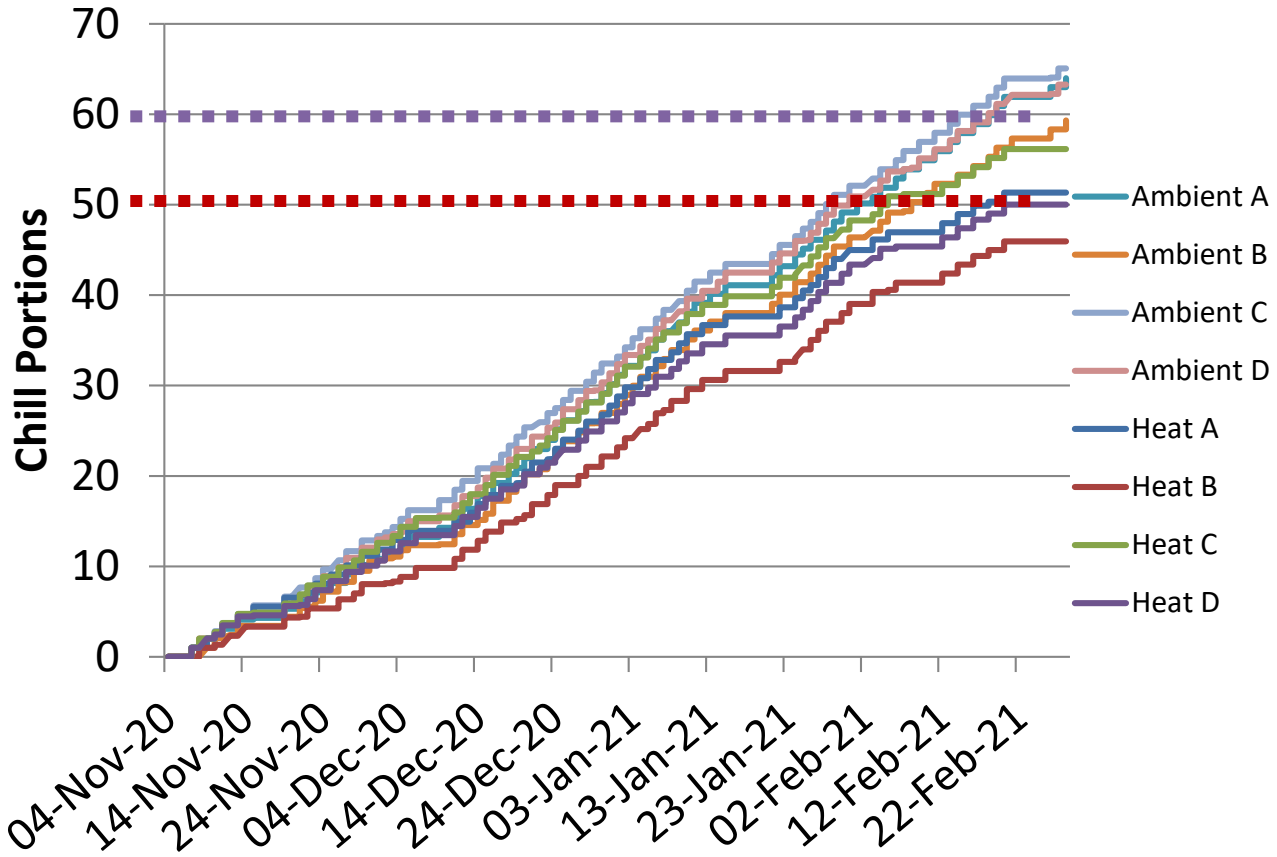
Results: Heating

Goal:

↑ 3˚ F, ↓ ~20% chill (50 CP)

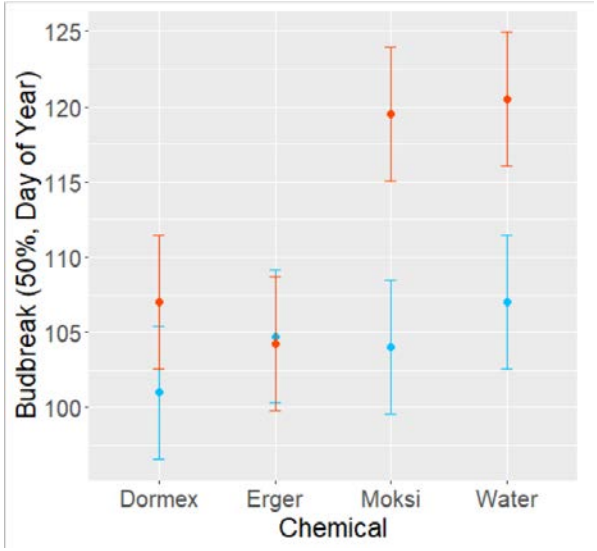
Heat ON between 39- 52˚ F

(Window where ↑ 5˚ F eliminates or reduces modeled chill)



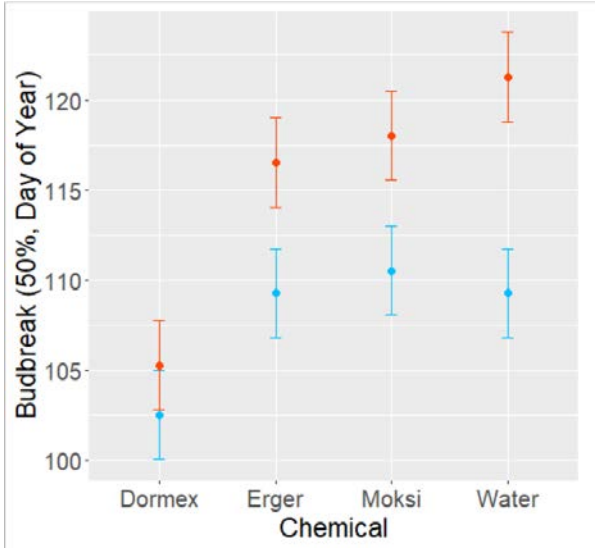
Results: Budbreak Timing

Catkin 50% Budbreak



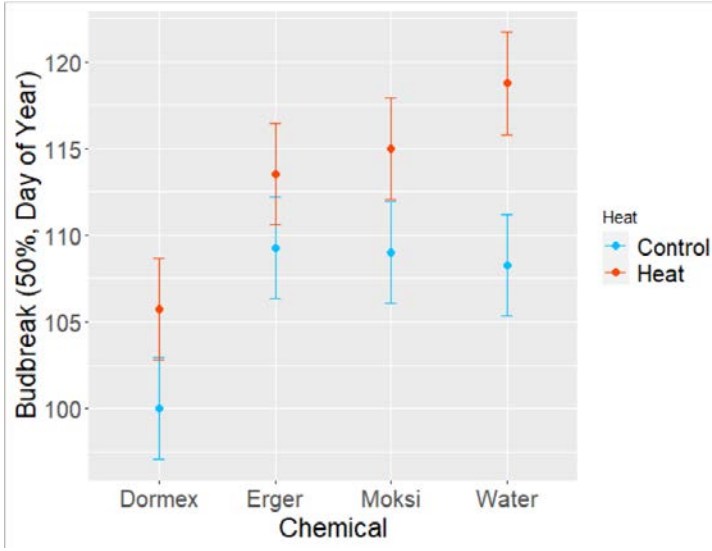
Treatments	Control		Heated	
Dormex	101	n.s.	107	a
Erger	105		104	a
Mocksi	104		120	b
Water	107		121	b

Terminal Veg 50% Budbreak



Treatments	Control		Heated	
Dormex	102	a	105	a
Erger	109	b	116	b
Mocksi	110	b	118	bc
Water	109	b	121	c

Lateral Veg 50% Budbreak



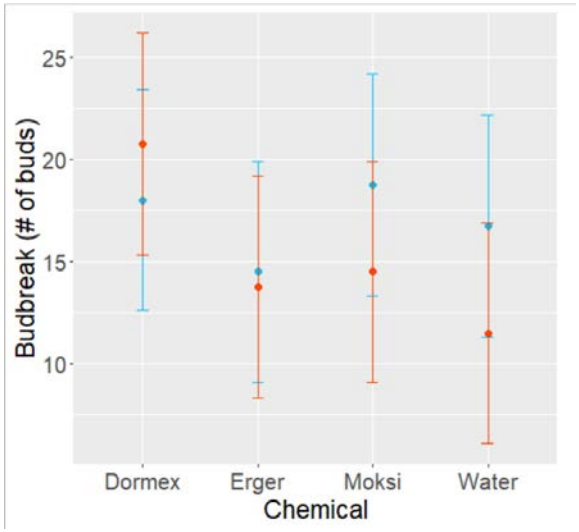
Treatments	Control		Heated	
Dormex	100	a	106	a
Erger	109	b	113	b*
Mocksi	109	b	115	bc
Water	108	b	119	c

(water)

Hydrogen Cyanamide moves budbreak earlier, regardless of sufficient/insufficient chill.
Erger moves budbreak earlier when chill is insufficient.

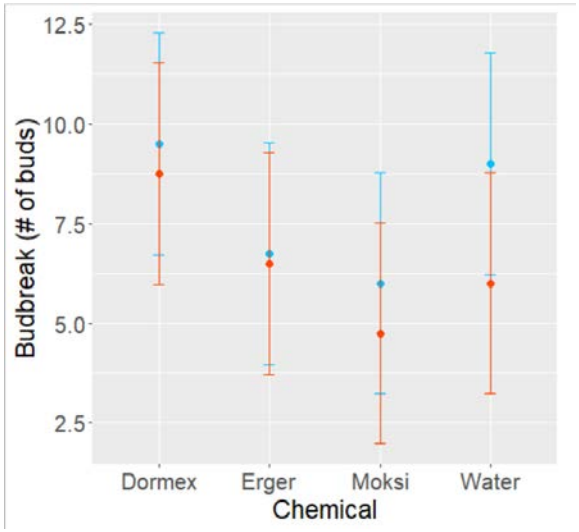
Results: Number of Buds Break

 # Terminal Fem Budbreak



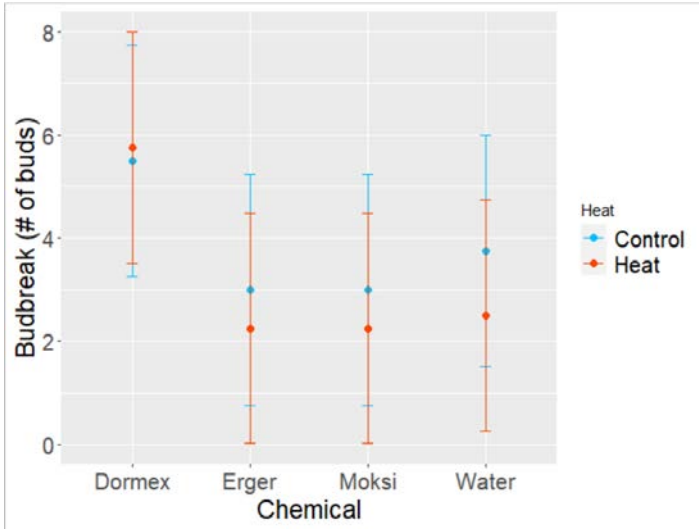
Treatments	Combined	
Dormex	19.8	a
Erger	14.1	b
Mocksi	16.6	ab
Water	14.1	b

 # Lateral Veg Budbreak



Treatments	Combined	
Dormex	9.1	a
Erger	6.6	ab
Mocksi	5.4	b
Water	7.5	ab

 # Lateral Fem Budbreak



Treatments	Combined	
Dormex	5.6	a*
Erger	2.6	b
Mocksi	2.6	b
Water	3.1	b

Note: Lat Fem - Lat Veg interaction
Possible mild decrease in budbreak from Erger.
Increase in budbreak with hydrogen cyanamide.
Need to monitor more, and more robust lateral buds next year.

Conclusions 2020-2021

- Hydrogen cyanamide @ 4% consistently different from water, regardless of ambient/low chill.
- Erger only different from water under low chill.

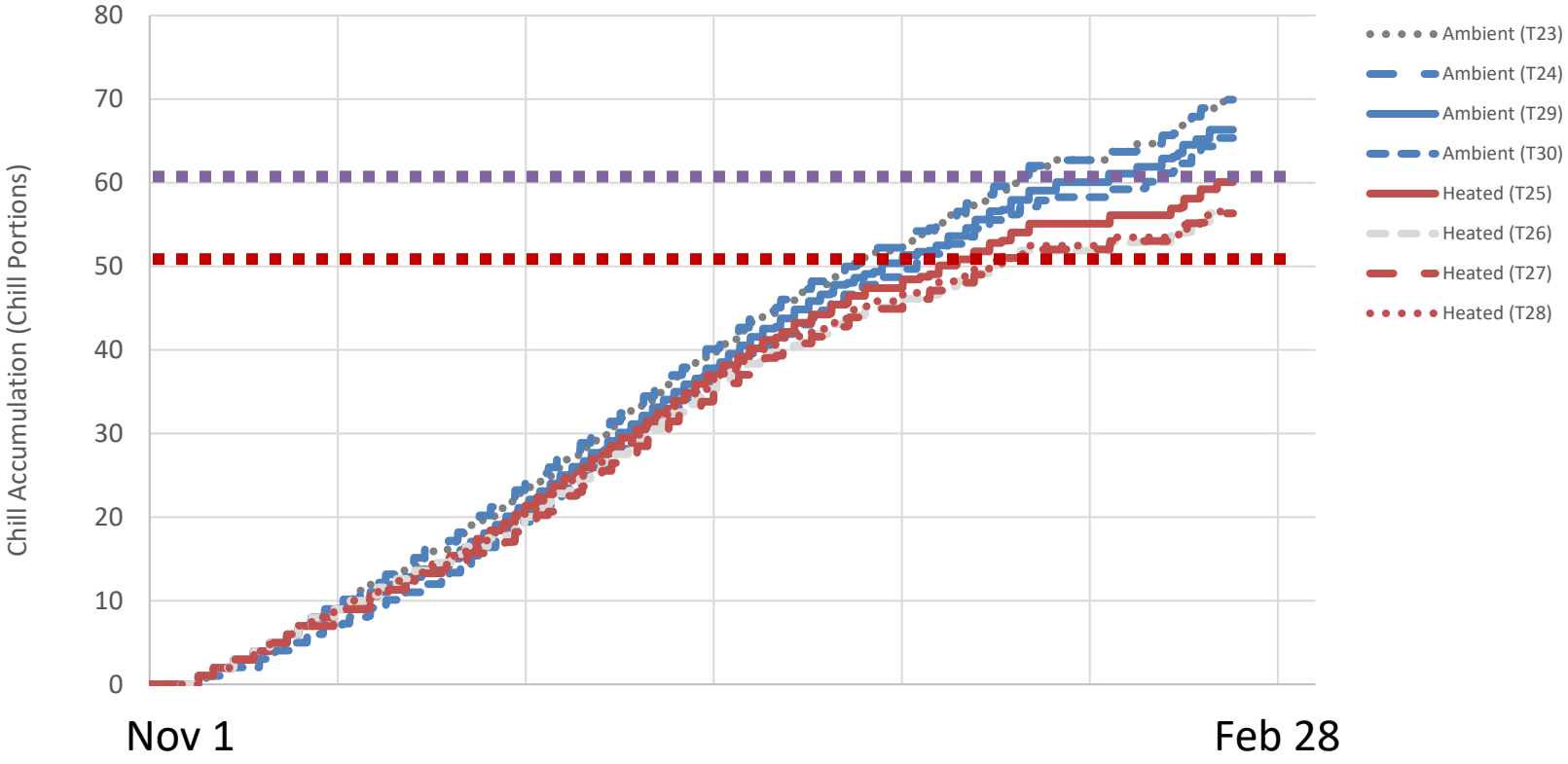
Rest Breakers 2021-2022

Split Plot Design, Rest Breakers as Sub Effect

Treatment	Rate	Adjuvant	Rate	Date
Water (Control)	n/a	n/a	n/a	3/7/2021
Mocksi® (CPPU)	20 ppm	PentraBark	0.2%	3/9/2021
CAN-17	20% (by vol)	Rainier EA	0.1%	3/8/2022
Dormex® (Hydrogen cyanamide)	2%	Latron	0.25%	3/9/2021

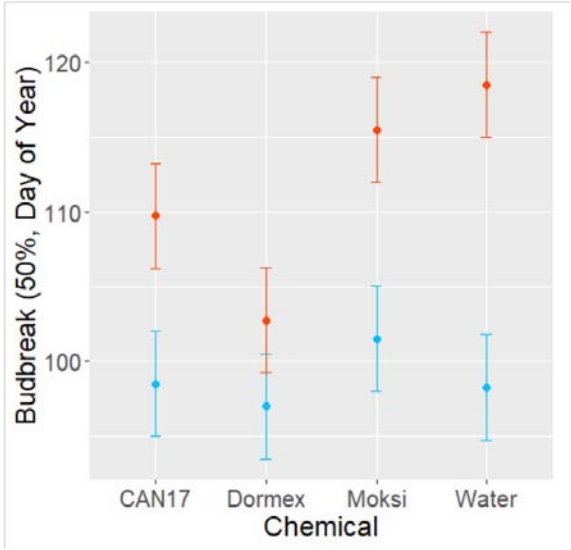
BellSpray Inc R & D JR-203S CO2 backpack sprayer (3 liter bottles)
150 gallons per acre equivalent (sprayed to drip), max 538 mL per scaffold,

Chill Accumulation, 2021-2022



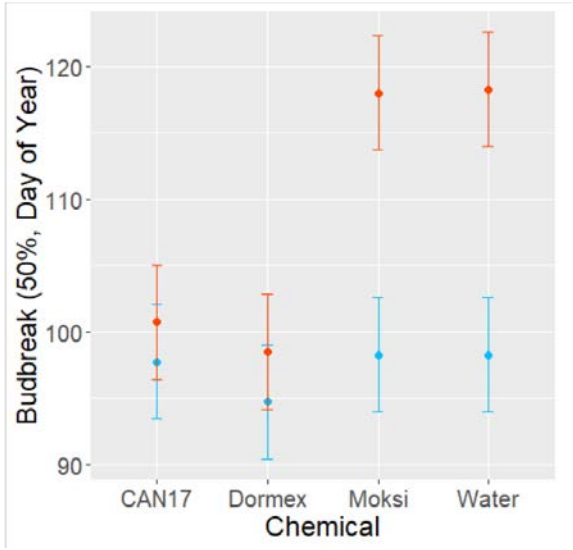
Budbreak Timing 2022

Catkin 50% Budbreak



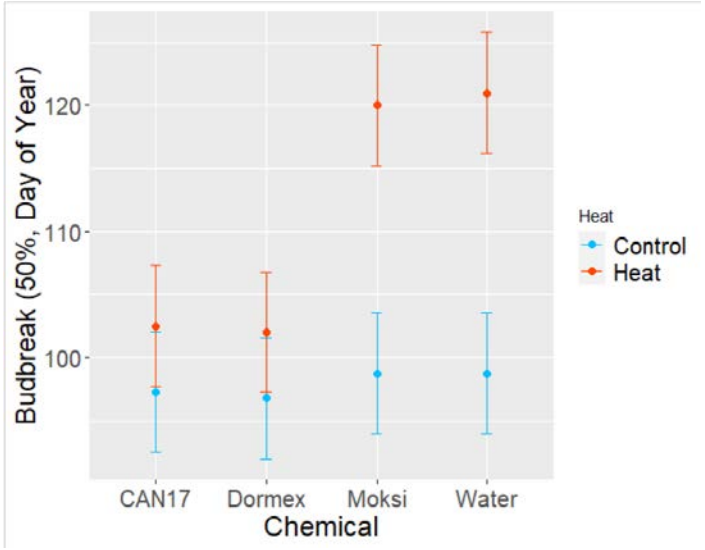
Treatments	Control		Heated	
Dormex	99	a	103	a
CAN-17	97	ab	110	b
Mocksi	102	b	115	c
Water	98	ab	118	c

Terminal Veg 50% Budbreak



Treatments	Control		Heated	
Dormex	95	n.s.	99	a
CAN-17	98		101	a
Mocksi	98		118	b
Water	98		118	b

Lateral Veg 50% Budbreak



Treatments	Control		Heated	
Dormex	97	n.s.	102	a
CAN-17	97		103	a
Mocksi	99		120	b
Water	99		121	b

Hydrogen Cyanamide & CAN-17 move budbreak earlier under insufficient chill.

Budbreak Duration, % Total 2022

Duration of budbreak (10% to 90%) by bud type in 2022.

	Terminal Vegetative				Lateral Vegetative			
	Control		Heated		Control		Heated	
Water	15.2	n.s.	23.0	a	12.5	n.s.	21.5	n.s.
Mocksi	16.5		17.7	a	13.5		19.5	
CAN-17	12.8		17.2	a	10.5		15.5	
Dormex	9.5		12.7	b	8.8		15.7	

Percent of total budbreak by bud type in 2022. *p = 0.0799

	Male				Terminal Vegetative				Lateral Vegetative			
	Control		Heated		Control		Heated		Control		Heated	
Water	100	n.s.	96	b*	92	n.s.	79	b	45	n.s.	25	n.s.
Mocksi	100		99	a	94		75	b	39		29	
CAN-17	98		94	b	91		78	b	49		29	
Dormex	100		100	a	92		92	a	41		34	

Conclusions So Far…

Budbreak timing

- Hydrogen Cyanamide @ 4% consistently different from water, regardless of ambient/low chill.
- Erger, Hydrogen Cyanamide @ 2%, CAN-17 different from water under low chill.

Percent budbreak

- Trend, though not always statistically significant, of increased budbreak with hydrogen cyanamide (2% and 4%)

Future Plans

- 2022-2023
  - CDFA Greenhouse Trial
  - Grower orchard & Nickels Soils Lab for yield data
  - Continue heated UCD trees – 1, 2, & 4% Dormex
- 2023-2025
  - CDFA Greenhouse Trial
  - Grower orchard & Nickels Soils Lab for yield data

NEED Southern San Joaquin Grower Site

Thank you!
Questions?

cdfa
CALIFORNIA DEPARTMENT OF FOOD & AGRICULTURE

California WALNUTS

BIG THANKS to the Hanson lab, esp Brad & Seth. And Dave w/ WIP.
Also Flo, Themis & Jim.
&
AlzChem, Erger & Simplot