

Chill Accumulation in Peaches

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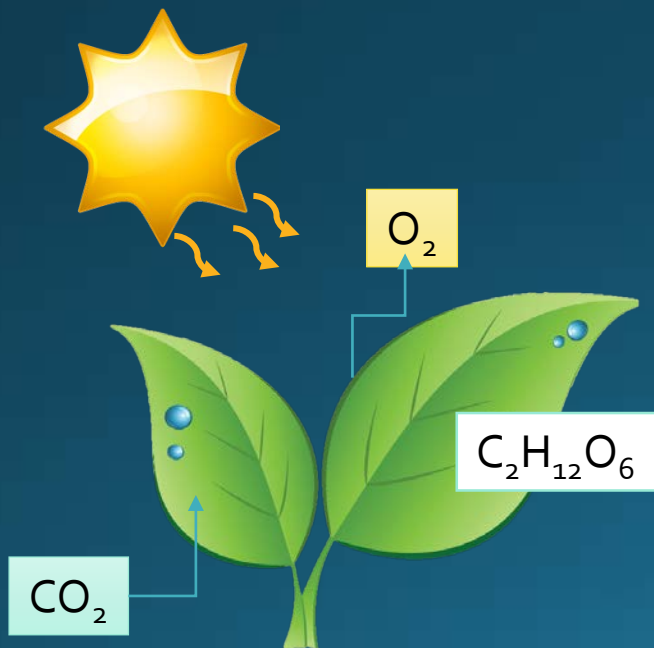
Why is Chill Accumulation Important?

- Leaf emergence



Why is Chill Accumulation Important?

- Low-chill peaches have a short *fruit developmental period* –
 - 78-95 days
- Early leaf area is important for sugar development (carbohydrates)



Fruit Quality

- Poor leaf area early due to low chill accumulation =



Bad Fruit Quality!

How Do We Accumulate Chill?

- Different varieties require different amounts of chill
- **Flower buds** need less cold weather than the **vegetative buds**

In low chill accumulating years:

- **Flower buds** break, bloom and set fruit
- **Vegetative buds** may be delayed in pushing out and creating mature leaves

The Two Levels of Chill: Ecodormancy

- Buds on the fruit or nut tree/bush/vine are dormant due to **environment**.
 - Water stress
 - Cold temperatures
 - Shortening of the daylength (photoperiod)
 - *Photoperiod* – length of light and dark periods affect plant processes



The Two Levels of Chill: Endodormancy

- Buds are dormant due to internal physiological blocks
 - Despite ideal environmental conditions
 - Chilling conditions above freezing end physiological block
- Advantages:
 - Keeps plants dormant during fluctuating temperatures
- Subtropical climate and frequency of entering this stage?

Chilling requirements

- Measured based on different models
 - **Standard method – chill hour**
 - Anything less than 7.2°C = chill unit accumulation
 - **32-45°F Model**
 - Used most commonly across multiple crops.
 - AgroClimate (<http://agroclimate.org/tools/Chill-Hours-Calculator/>)
 - ***Utah chill model*** (Richardson et al., 1987)
 - Temperatures between 1.6-12.5°C promote chill accumulation
 - 7°C is ideal (1 hr. @ 7°C = 1 chill unit)
 - Warmer temperatures negate (take away) chill
 - **Dynamic method – chill portion**
 - e.g. 1 portion = 28 hours at 6°C
 - More recent, used with chemical rest-breaking agents such as hydrogen cyanamide (cherries in California)

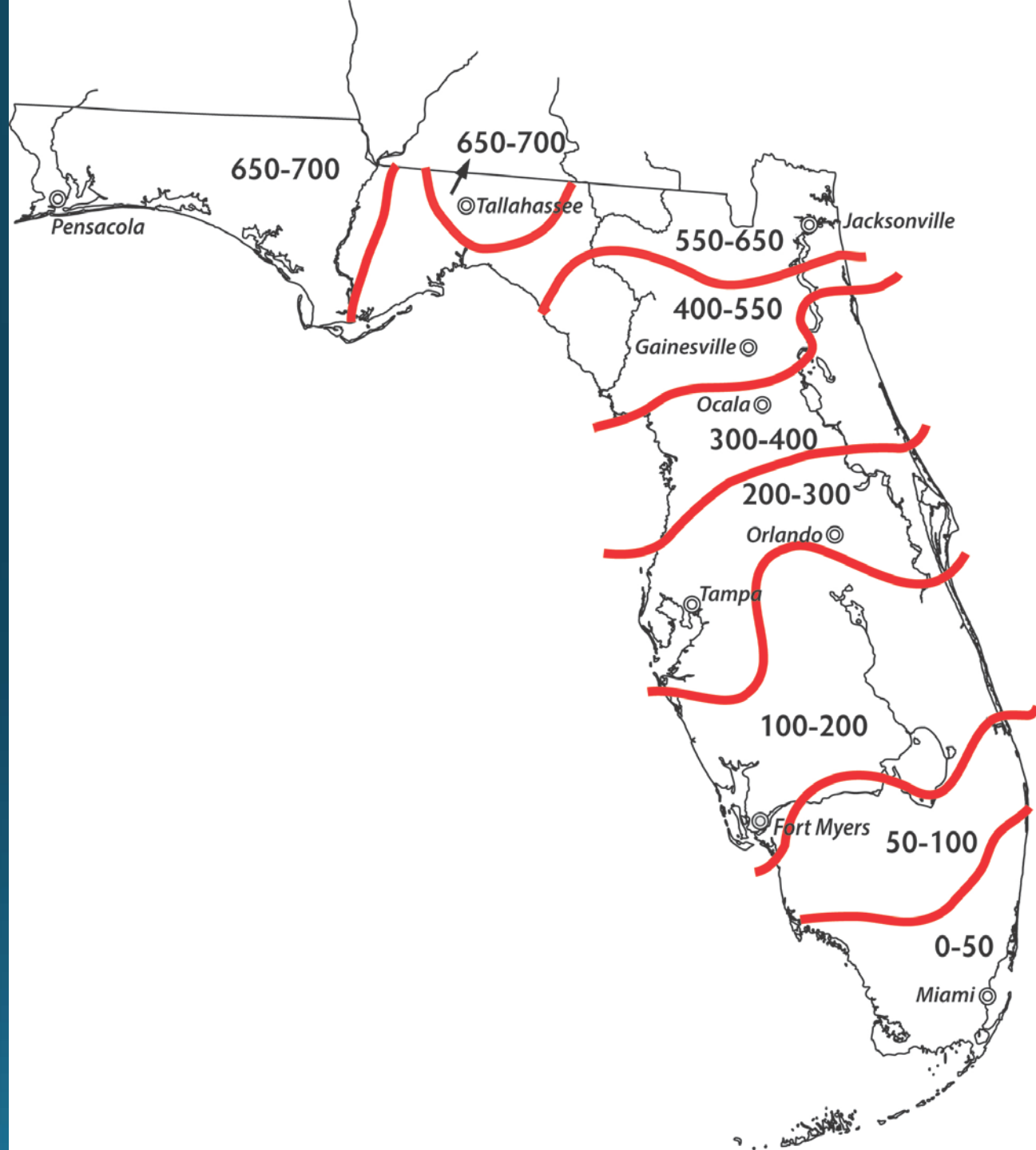
Utah Chill Model

- Allows for addition and subtraction of chill units accumulated over winter

Temperature	Chill Unit
< 34.5°F	0.0
34.7 – 36.5°F	0.5
36.6 – 48.4°F	1.0
48.5 – 54.3°F	0.5
54.5 – 60.6°F	0.0
60.8 – 64.4°F	-0.5
> 64.5°F	-1.0

Historical Chill Unit Accumulation

**Based on hours below 45°F received to Feb. 10th in 75% of the winters



2013-14 Chill Accumulation

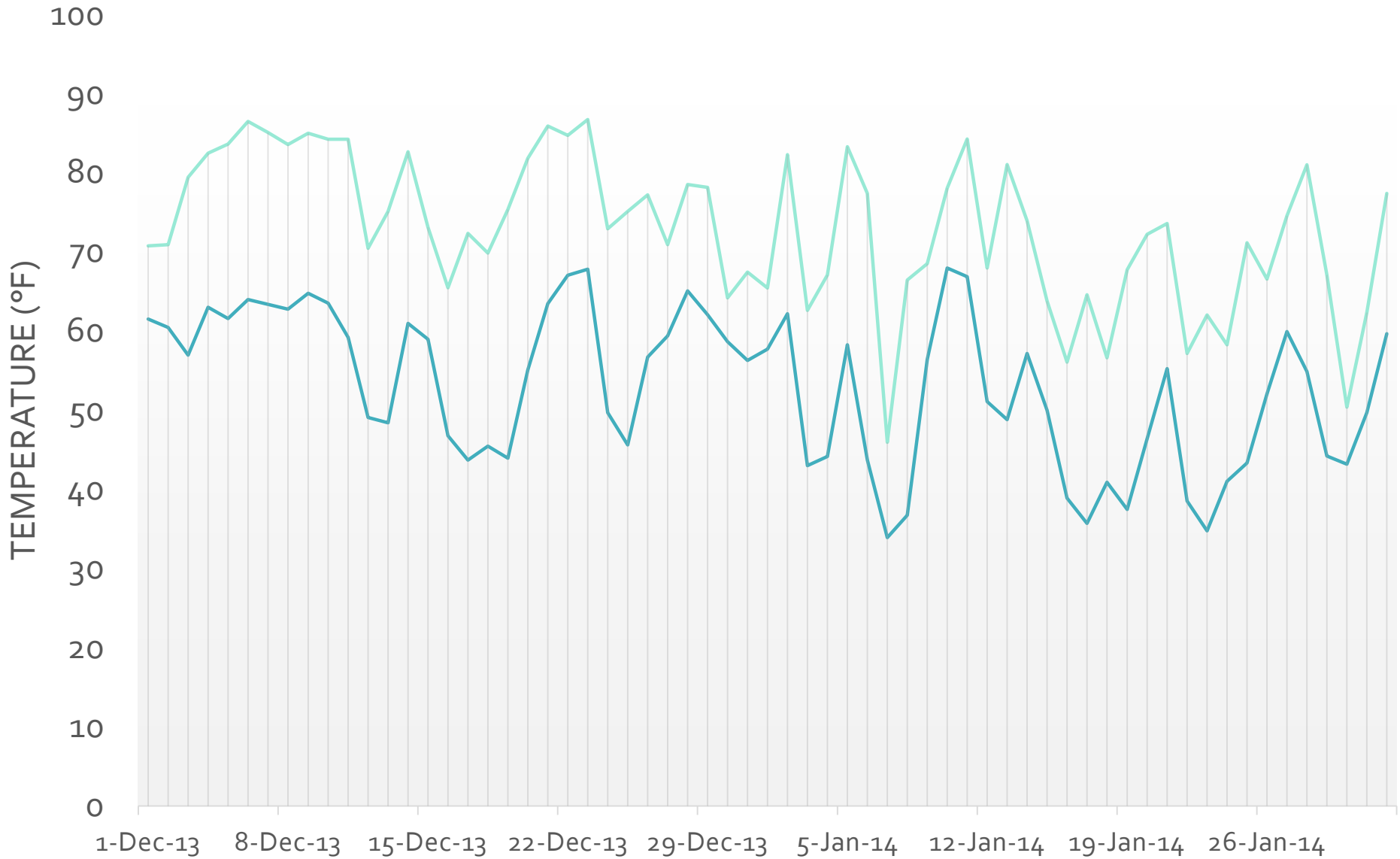
October 1, 2013 – February 28th, 2014

<i>Model</i>	Citra	Fort Pierce	Lake Alfred
Standard Chill (<45°F)	417	97	85
AgroClimate (32-45°F)	382	72*	144
Utah Chill Model	-1027	-1828	-474
Dynamic Portion Model	20 chill portions	3 chill portions	2 chill portions
<i>Historical Average (FAWN)</i>	368	224*	209

*Sebring, FL is closest station

Lake Alfred, FL

— Maximum Temp. — Minimum Temp.

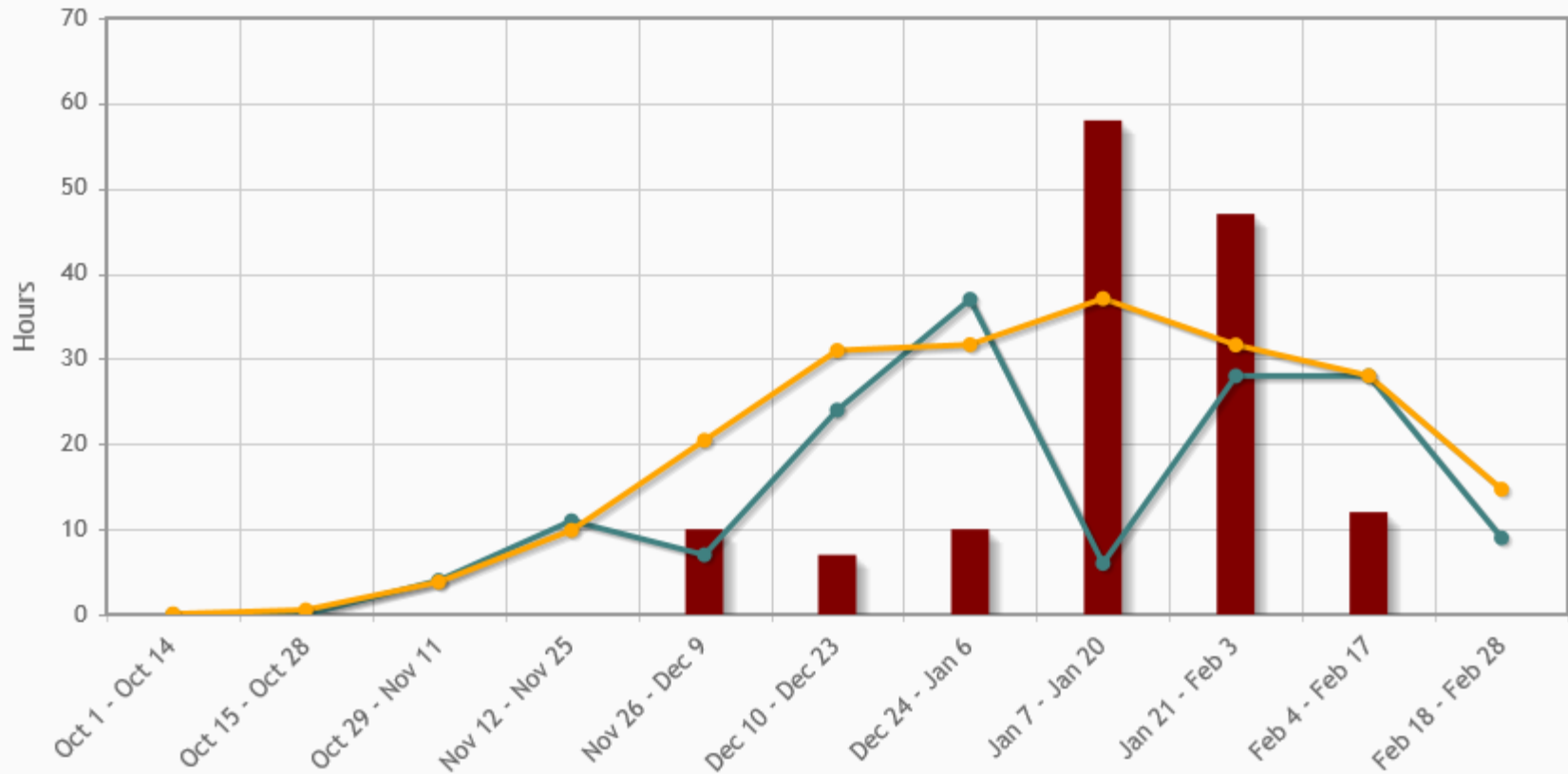


Temperature: 32-45 °F - Polk County (FL)

Period [Oct 1, 2013 - Feb 28, 2014]:	This season	144 Hours
	Last season	154 Hours
	Historic average	209 Hours

■ Current accumulation
 ■ Historic Average
 ■ Last season

Accumulated by 14 day periods



Warm Winter Weather Impacts

- Cancellation of chill units accumulated
- How far back?
 - 2-3 days at most
 - *Modified Utah Chill Model*
- Phenological stage (Bud Break → Fruit Set)
 - Citra, FL
 - Bloom = February 6-7, 2014

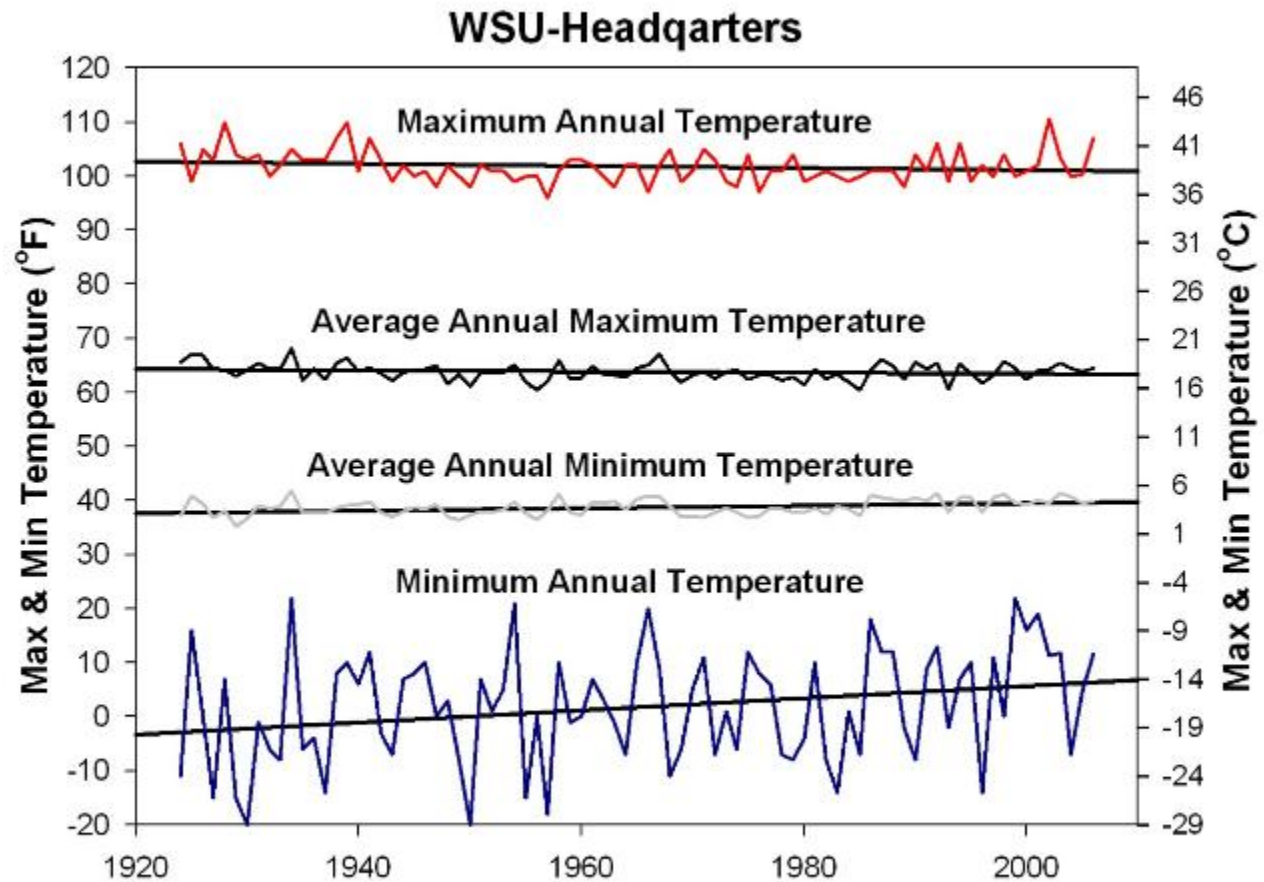
	Oct. 1 – Jan. 1	Oct. 1 – Feb. 1	Oct. 1 – Mar. 1
AgroClimate (32-45°F)	163	315	382

Short-Term Historical Averages

- Low chill accumulation – past 2-3 years

Year	Tallahassee	Jacksonville	Alachua	Lake Alfred	Fort Pierce	Immokalee
	(Monticello)	(Macclenny)				
2000-2001	NA	NA	582	314	210	202
2001-2002	NA	NA	391	134	88	86
2002-2003	NA	714	712	317	253	247
2003-2004	647	490	516	192	103	177
2004-2005	571	510	495	170	129	174
2005-2006	570	529	530	193	147	184
2006-2007	540	442	419	101	64	66
2007-2008	512	440	385	123	49	66
2008-2009	517	505	490	246	138	196
2009-2010	664	519	503	306	235	237
2010-2011	778	679	646	371	223	227
2011-2012	452	333	343	115	86	94

Change in Prosser, WA-1924-2005



Dealing with Low Chill Accumulation

- What can be done?
- Variety selection
 - Choose variety with a chill unit requirement that is 75% of historical average
 - 350 chill units = 262 chill units
 - Gulfking → UFOne
- Evaporative cooling of buds
 - Desert climate (Israel)
 - Need low daytime relative humidity to allow for evaporative cooling
 - Wet conditions may increase root diseases
- Can you replace chill with chemicals?

Replacing Chill?

- Hydrogen cyanamide
 - Rest-breaking chemical
 - Helps leaves to break bud sooner
- Used in Florida blueberry production frequently
 - Use low volumes
 - 0.75 to 1.0%
 - Flower bud damage can occur with higher rates
 - Timing is critical



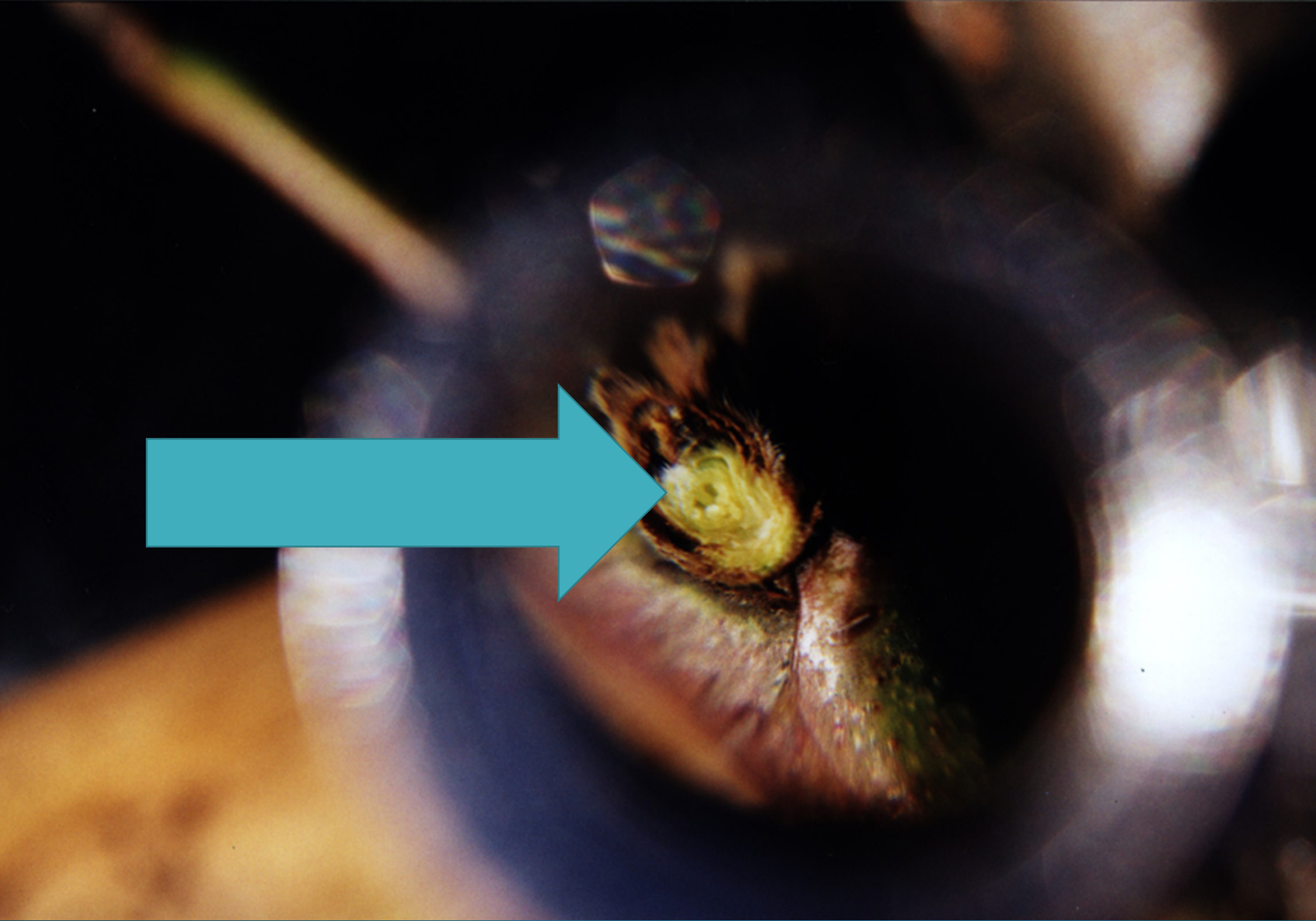
Hydrogen Cyanamide in Peaches

- Research at Auburn University (Dr. Powell)
 - Different rates:
 - 0.5% to 2.0%
 - Over 2.0% = overthinning of flower buds due to bud damage
 - Can replace up to 250 to 290 chill hours
 - Tests done on 'Ruston Red' = 850 chill unit requirement
 - Will that be less if we use lower chill peaches? When are the buds receptive?
 - Can cause early bloom
- Question for FL:
 - How much chill can be replaced?
 - What rates should be used?
 - When to apply?

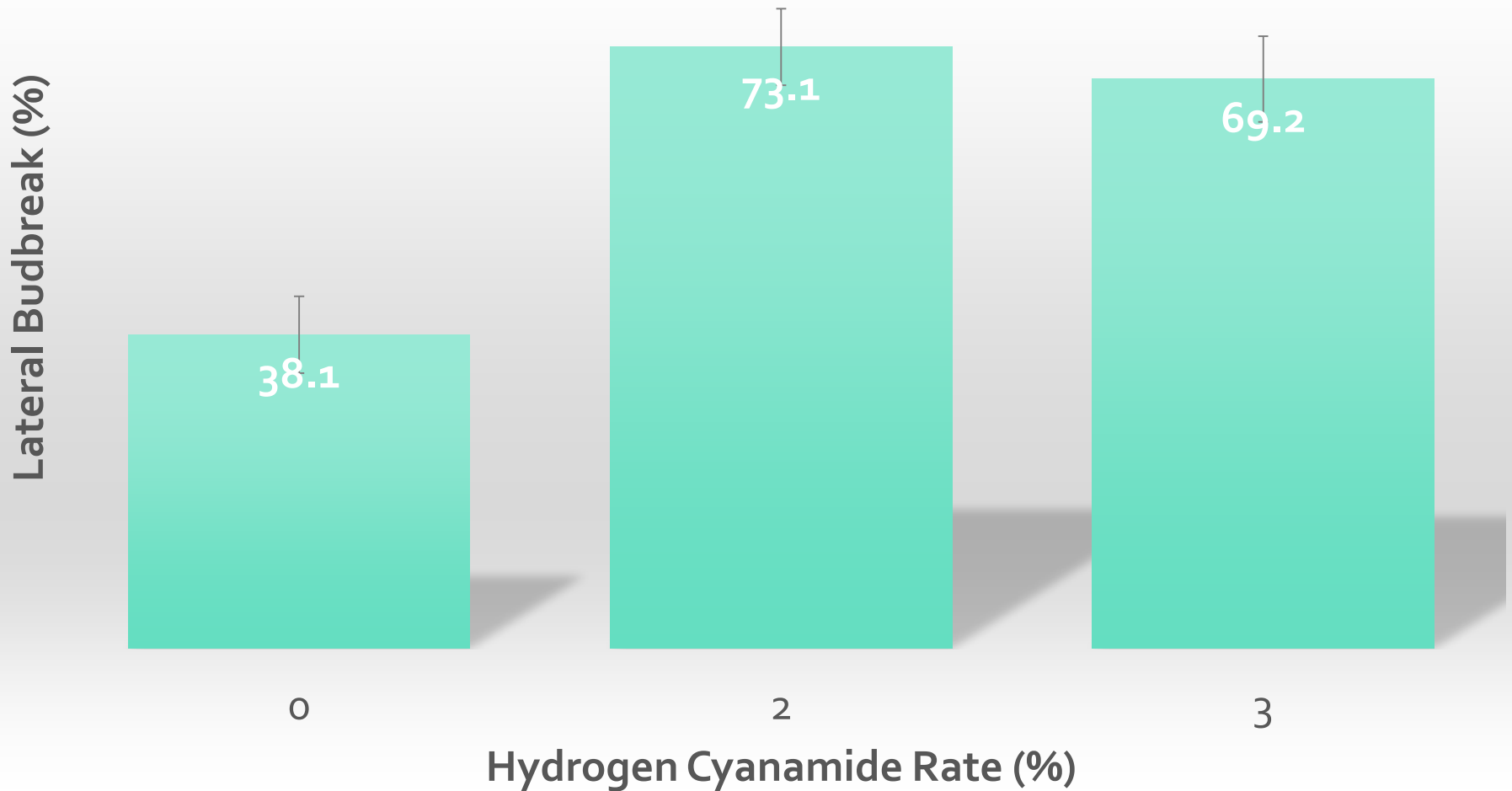
Hydrogen Cyanamide in Florida Peaches

- 'UFSun' and 'UFOne'
- Vero Beach, FL
- Dormex[®] application (v/v)**
 - 2%
 - 3%
 - Used Silwet L-77 Surfactant
 - Sprayed at 125 gpa
- Application = December 17, 2013
 - 3 weeks before anticipated budbreak
- Timing is important – look at pollen grains

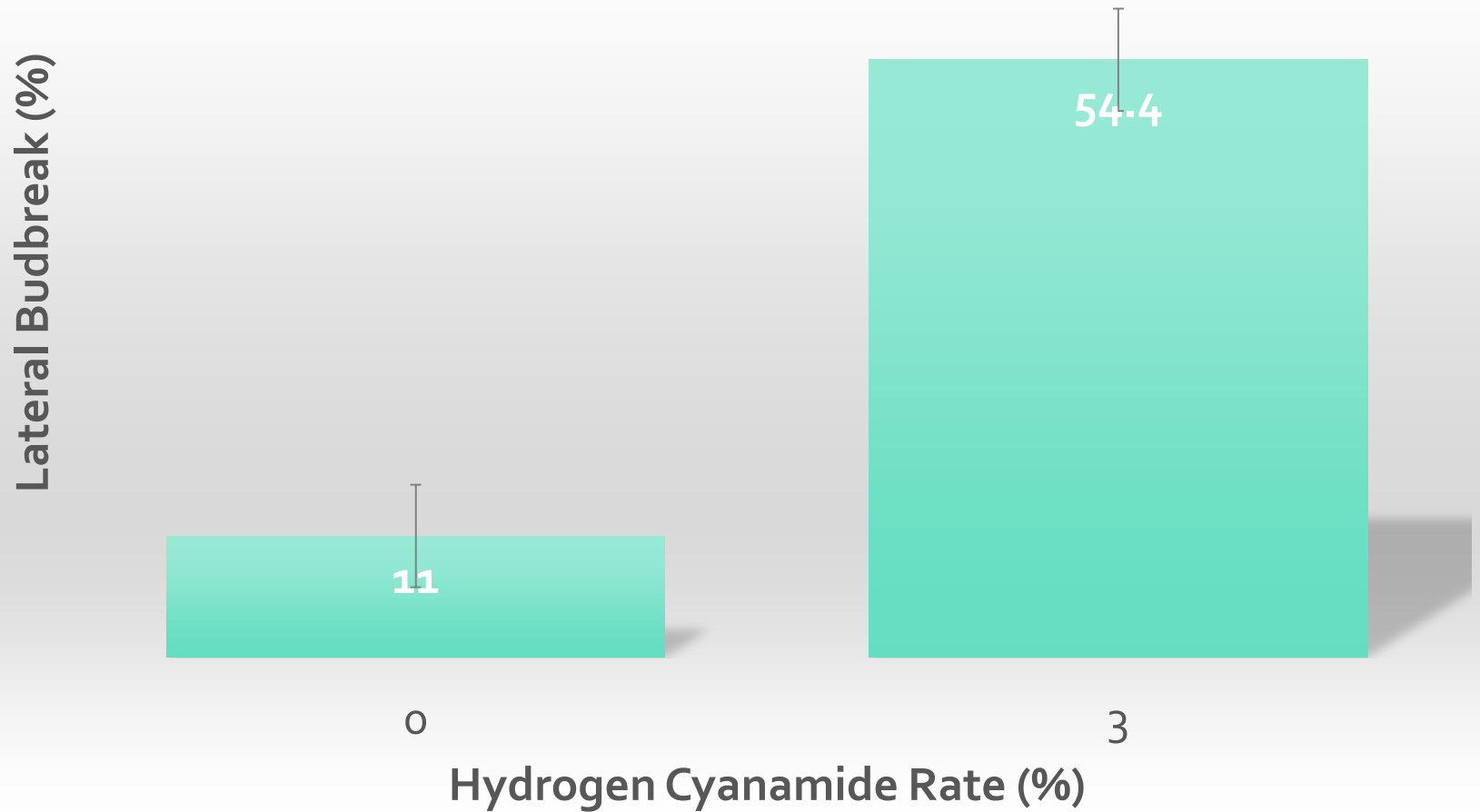
**BudPro also will be tested in 2014-15; did not apply before bloom



HC on 'UFSun'



HC on 'UFOne'



HC on Florida Peaches



February 17, 2014, courtesy of Ryan Atwood.

HC in Florida Peaches

- Data is encouraging
- Need further research
 - Grower cooperators
 - Different formulations
 - Different rates and timing
- **CAUTION!!!**
 - HC is a toxic chemical and there are many restrictions for application and worker protection
 - Buds can be severely damaged if flower buds are swelling
 - Don't spray oil within 2 weeks of HC application

Summary

- Chill is accumulated using several models
 - Low chill peaches don't fit one particular model
 - Warm, humid nights and high disease pressure
- Climate is getting warmer
 - Night temperatures have large impact on acid retention
 - Flavor compounds



Summary

- Cultural techniques aren't perfect to deal with low chill accumulation
 - Variety selection, good frost protection is key
- Chemical alternatives are still open for research
 - *Make sure to have a control for comparison!*



UF Stone Fruit Resources

- Web Page
 - <http://hos.ufl.edu/extension/stonefruit>
- Stone Fruit Growers ListServ
 - Contact Mercy for addition to list
 - Be sure to add address to “safe” list
- Just Peachy Blog
 - <http://ufstonefruit.wordpress.com/>
- EDIS
 - Extension documents
 - <http://edis.ifas.ufl.edu/>