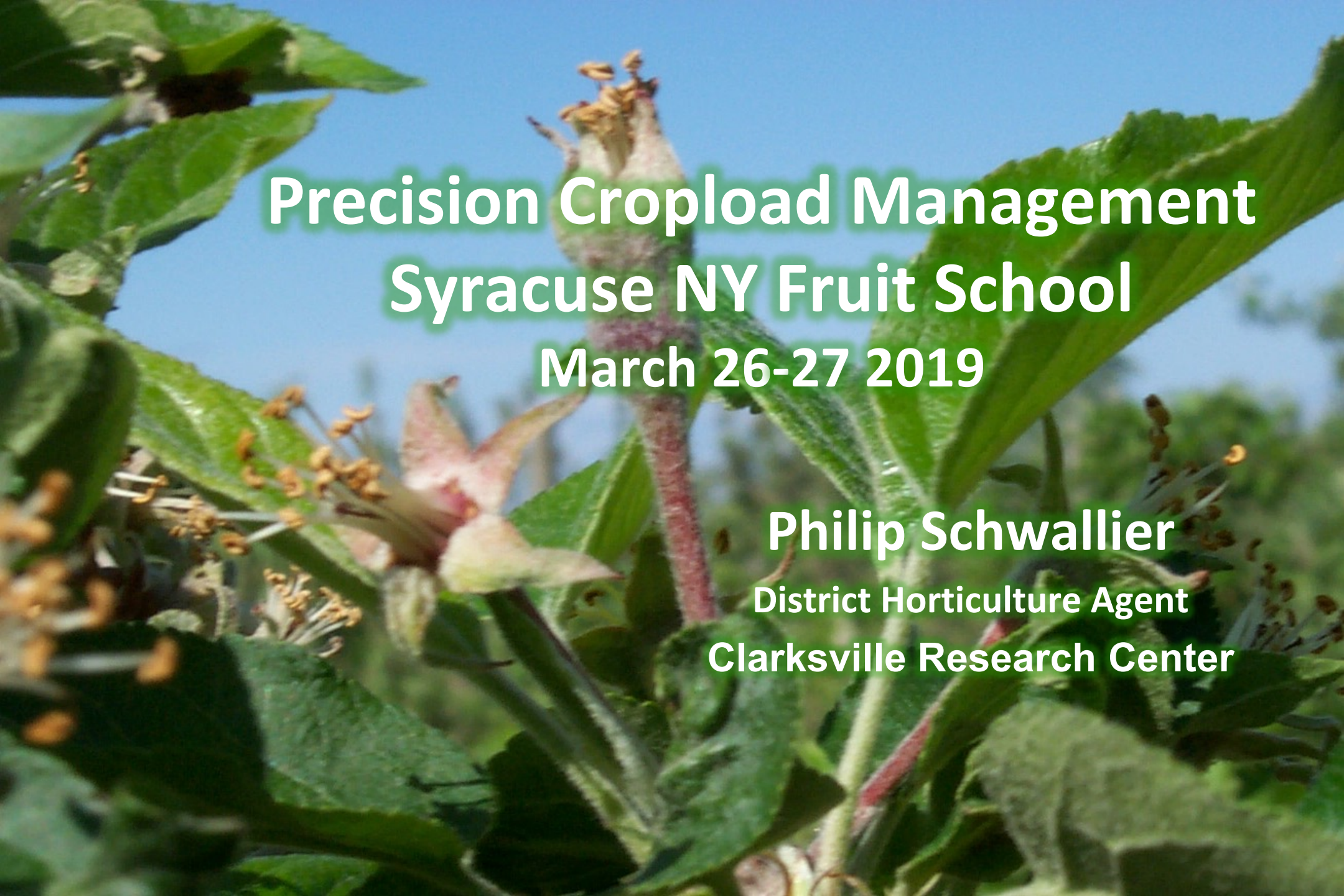


A close-up photograph of a flowering plant, likely a fruit tree, with green leaves and yellow stamens. The text is overlaid on the image.

Precision Cropload Management

Syracuse NY Fruit School

March 26-27 2019

Philip Schwallier
District Horticulture Agent
Clarksville Research Center

Precision Cropload Management

- Adjusting cropload is most important practice.
- Carbohydrate Model
- Predicting Fruitset Model

To set a ideal Cropload

- **You have a plan**
- To be successful
 - Start early
 - Pruning to adjust bud load
 - Use information and tools
 - Plan on multiple chemical applications

What is Precision Cropload Management?

1. Set a **Target** Cropload/Tree.
2. Prune to a Precise **Budload/Tree**.
3. Start Chemical Thinning Early.
4. Use Models to **Predict Success**.
5. Repeat Chemical Thinning as needed.
6. Hand Thin

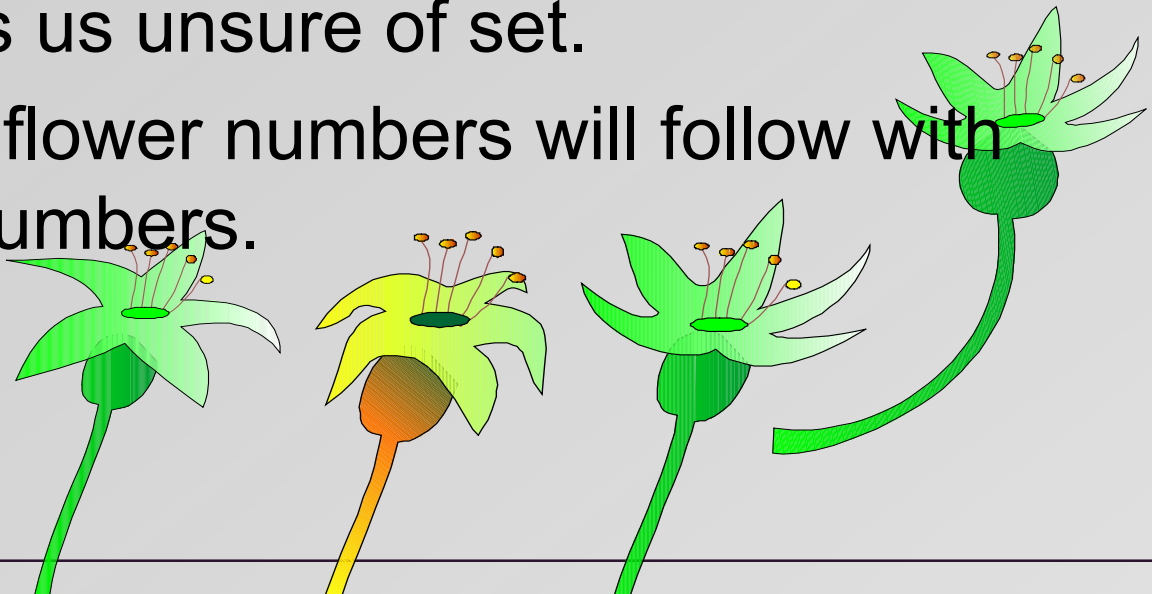
Precision Orchard Management



Early Thinning

We will often let the early thinning window go by because we are unsure of fruit set.

- Trees and fruits are resilient
- Frost, bee activity, pollination, fertilization is unknown.
- All of this makes us unsure of set.
- Abundant initial flower numbers will follow with abundant fruit numbers.



Precision Thinning

Lets thin a little at every opportunity

Less Risk

More Success

More Confidence





100 Apple/tree Target
Yet some blocks have
400 cluster/tree
or 2000 flowers/tree
2X, 4X, 6X



Prune to a 1.5 x budload of target fruit/tree



Use your tools

n Budload Pruning

- | | |
|-------------------|------------|
| –Target Michigan | 1.5x to 2x |
| –Frosty sites | 2x |
| –Good sites | 1.5x |
| –Frost protection | 1.5x |

Statewide Precision Thinning



Statewide Precision Thinning

Initial Flower Load	400 clusters/tree
Target Cropload, MI	100 fruit/tree
Therefore Target	1.5x
70% Underpruned	2x to 3x (5x)
30% Pruned close	1x to 1.25x
Chem Application	1 to 3 Apps
Hand Thinning	30%

Nibble or Precision Thinning Concept

Repeated Concept

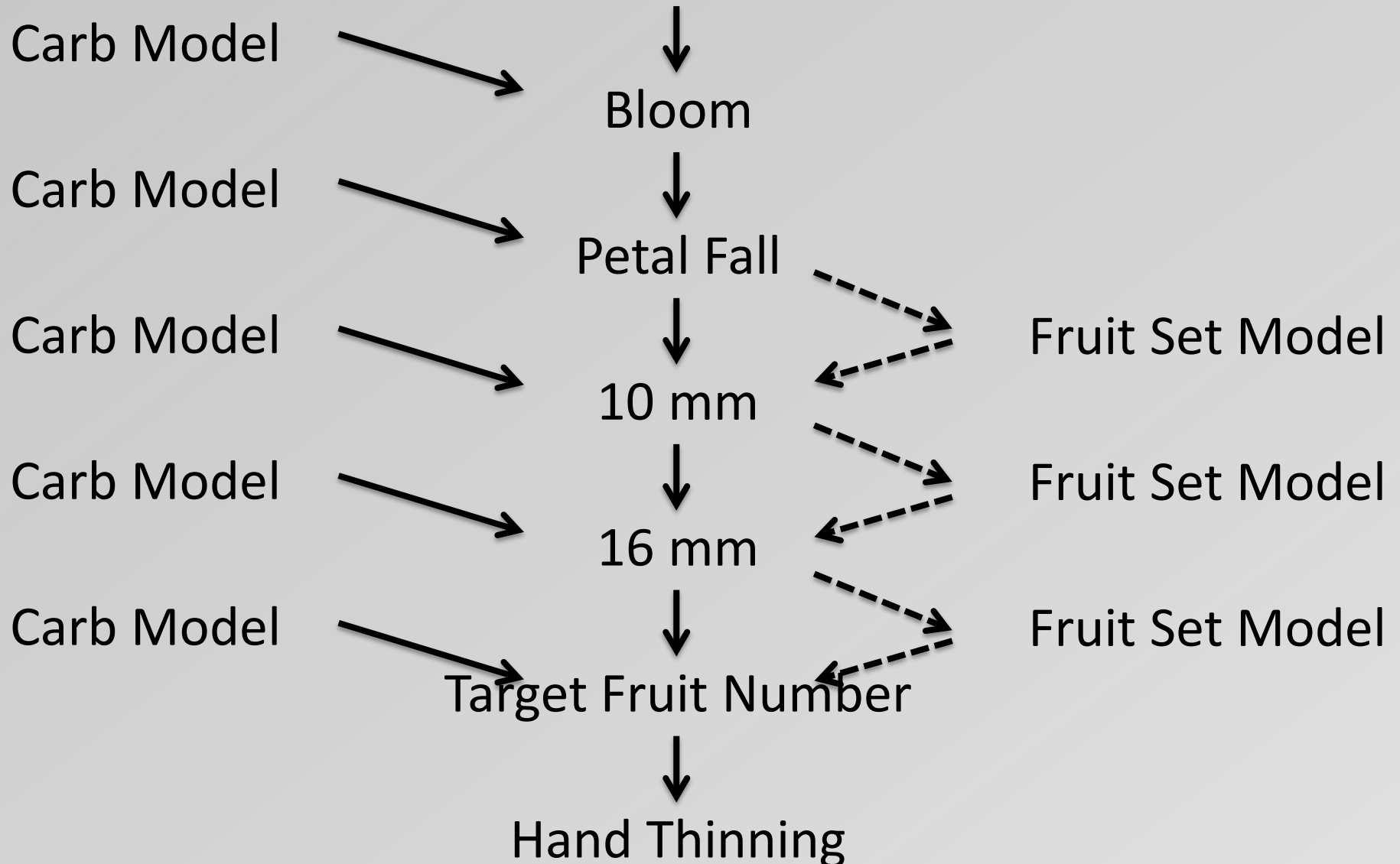
Precision Thinning

- Start thinning early
- Plan multiple sprays.



Precision Cropload Flow Chart

Initial Flower Load



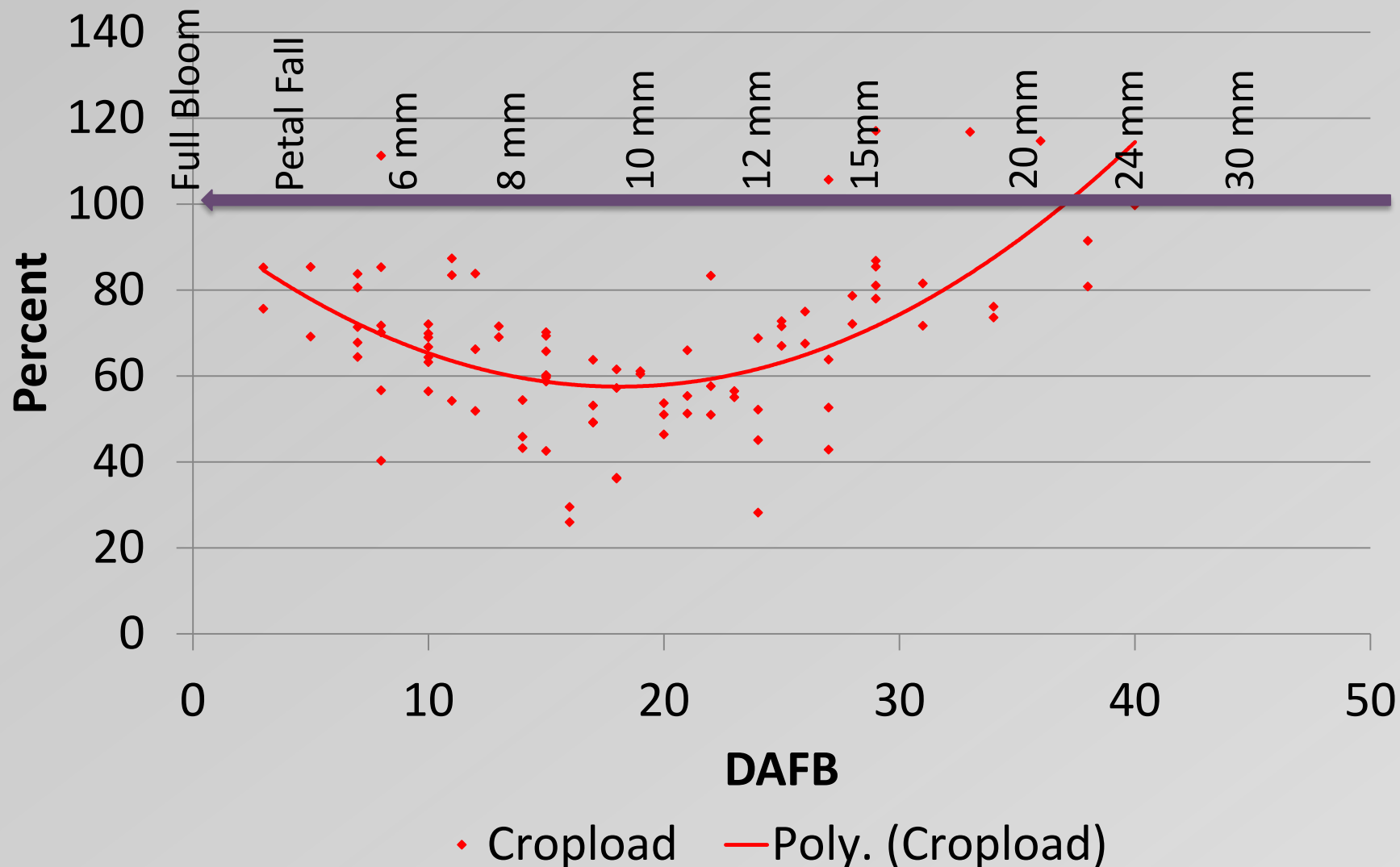
Natural Apple Background Sensitivity to Thinning

We applied **S+M** and **S+N** every 3.5 days to determine when thinning occurred.

Started at PF and ended 28 days later

To Gala for 8 years.

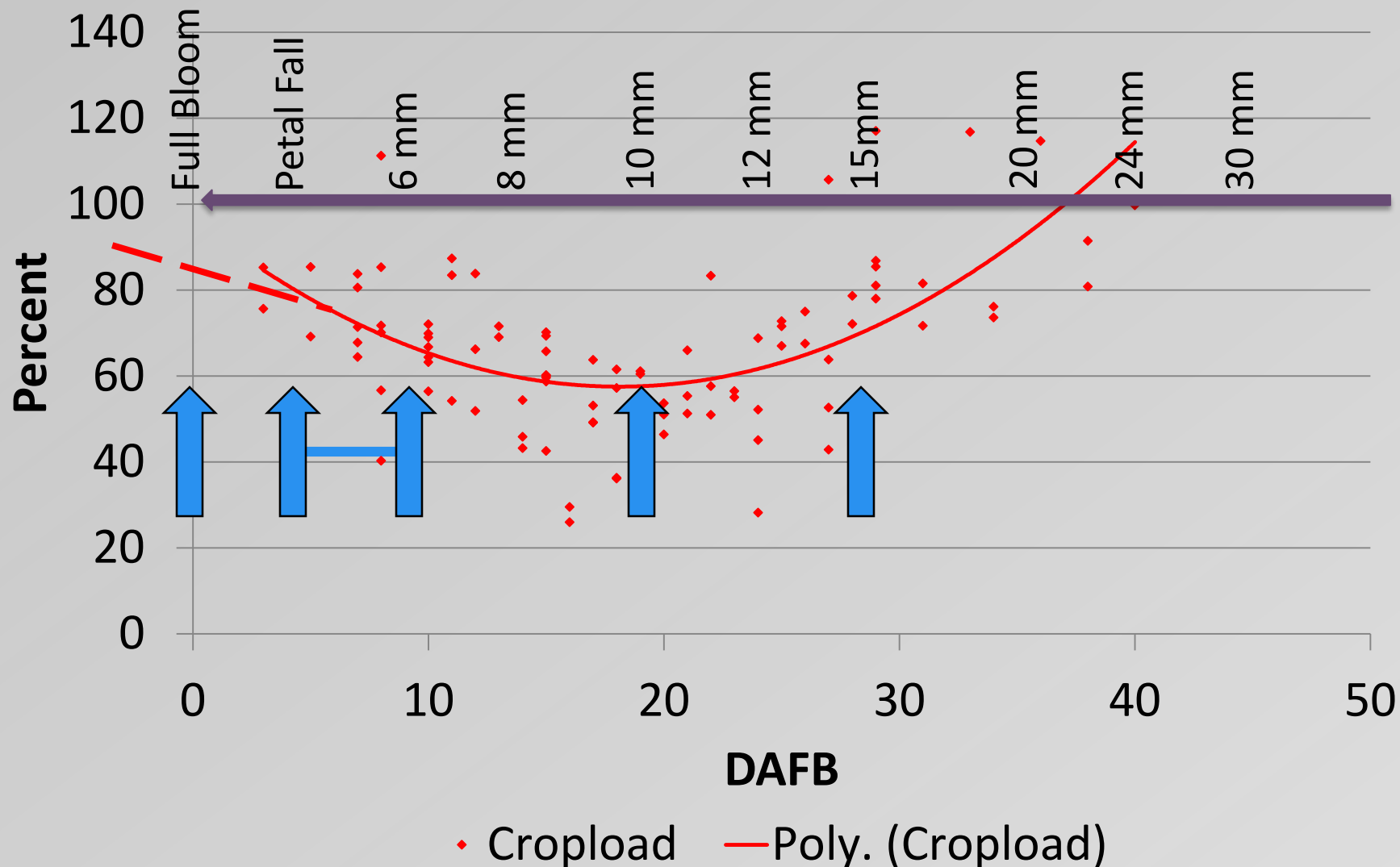
Natural Apple Background Sensitivity to Thinning



CROPLoad = % FRUIT/TREE OF UTC

DAFB=Days After Full Bloom

Natural Apple Background Sensitivity to Thinning

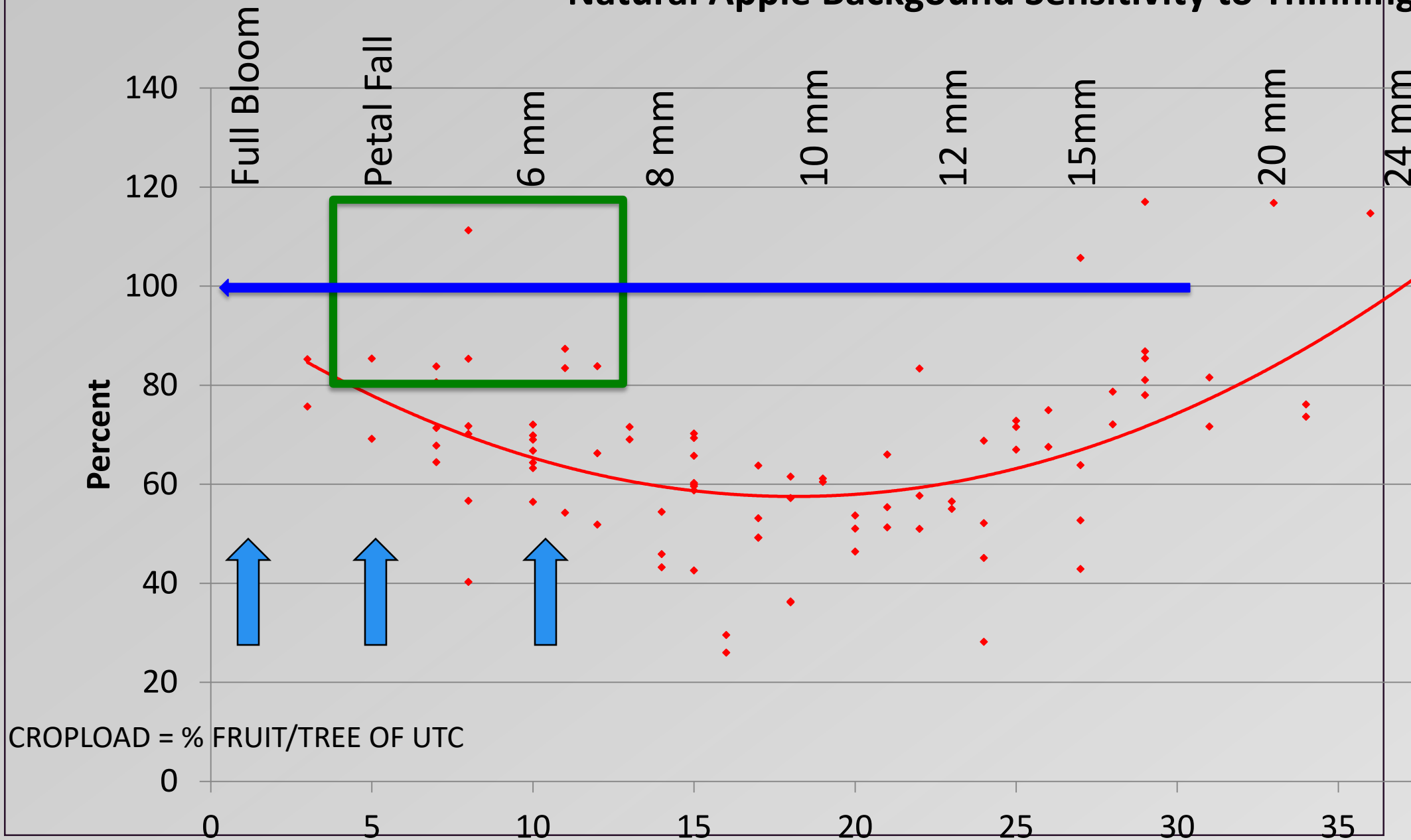


CROPLOAD = % FRUIT/TREE OF UTC

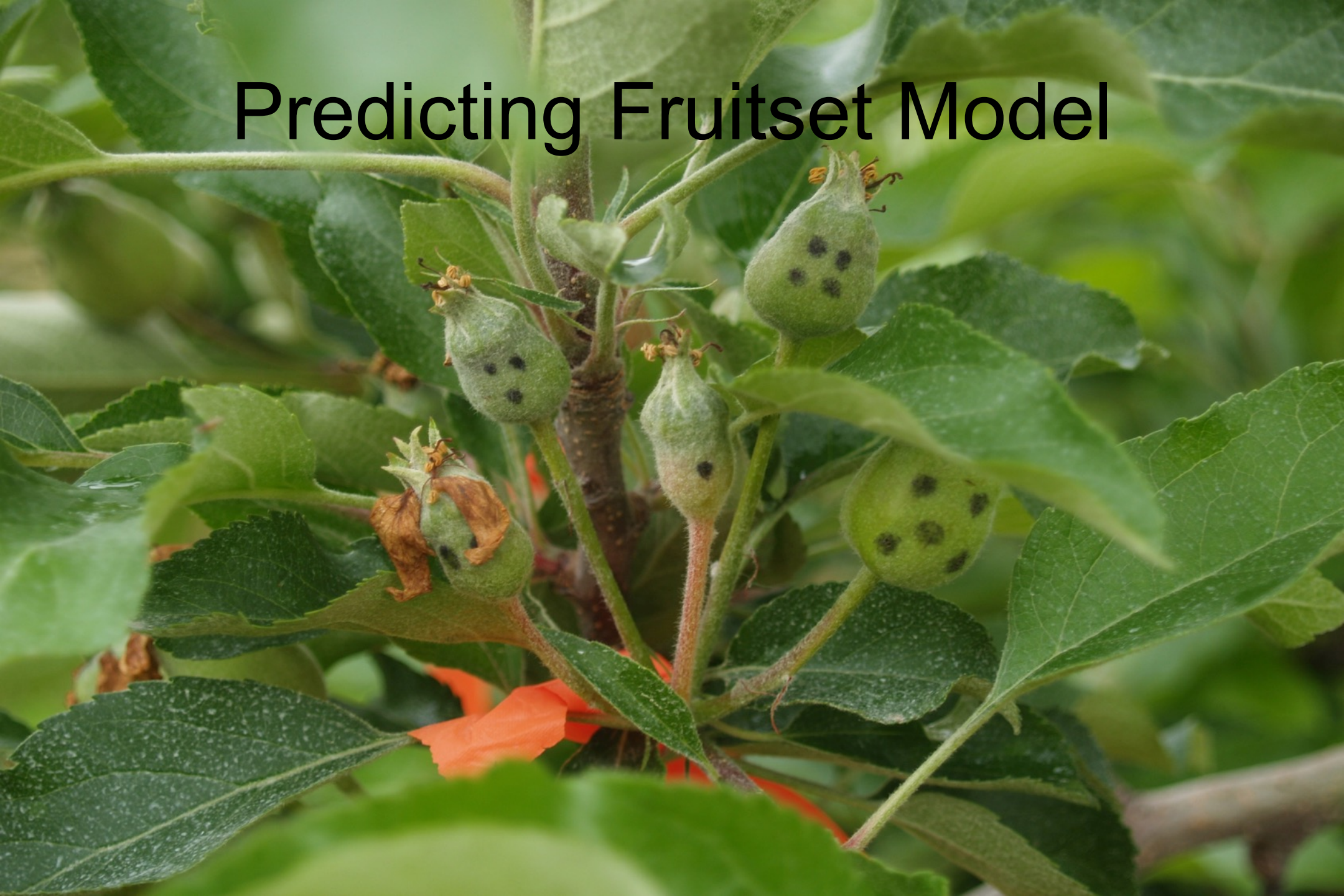
DAFB=Days After Full Bloom

Precision Thinning

Natural Apple Background Sensitivity to Thinning



Predicting Fruitset Model



Mark Clusters

- 15 clusters/tree on 5 trees
- 75 total clusters
- Pink to bloom
- Representative clusters
- Not high or low in tree



100

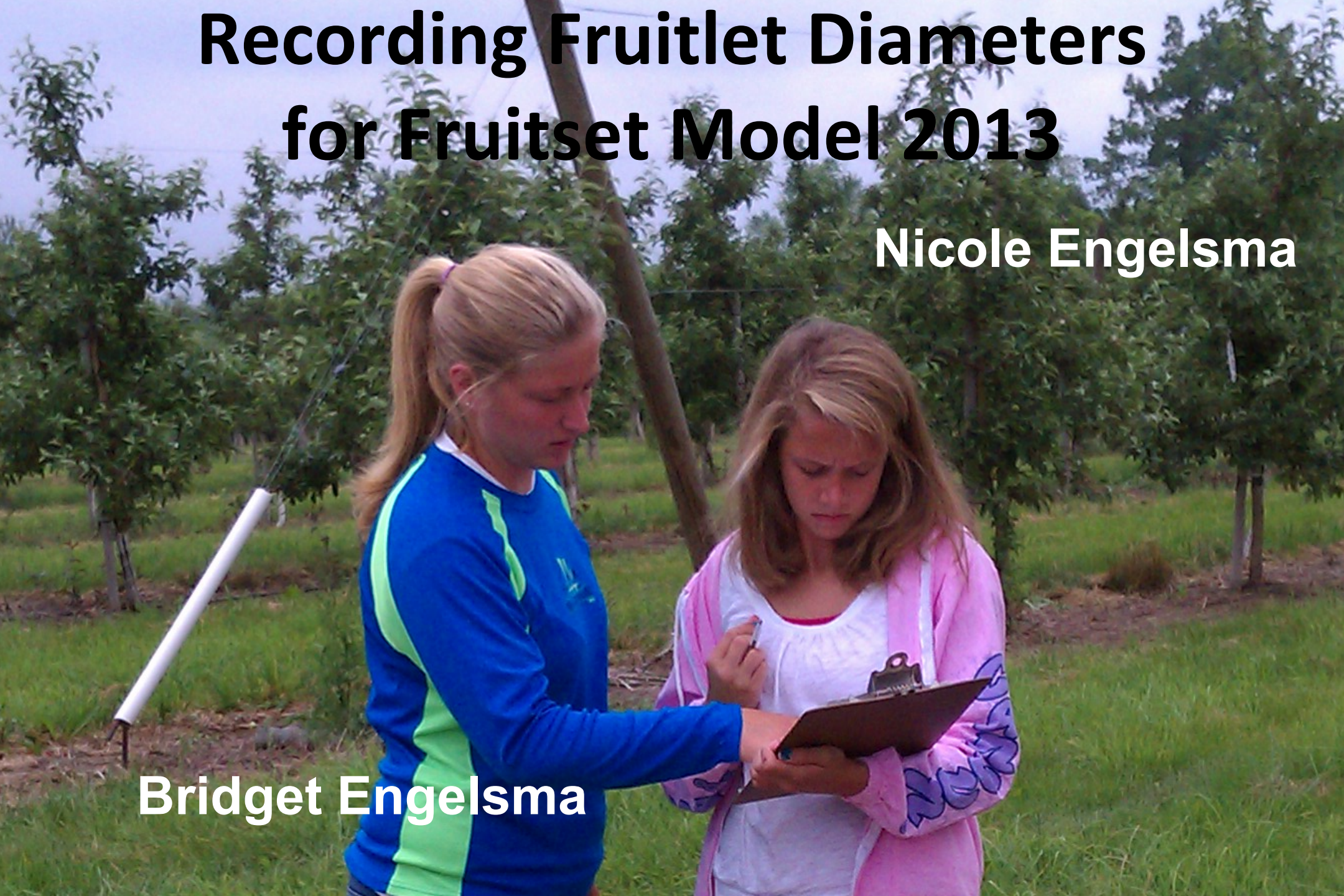
STANDARD MAIN

5.78

Recording Fruitlet Diameters for Fruitset Model 2013

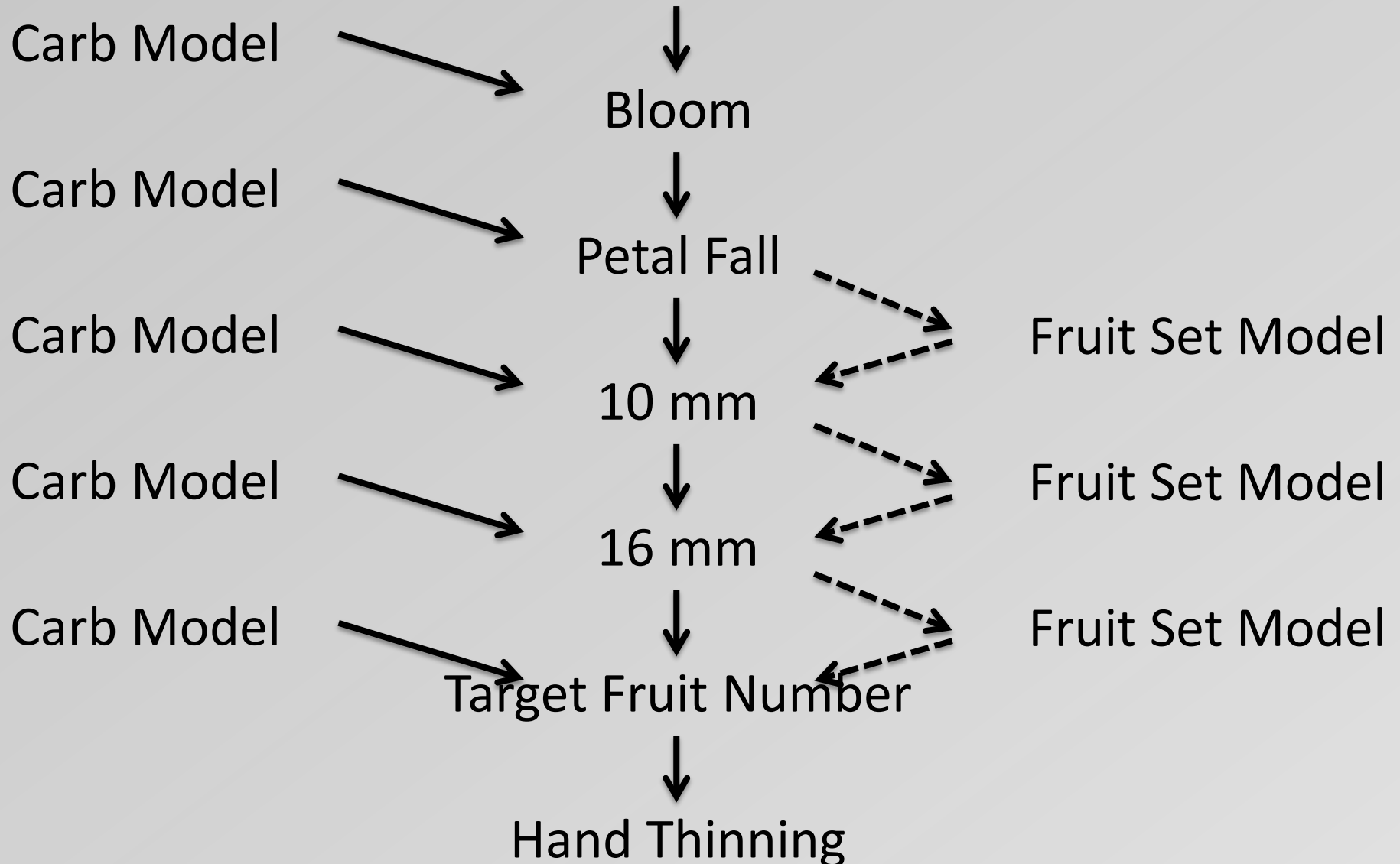
Nicole Engelsma

Bridget Engelsma



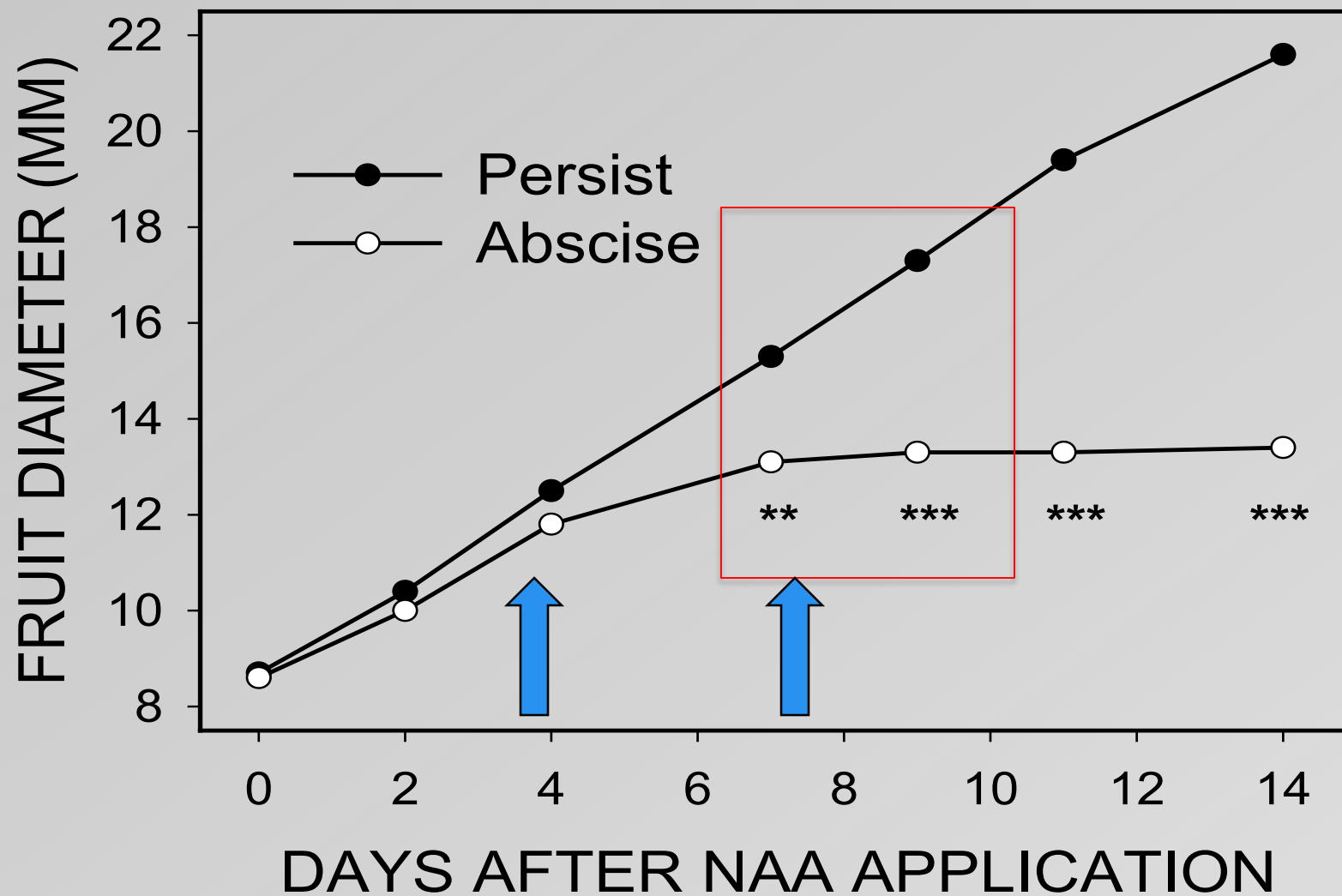
Precision Cropload Flow Chart

Initial Flower Load



Predict if a Fruit Will Persist or Abscise

- Persist: A fruit was predicted to persist if the growth rate over the measurement period was at least **50% or greater** of the fastest growing fruit.
- Abscise: A fruit was predicted to abscise if the growth rate of the fruit **slowed to 50%** or less of the growth rate of the fastest growing fruit.



Predicting Percent Fruitset

Table 4. Predicting Percent Fruitset Summary Sheet Example.

Summary Sheet			Farm: TestData Farm Block: Test Block							
Target Fruit Number					35		Target % Fruitset			7%
Sampling			Diameter (mm)		Diameter Growth (mm)		Number of Fruit			Predicted % Setting
Number	Date	Days between sample dates	Mean of 20 largest fruitlets	Mean of all fruitlets	Mean of up to 20 fastest growing fruitlets	50% fastest growing fruitlets	>50% fastest	<50% fastest	Measured	Based on Original # of Fruit
1	5/1	0	10.05	7.04					505	
2	5/4	3	13.21	7.55	3.54	1.77	64	419	483	12.7
3	5/7	3	15.98	8.27	3.32	1.66	50	368	418	9.9
4	5/10	3	17.56	8.89	1.88	0.94	43	329	372	8.5
5	5/13	3	19.88	10.60	2.72	1.36	38	173	211	7.5
6	5/16	3	21.31	12.13	1.68	0.84	41	112	153	8.1
7	5/19	3	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	0	0	0	0.0

Predicted number of fast growing fruit

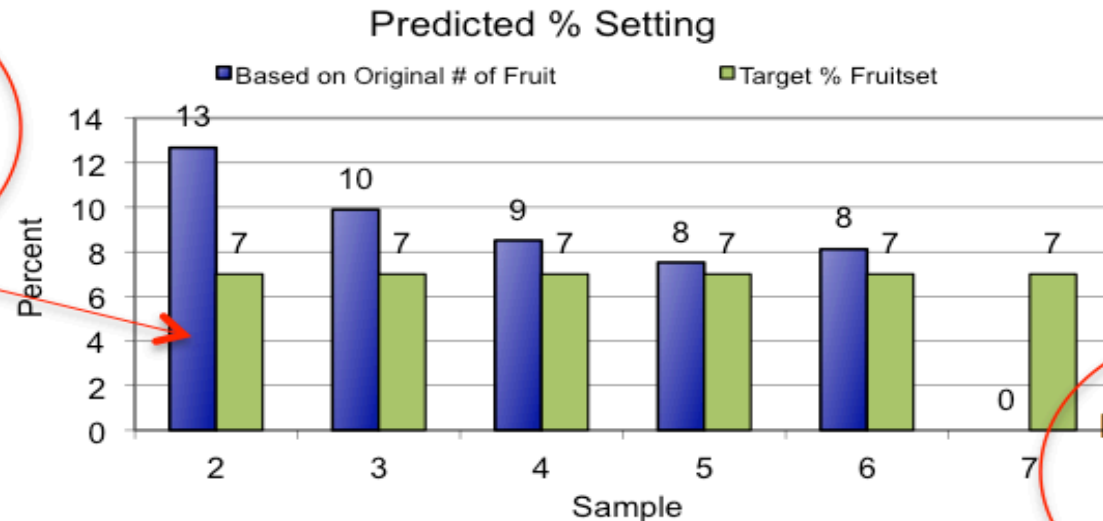
Target number of fruit and target percent.

Number of fruit originally marked and measured.

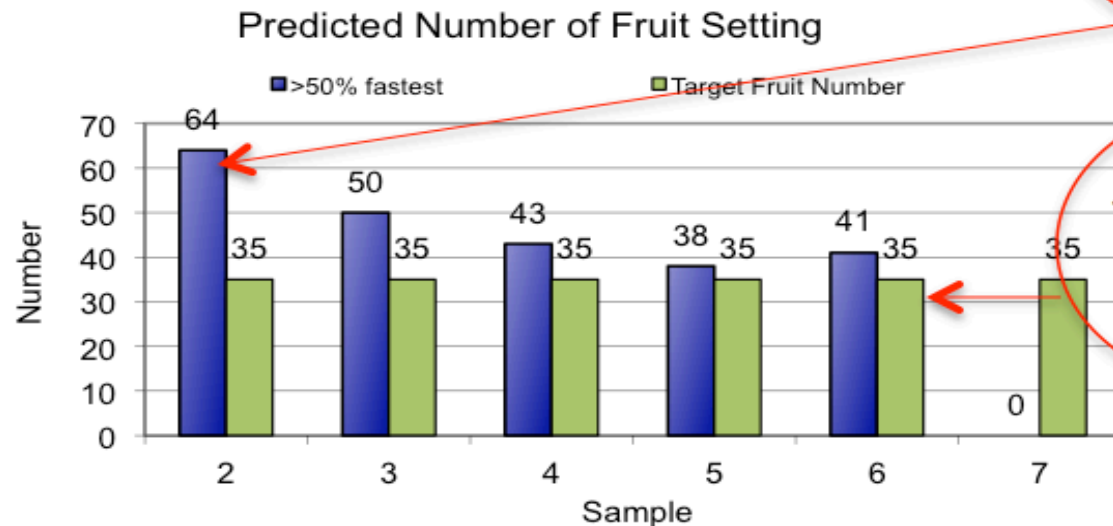
Predicted % fruitset of the original measured fruitlets.

Predicting Percent Fruitset

Predicted % fruitset
of the original
measured fruitlets
(blue bar).

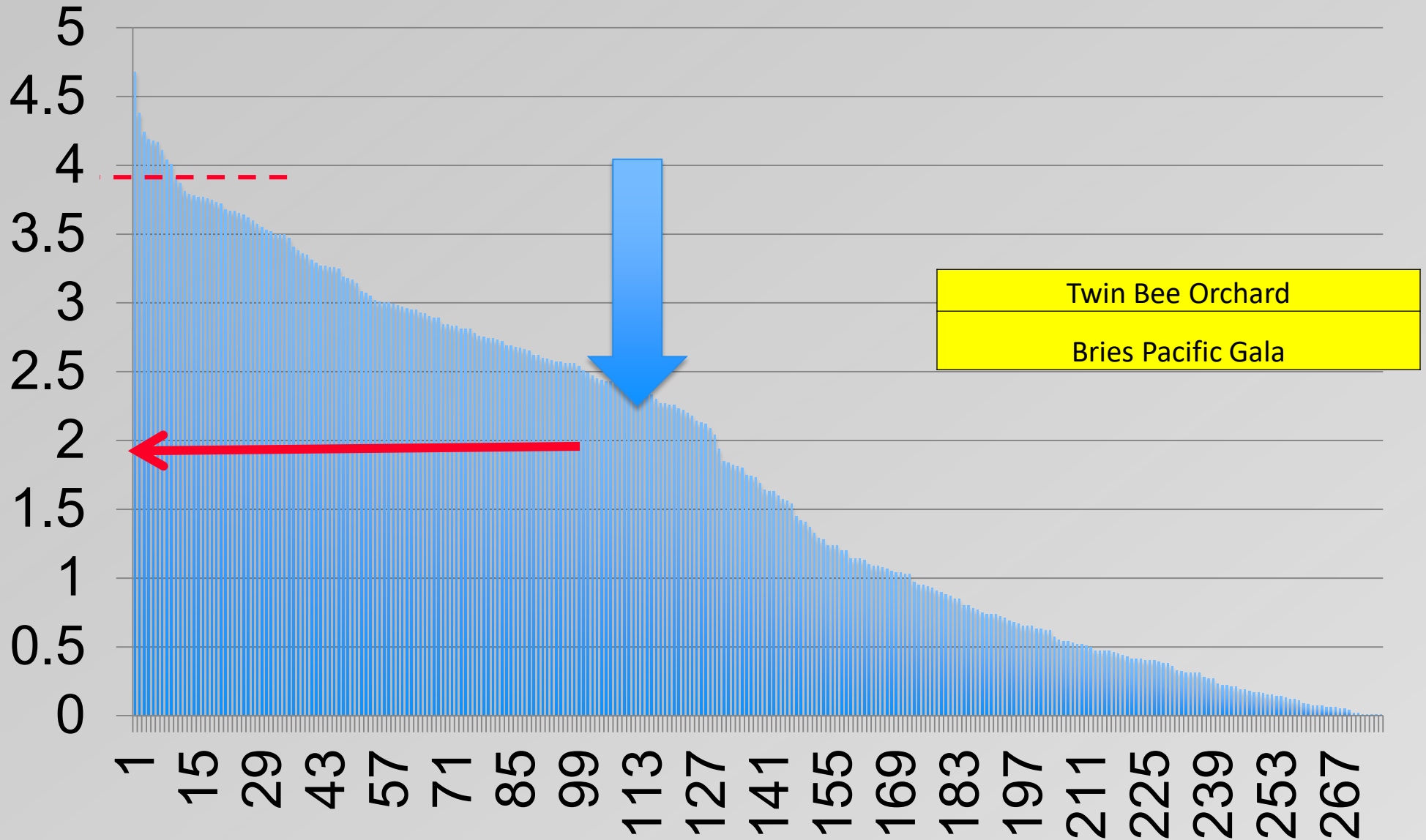


Predicted number
of fruit setting
(blue bar).

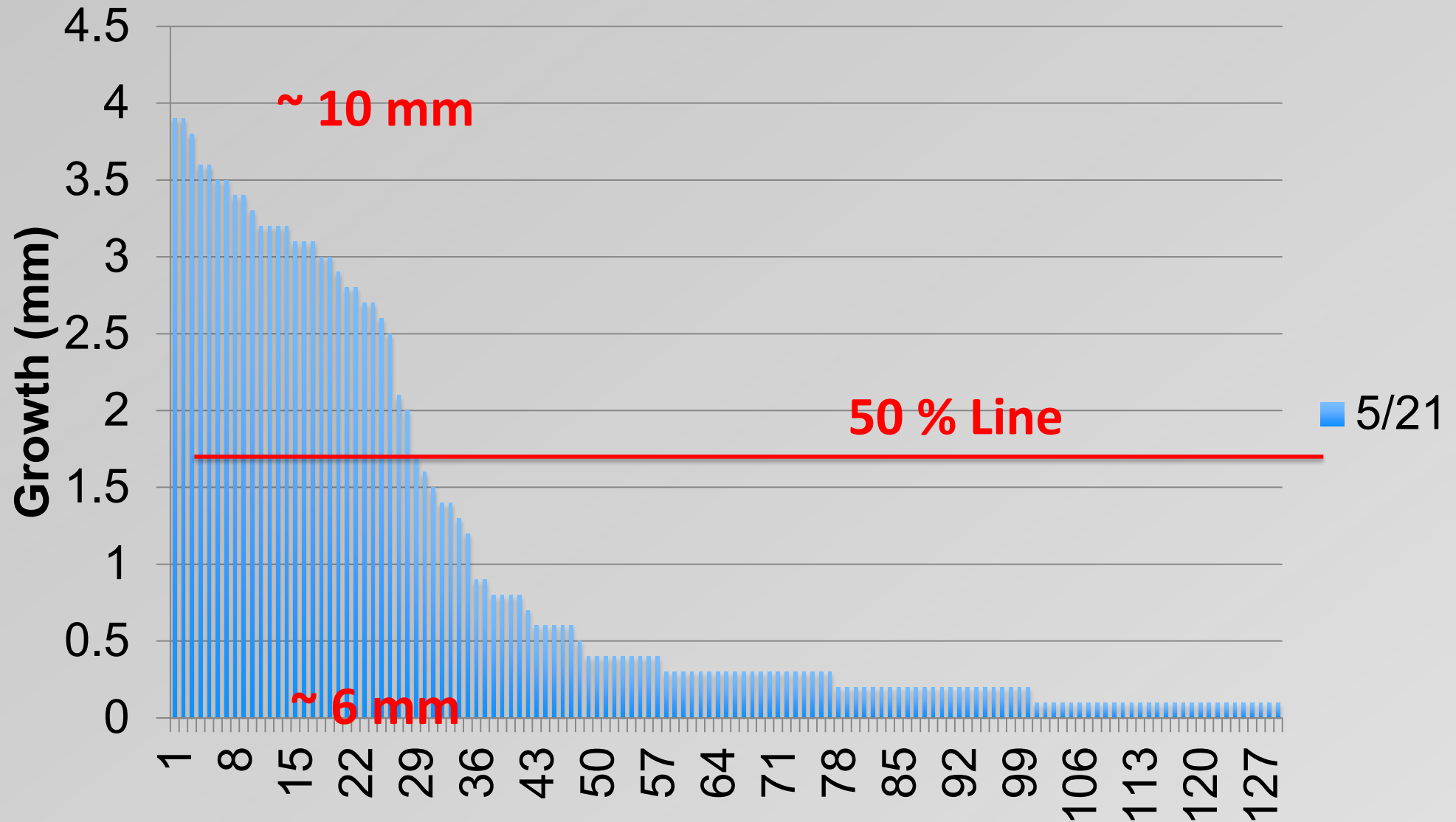


Target number of
fruit (green bar).

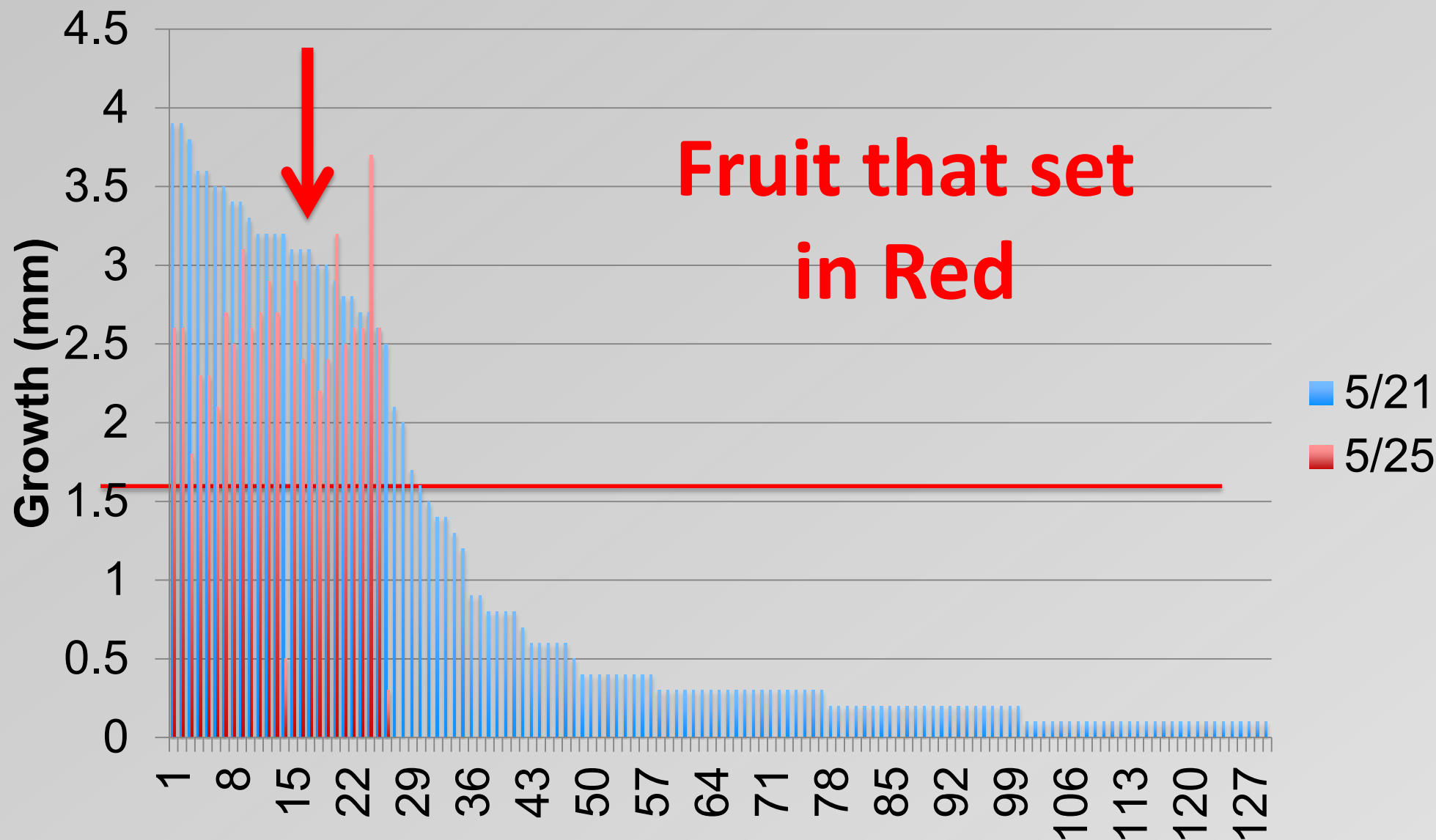
2 Measurement



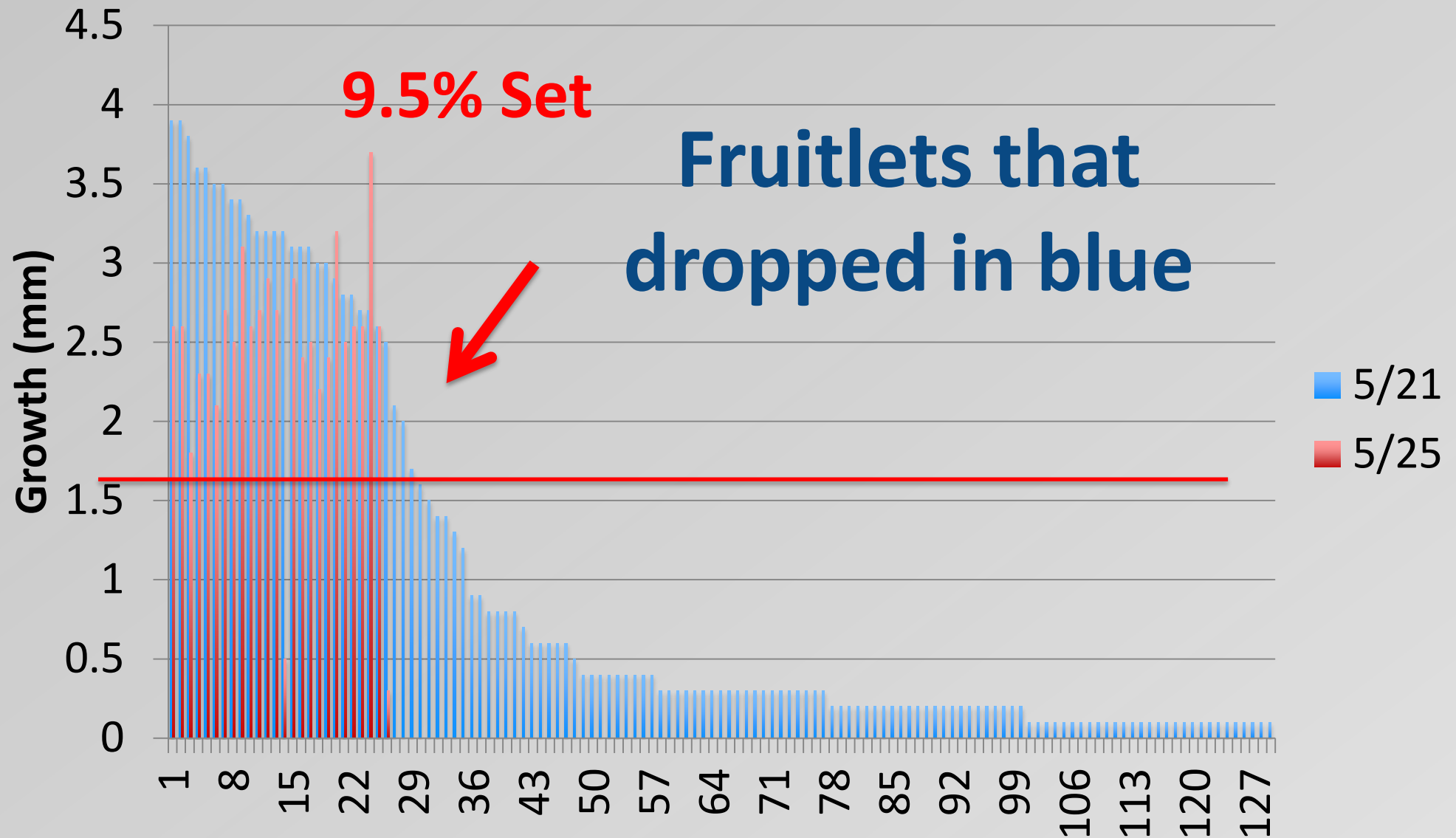
Fruitlet Growth 1st-2nd Measurement



Fruitlet Growth 1st-2nd Measurement

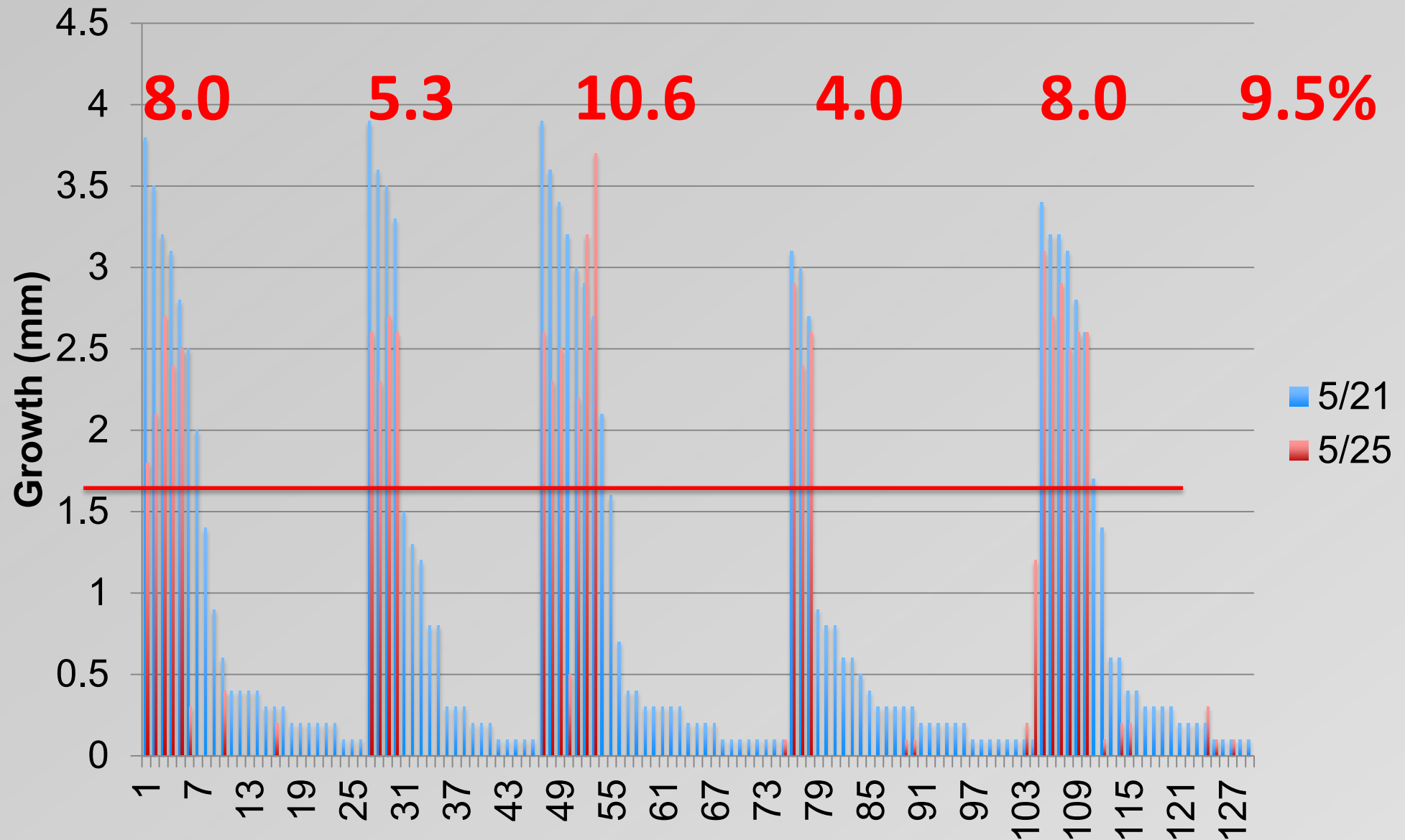


Fruitlet Growth 1st-2nd Measurement



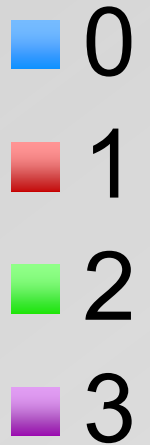
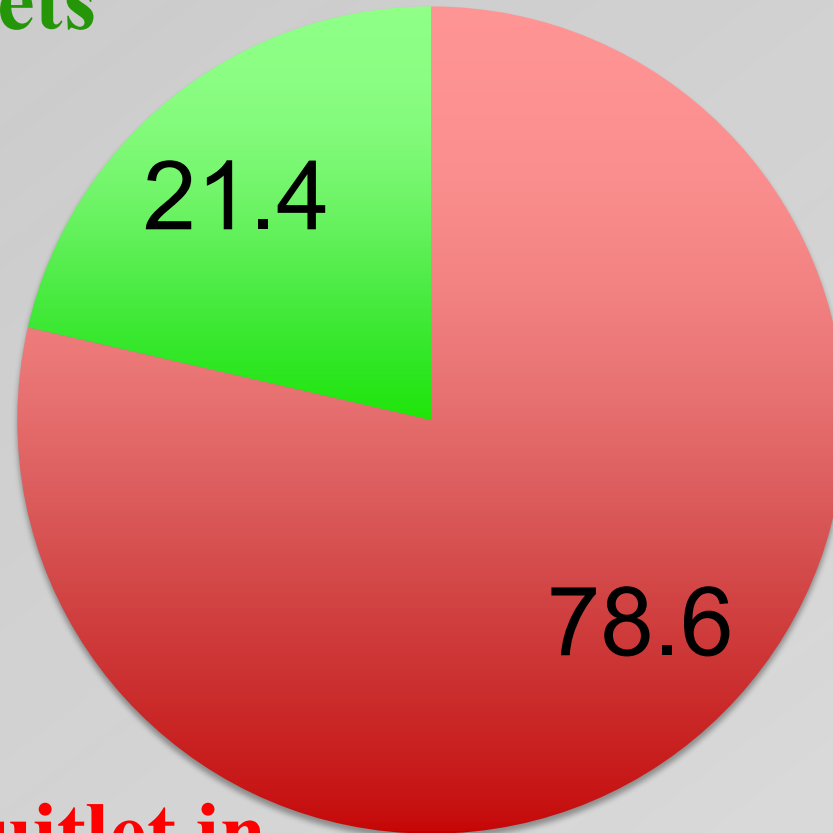
By Tree

Fruitlet Growth 1st-2nd Measurement



Distribution

**2 Setting Fruitlets
in a Cluster**



**1 Setting Fruitlet in
a Cluster**

MaluSim Carbohydrate Model

n Carbohydrate Model of Cornell University

- Alan Lakso
- Terence Robinson

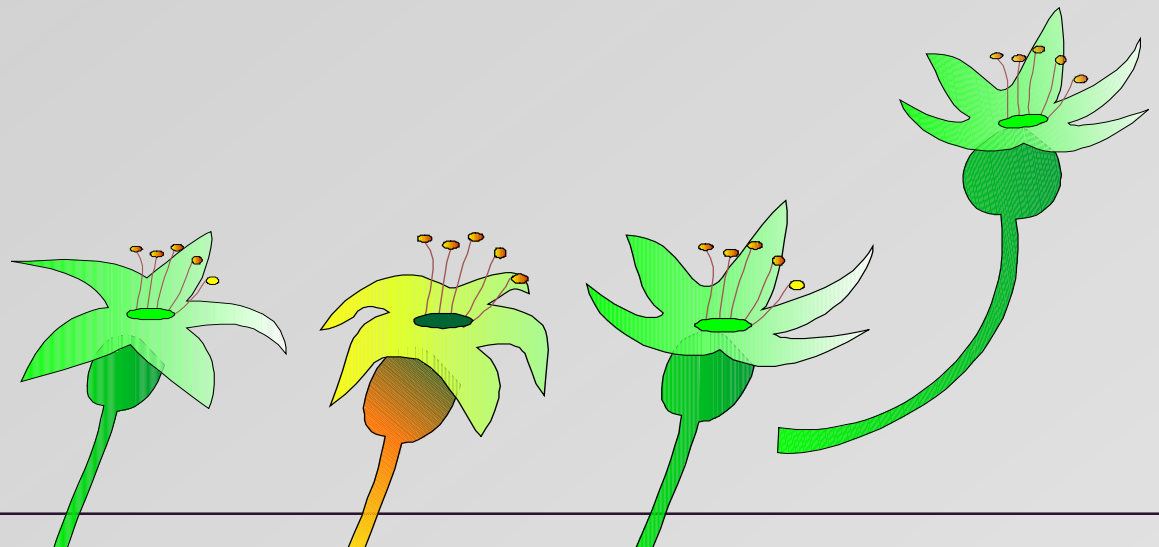


n Predicts Tree Carb Balance

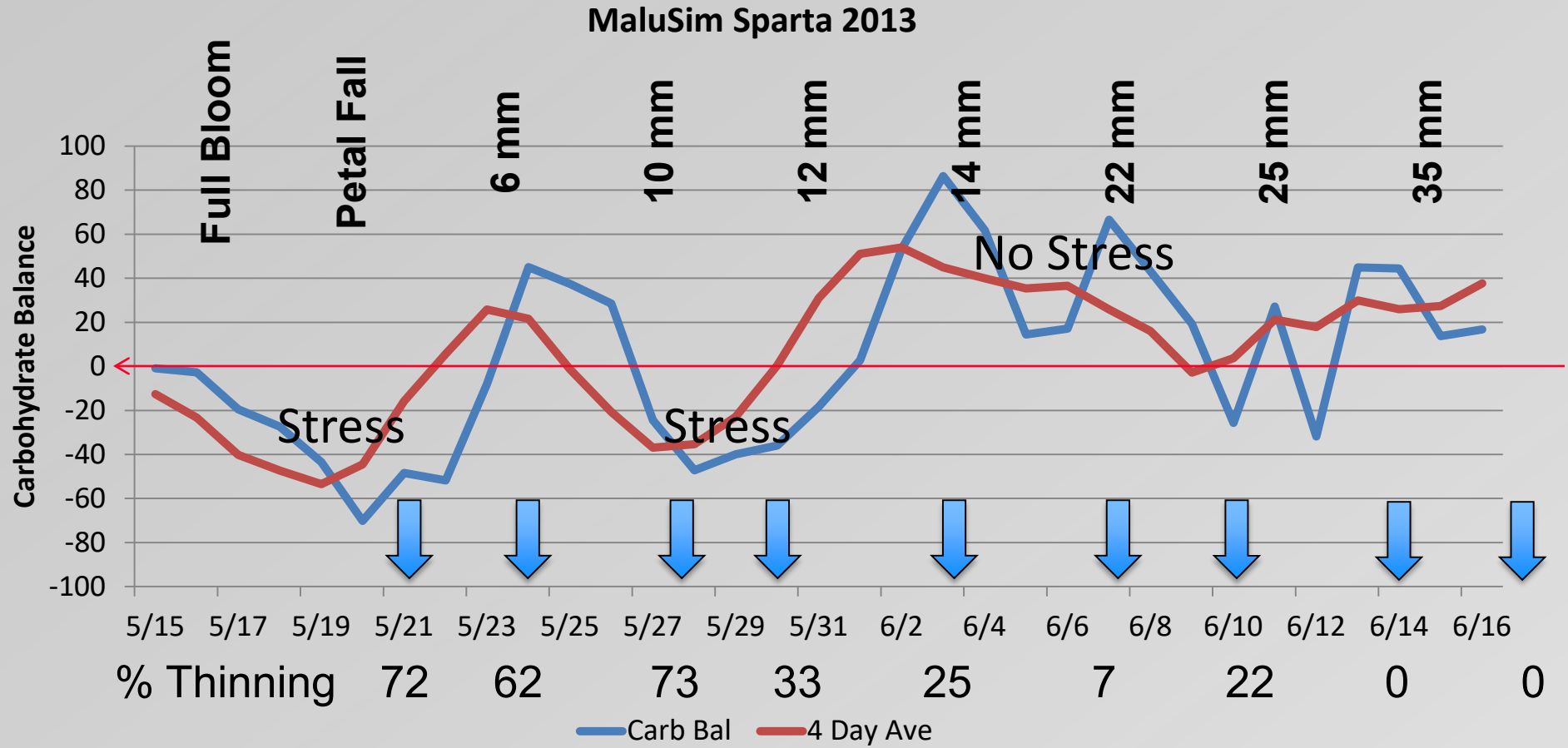
- Max, Min, Solar Radiation, Latitude

Theory of Fruitset

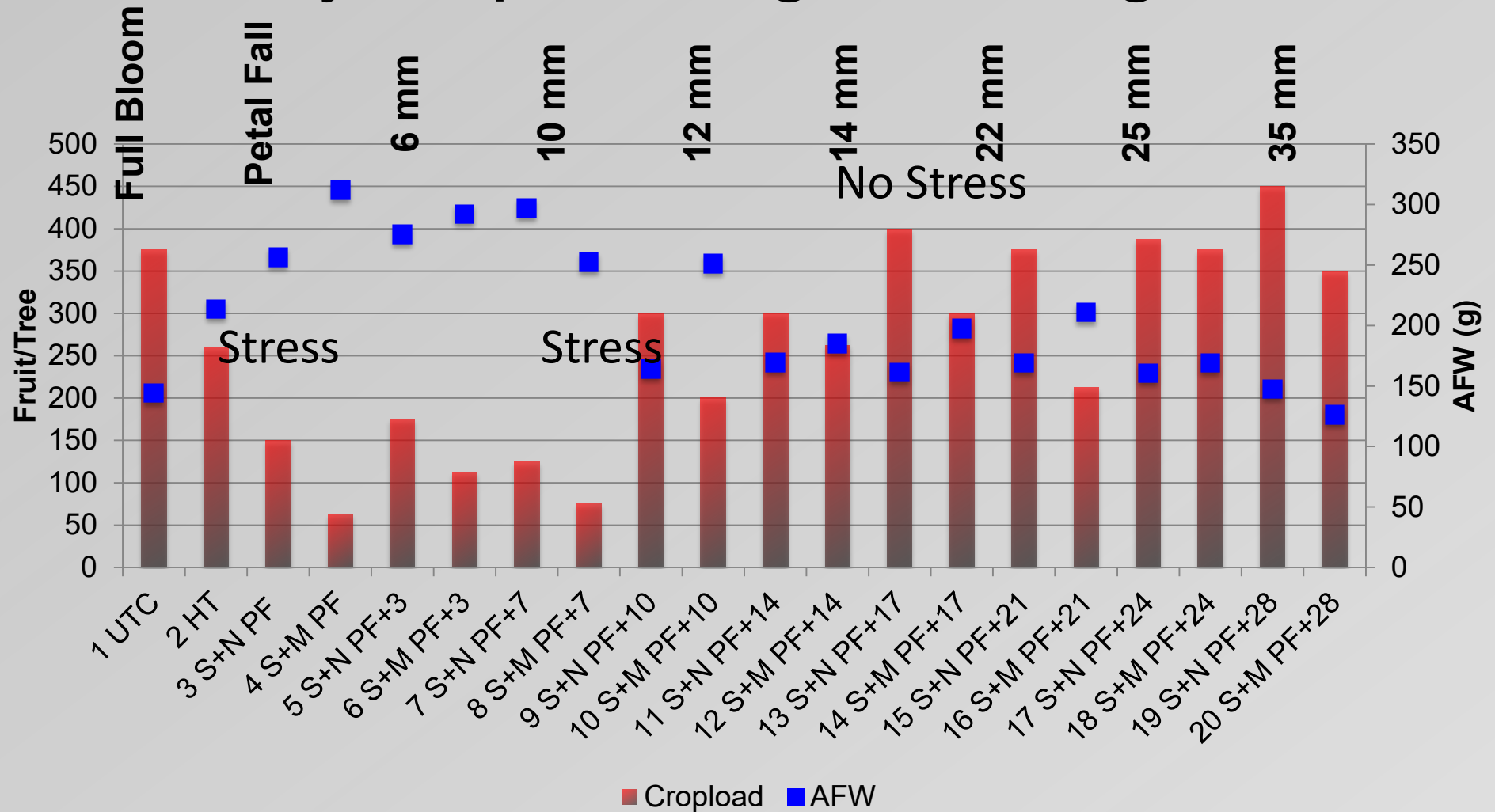
- Temperature affect **demand of energy** (carbon) from fruit and other tree growth.
- When fruitlets demand energy that exceeds supply, the **weakest fruitlets drop**.
- When energy is abundant, **fruitlets set and resist thinning**.



MaluSim Sparta Carbohydrate Model 2013

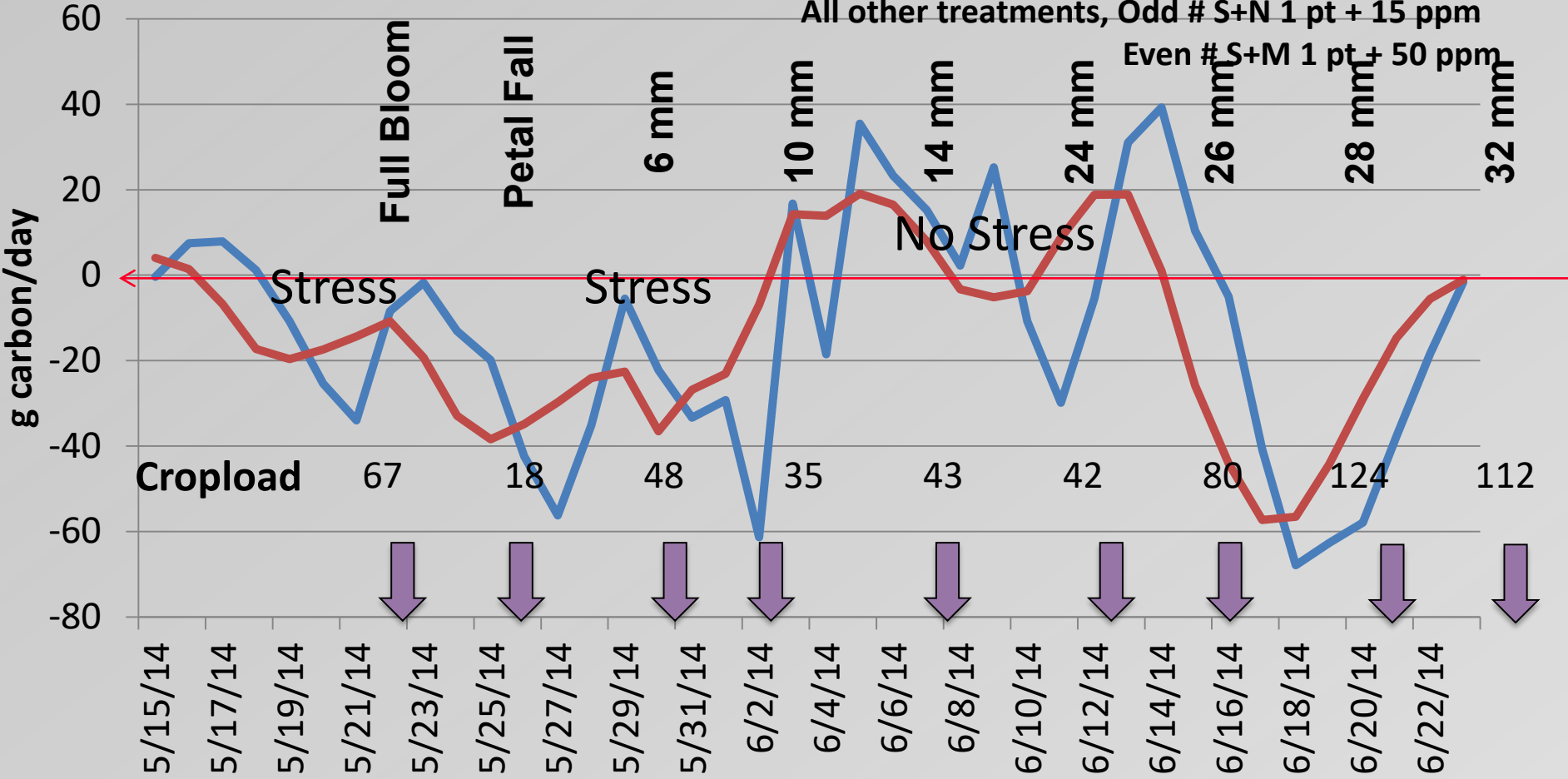


Honeycrisp Timing Thinning 2013



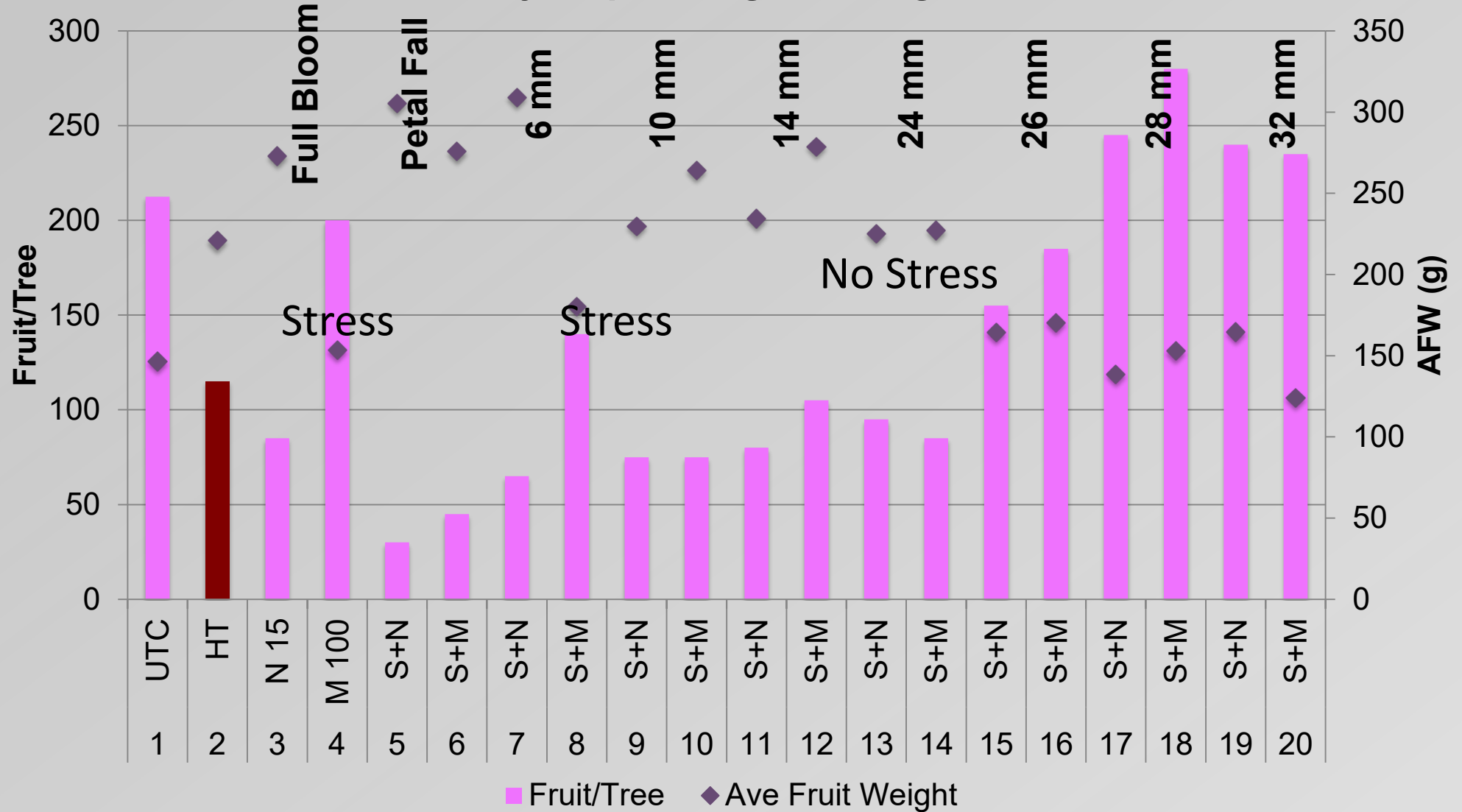
Sparta Carb 2014 6-17-14

Full Bloom, #3 NAA 15 ppm, #4 Maxcel 100 ppm
All other treatments, Odd # S+N 1 pt + 15 ppm
Even # S+M 1 pt + 50 ppm



Thinning applications.

Honeycrisp Timing Thinning 2014



MaluSim Carb Model Thinning Decision Guide.

Stress Level	4 Day Ave Carb Balance	Thinning Rate Recommendation	Example for Gala
No	> 0	Increase Rate by 30%	S+M 150 ppm
Slight	-20 to 0	Use Standard Rate	S+M 100 ppm
Mild	-40 to -20	Reduce Rate by 15%	S+M 100 ppm
Moderate	-60 to -40	Reduce Rate by 30%	S+M 50 ppm
Severe	-80 to -60	Reduce Rate by 50%	M 150 ppm
Extreme	<-80	Do not thin, many fruits will fall off	

Precision Cropload Flow Chart

Initial Flower Load



Bloom

0 to 5%



Petal Fall

10 to 20%



10 mm

35%



16 mm



Target Fruit Number



Hand Thinning

5%

Tops of Trees vs Bottoms

- Bottoms of trees will thin 10 to 40% more.
- Put 2/3 spray in top 1/3 of tree.
- Under frosty conditions, still thin tops, none on bottoms.

Fruitlet Stress Increases

- Night Temp > 65°F minimum
- Day Maximum > 85°F maximum
- Solar Radiation Cloudy
- Growth Stage 10-13 mm
- Last Years Crop Heavy
- Last Fall Weather Cold Short Fall
- Bloom Level Heavy bloom
- Winter Freeze
- Spring Frost Damage

Strategies 20179

Plan Multiple Treatments

Thin Early

Last Year's Crop (Stress)

Winter or Frost Damage

Use Information to avoid mistakes

Carb Model

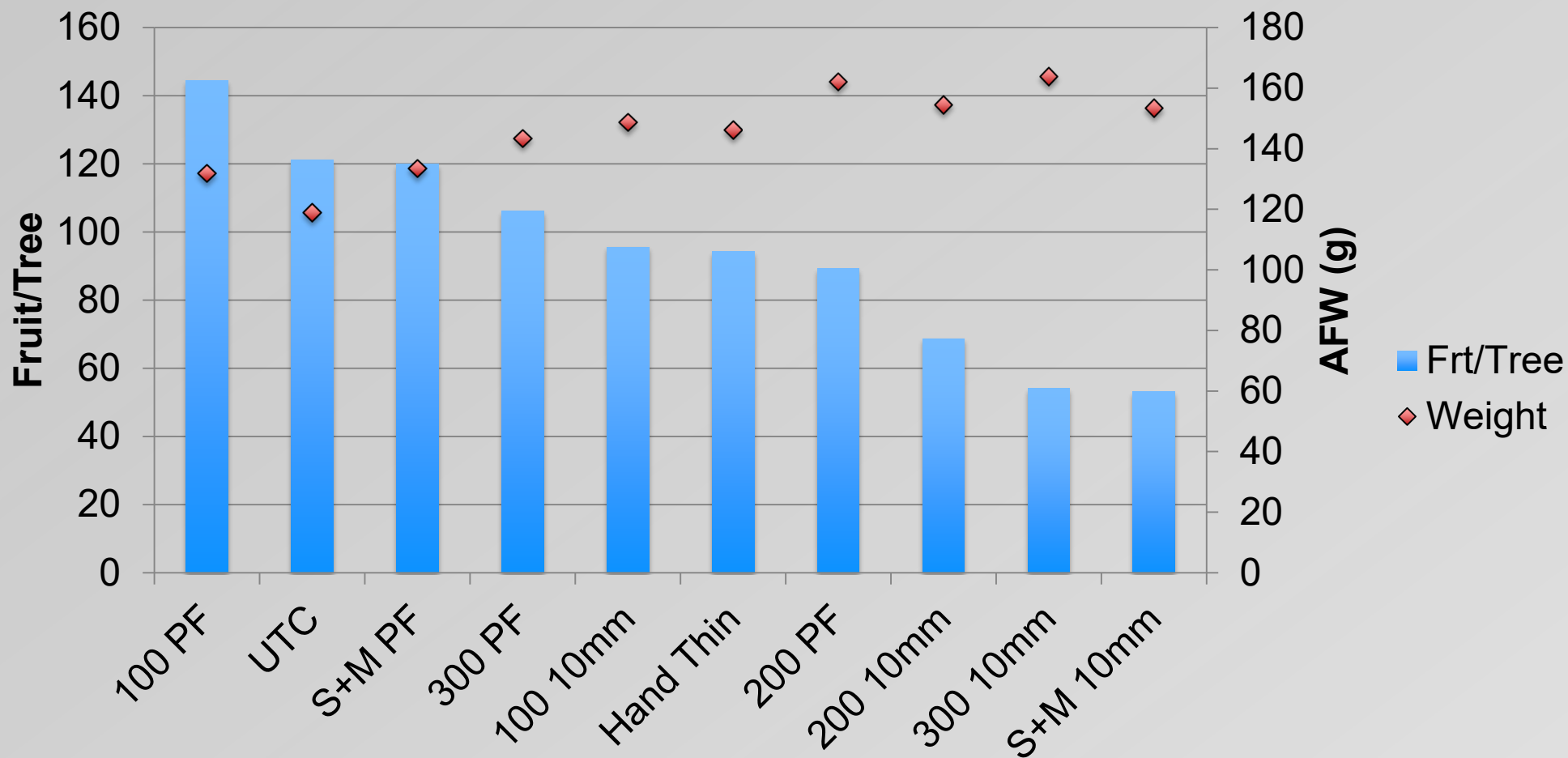
Predicting Fruitset Model

Summary

- Plan on starting early.
- Budload.
- Plan multiple sprays.
- Precision Thinning
- Fruitset Model
- Spray at the beginning of a warming trend.
- Use aggressive combinations when late or difficult varieties.

Metamitron Thinning Gala

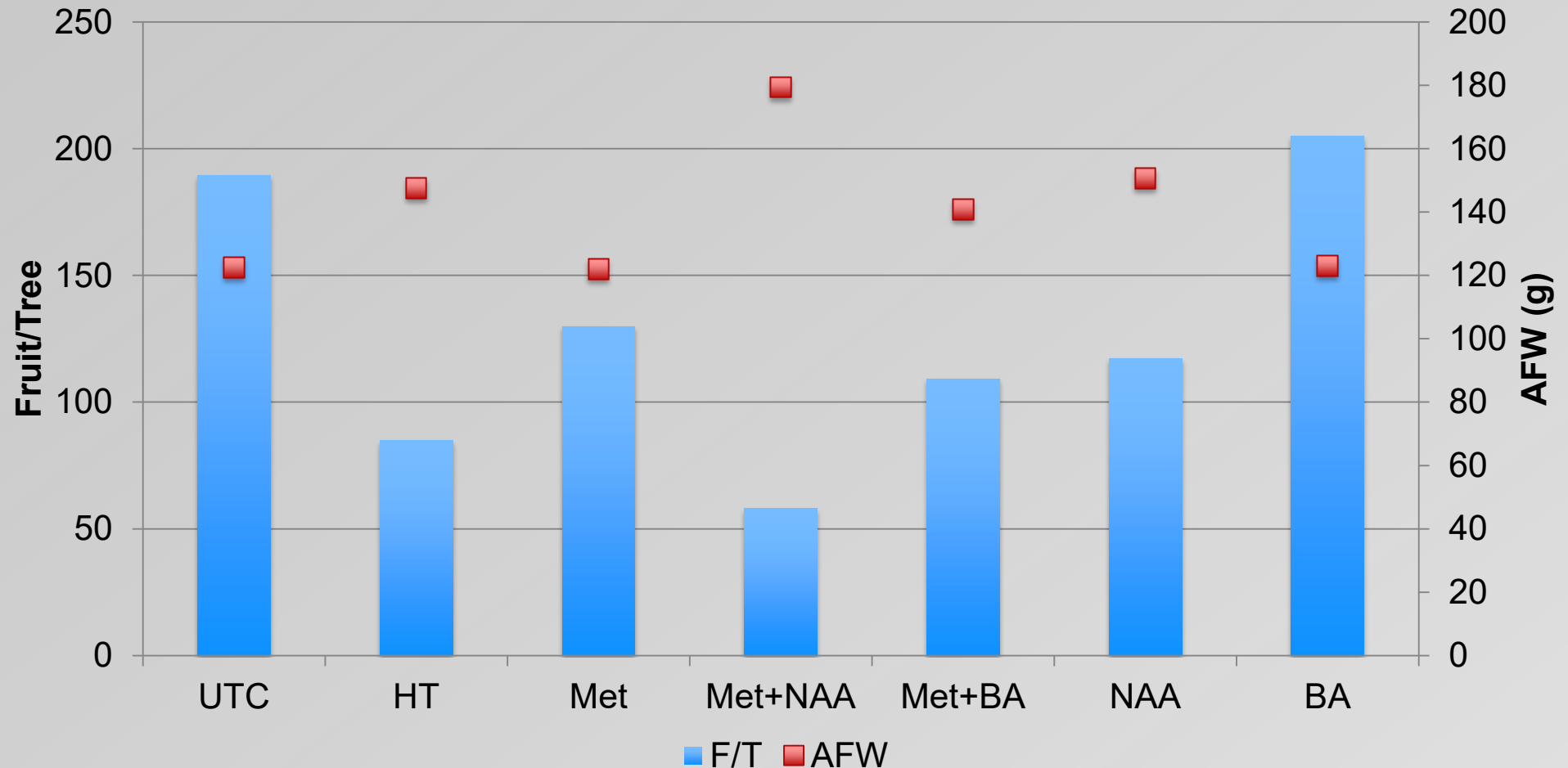
Metamitron Thinning Trial 2014 Gala Airblast



Metamitron Thinning Gala²⁰¹⁵

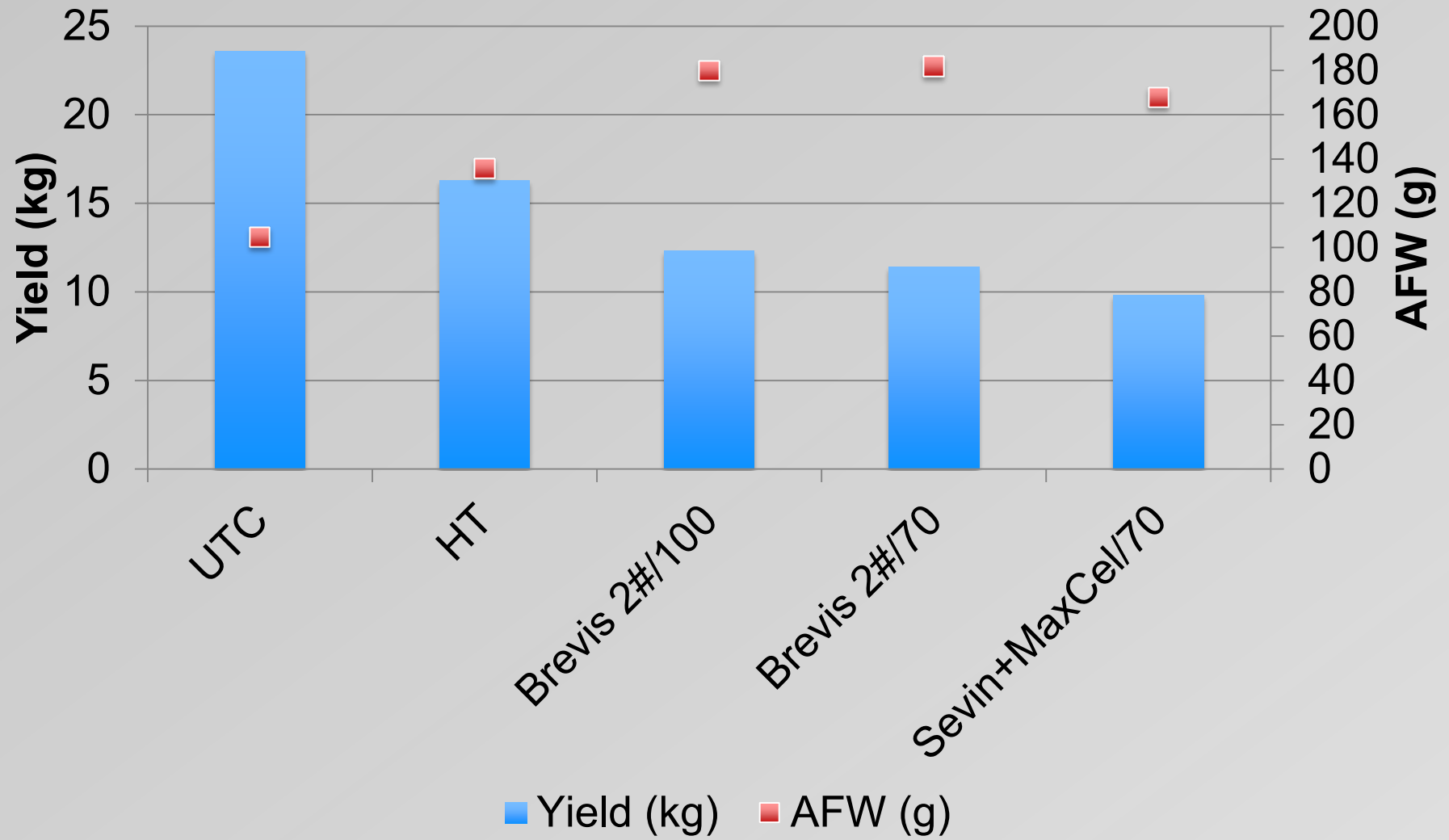
Trial 3 @ PF

Metamitron Airblast Gala 2015 Trial



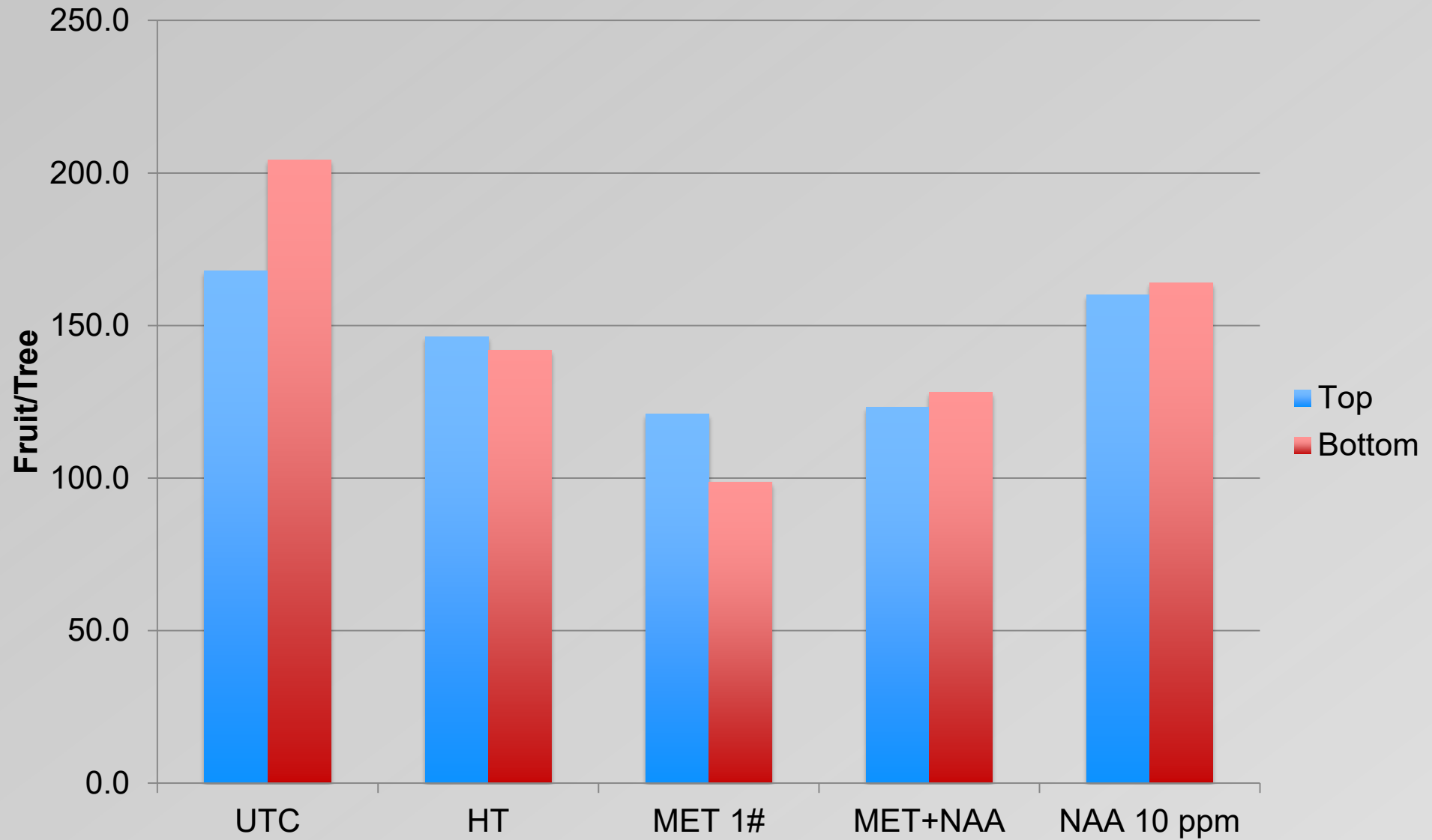
2016

Metamitron Gala Thinning Trial 2016



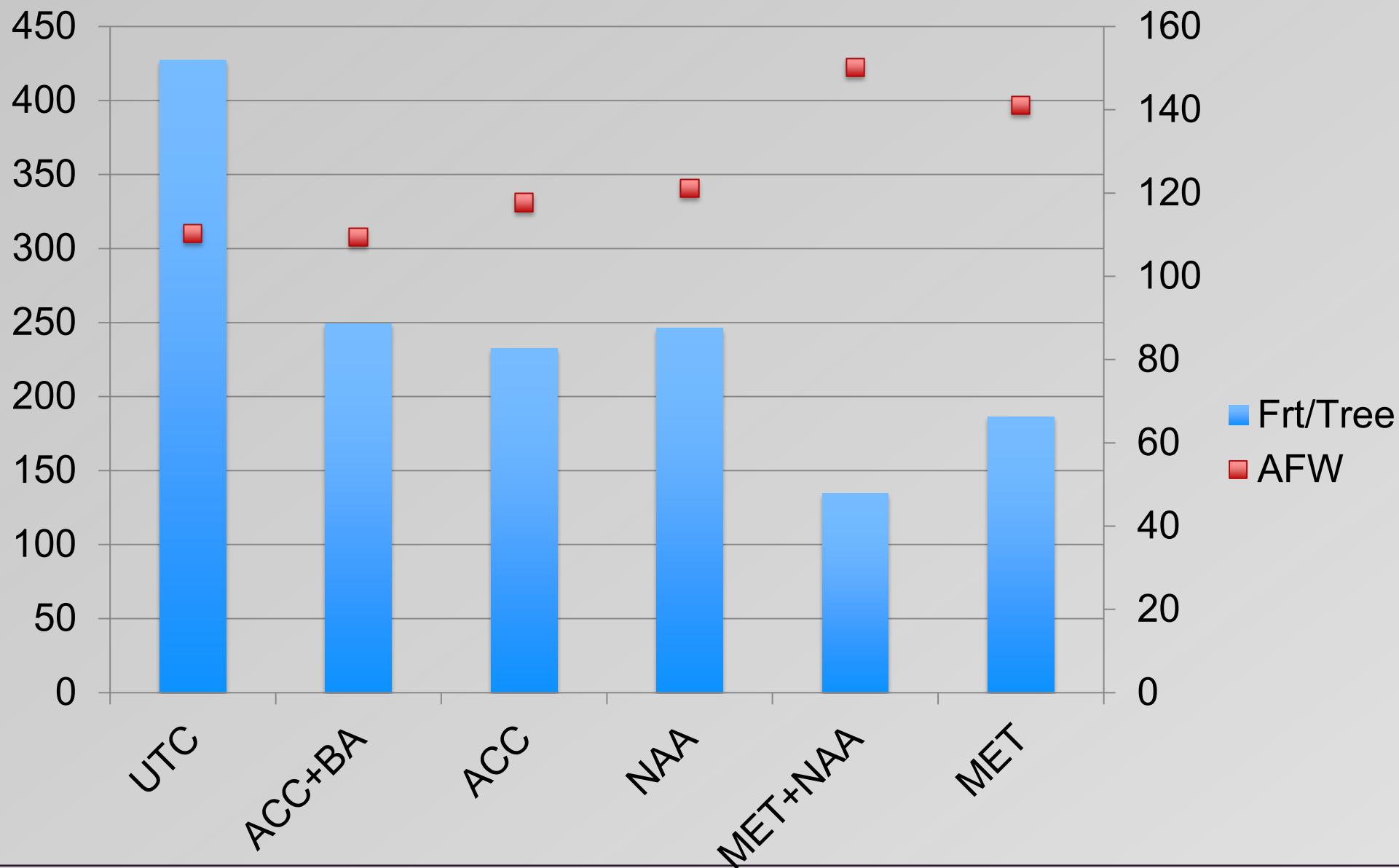
Met #1

Metamitron/NAA Gala Frt/Tree 2017



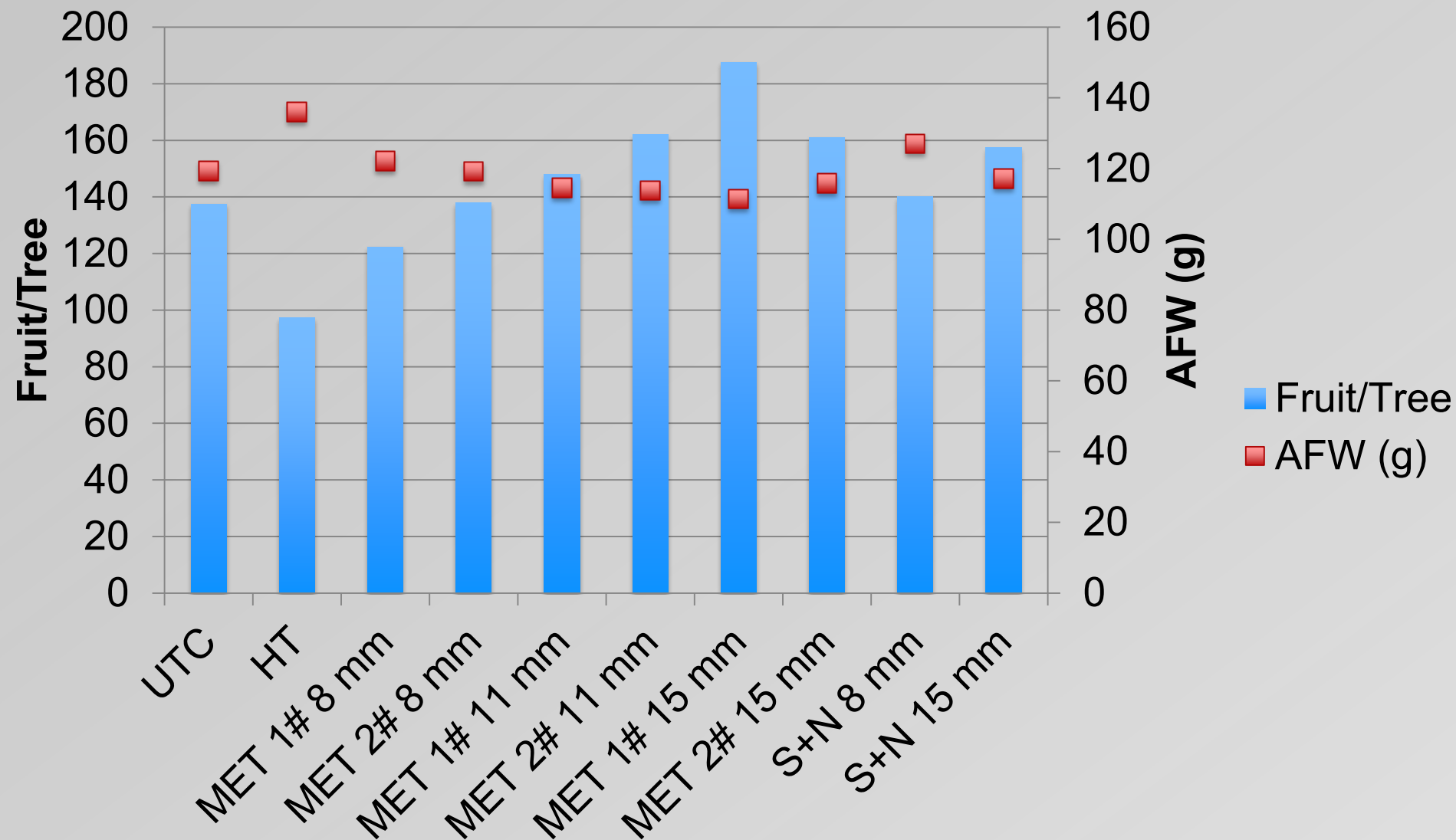
Met #2

Gala Handgun



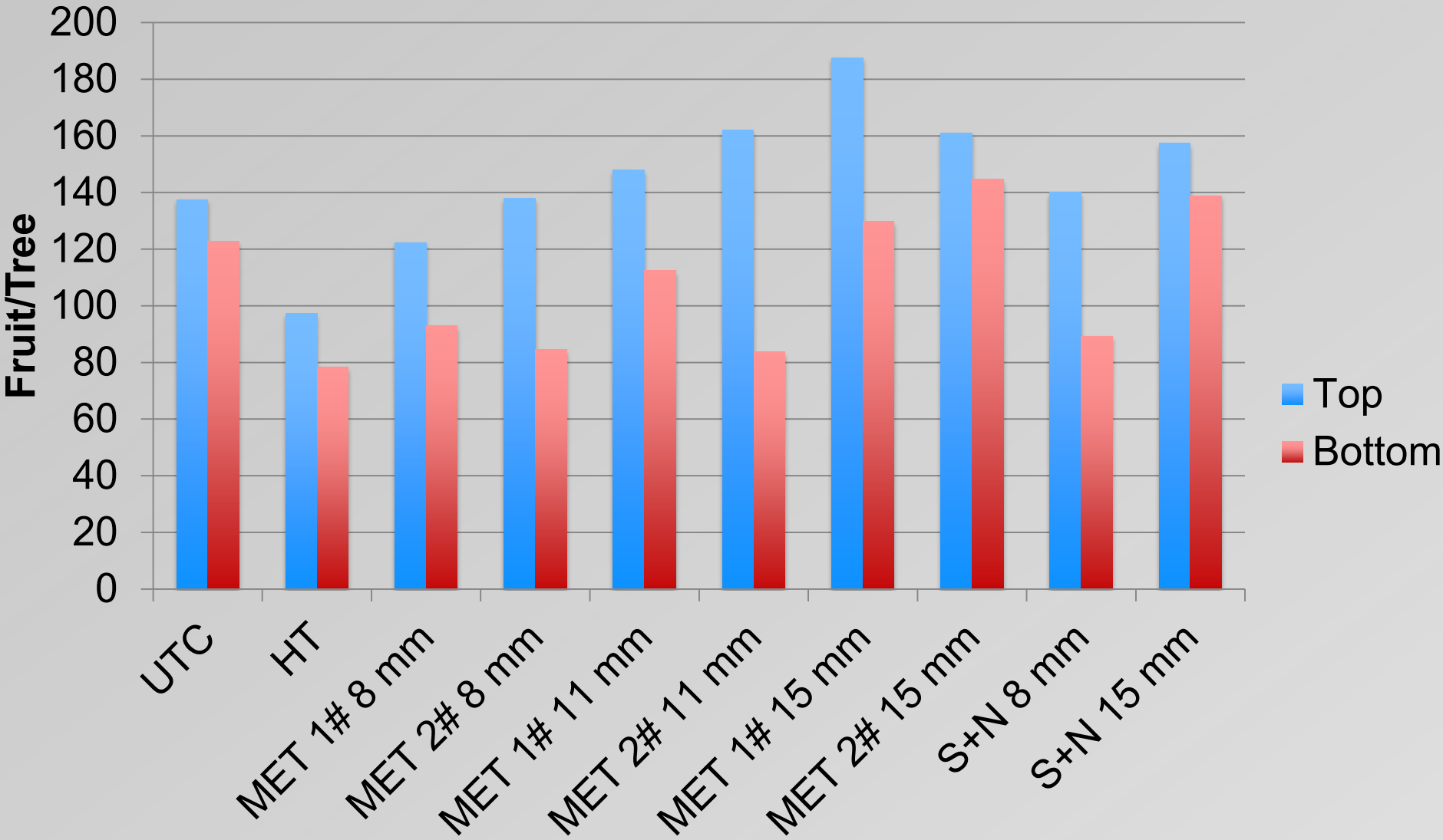
Met

Metamitron Gala Thinning Trial (Tops)

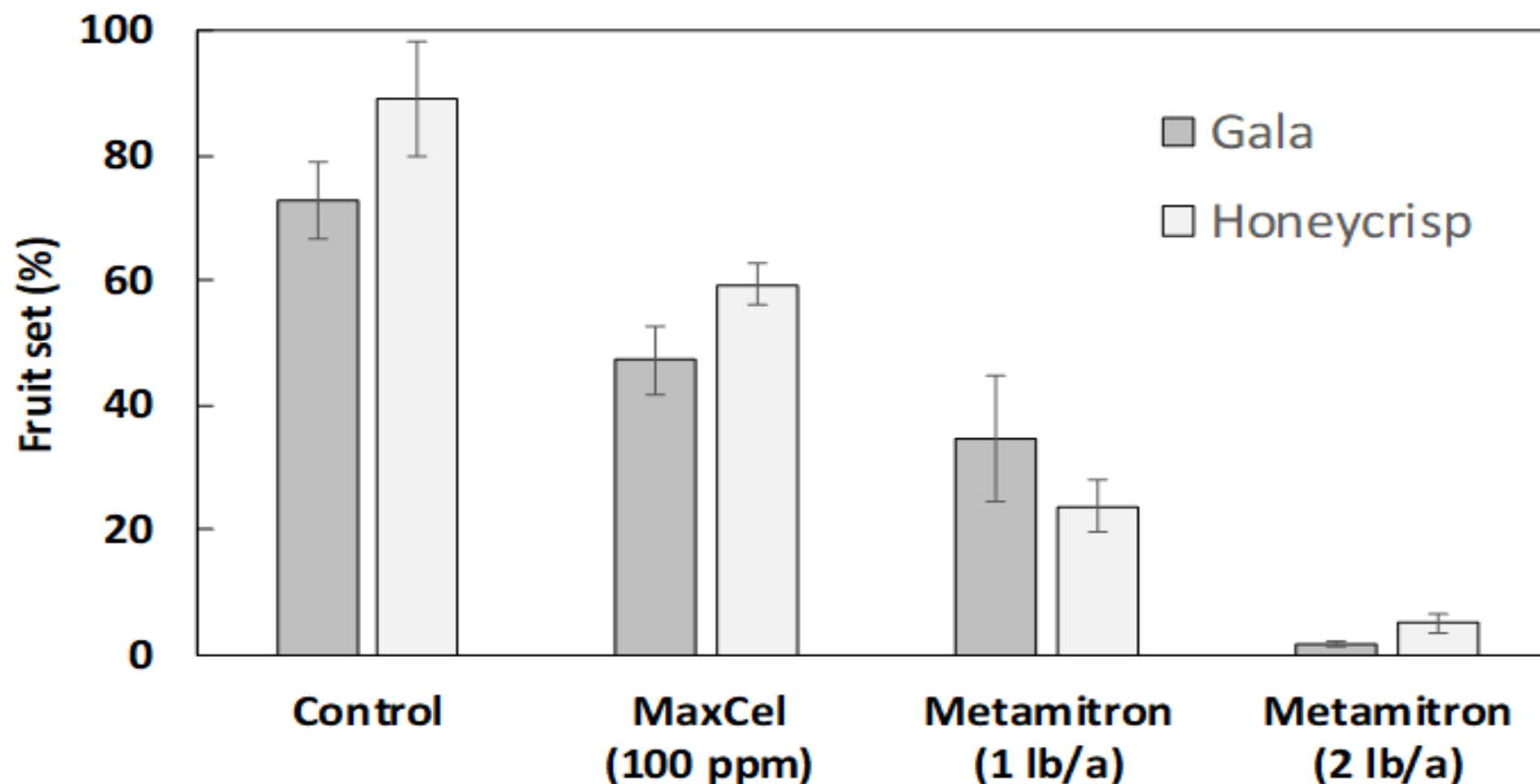


Met

Metamitron Gala Thinning Trial

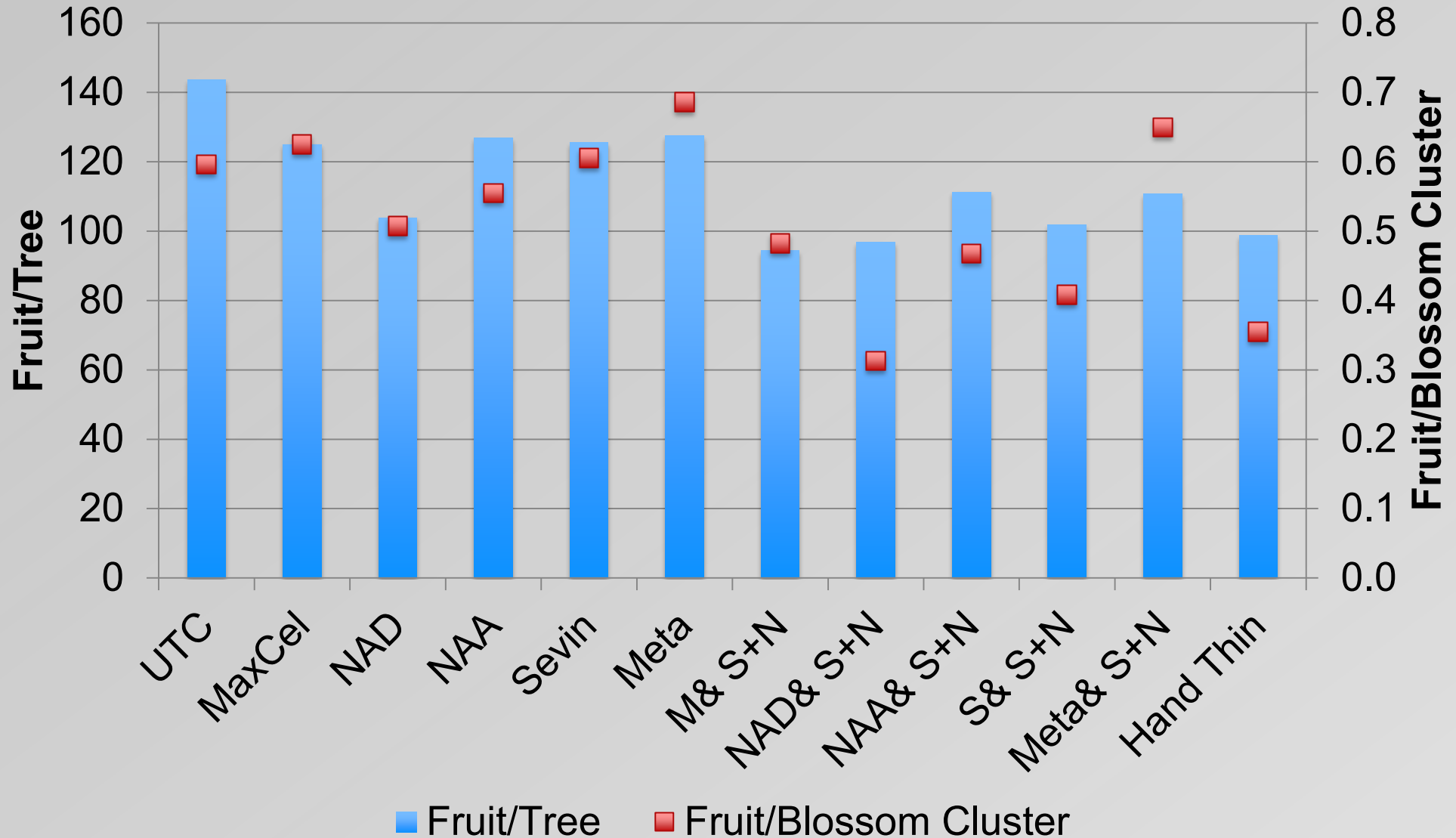


2017 Metamitron: Fruit Set

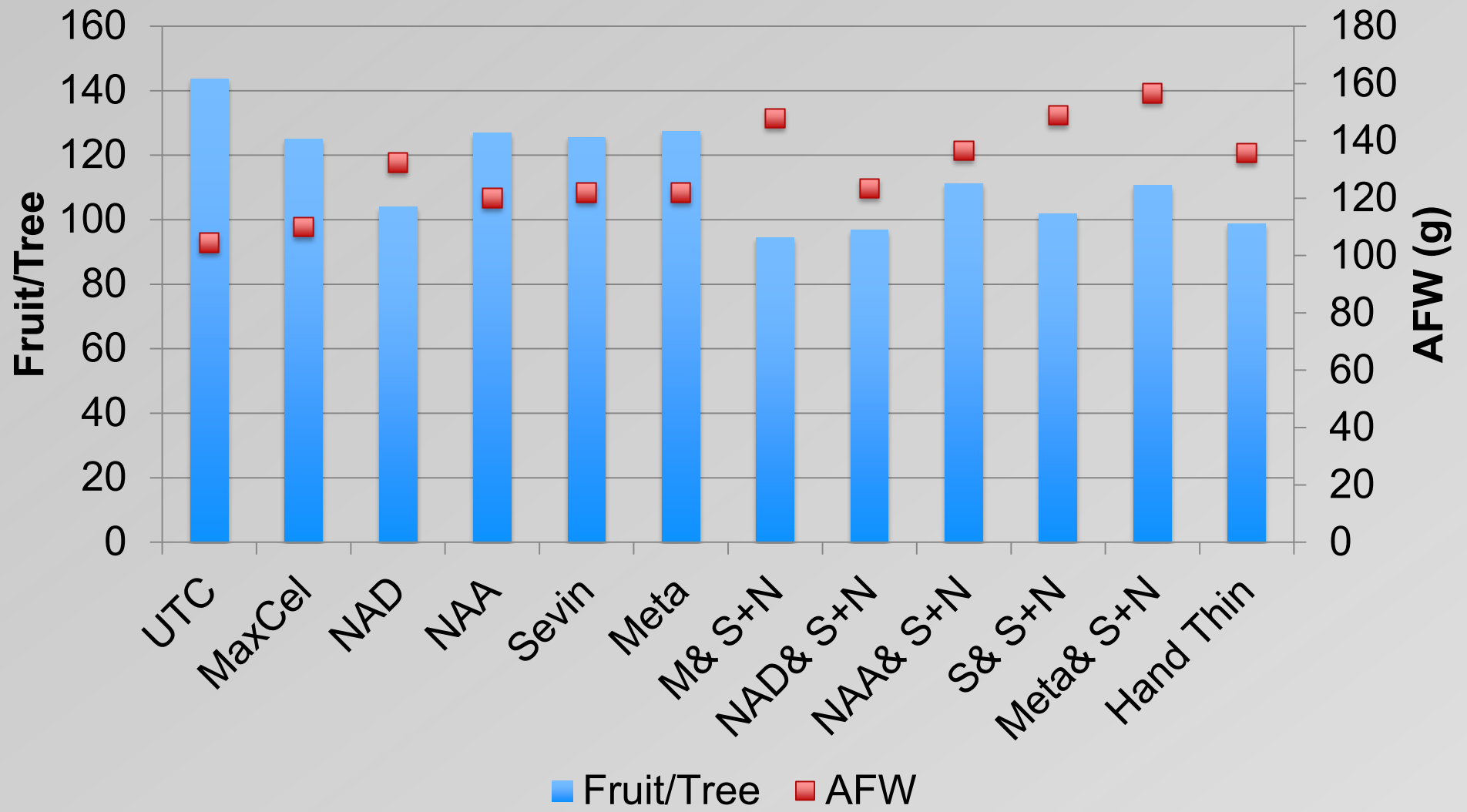


- Applied to whole-canopies at ~11 mm
- Thinning response of Gala and Honeycrisp similar
- Thinning was responsive to rate

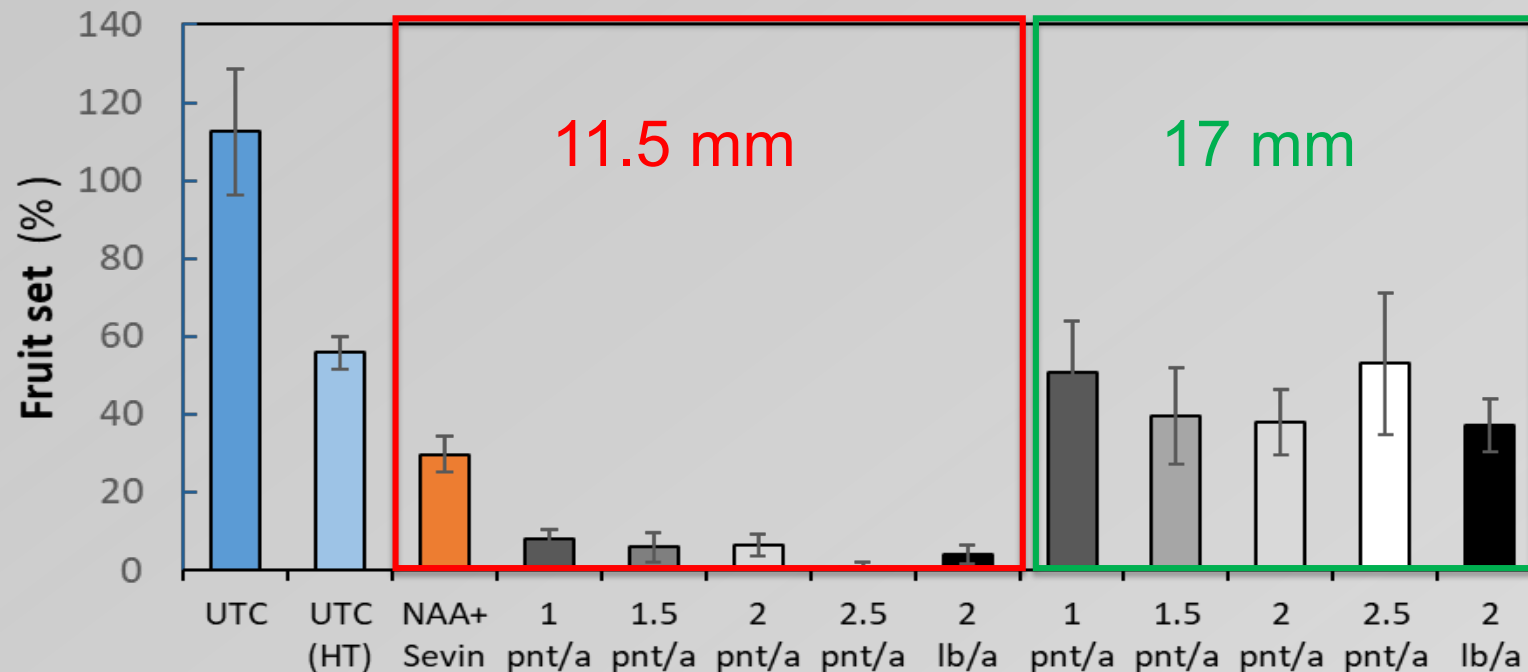
Metamitron Thinning Trial Gala 2018



Metamitron Thinning Trial Gala 2018

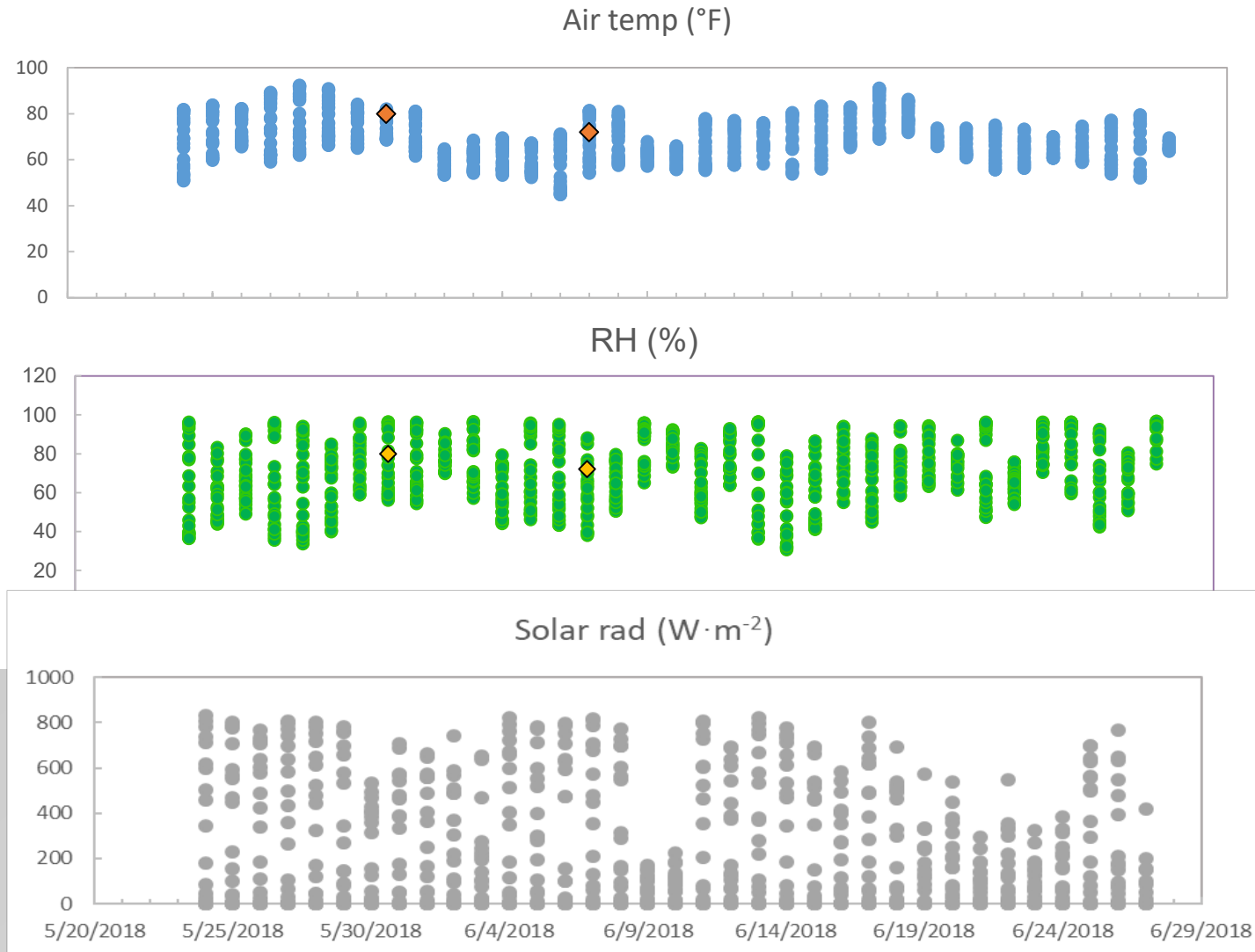


Metamitron: Fruit Set



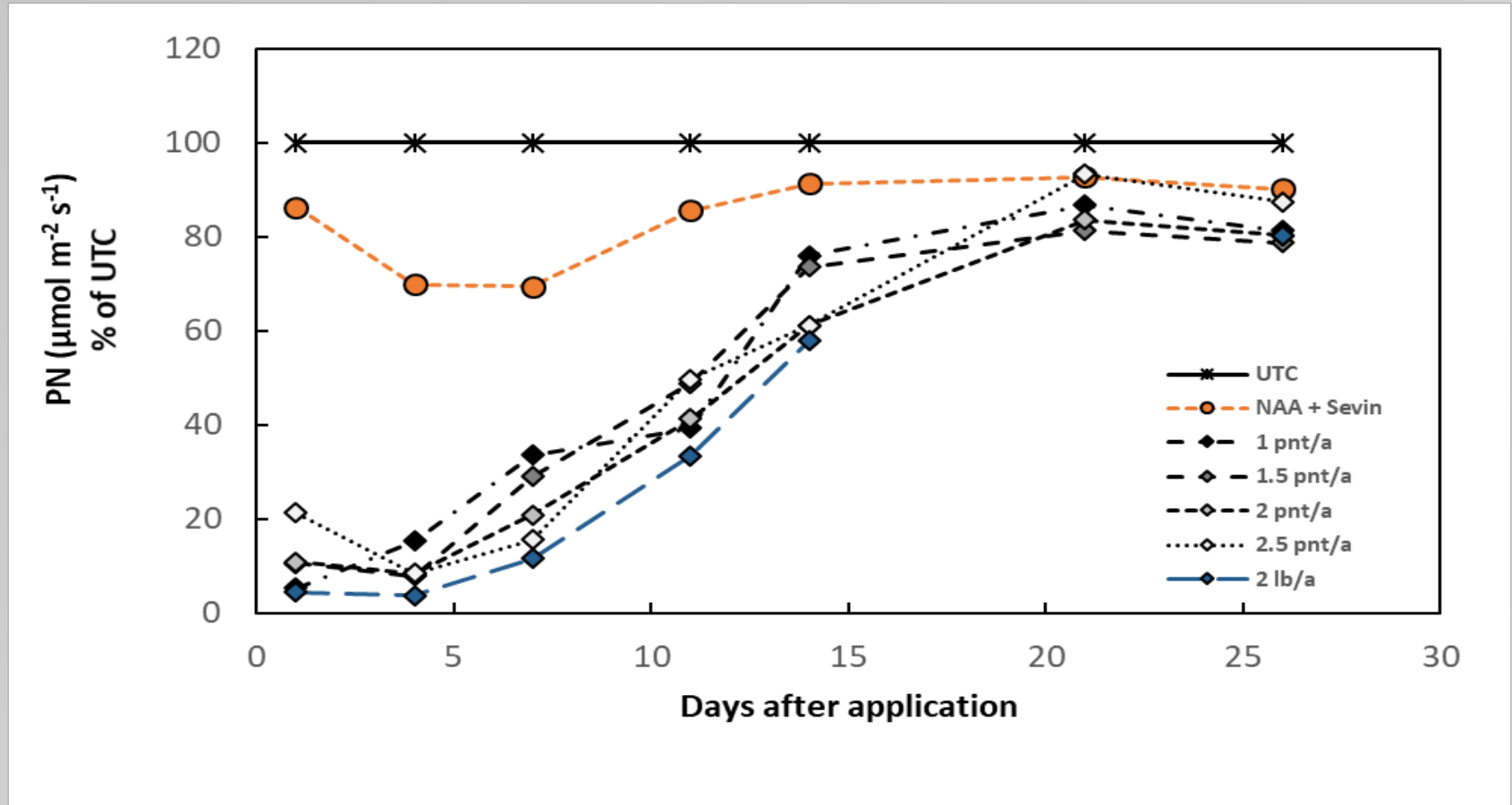
- Metamitron SEVERELY over-thinned at 11.5 mm
- Thinning at 17 mm was excellent
- NO Rate Response at either timing
- NAA thinned well

Metamitron: Climate factors



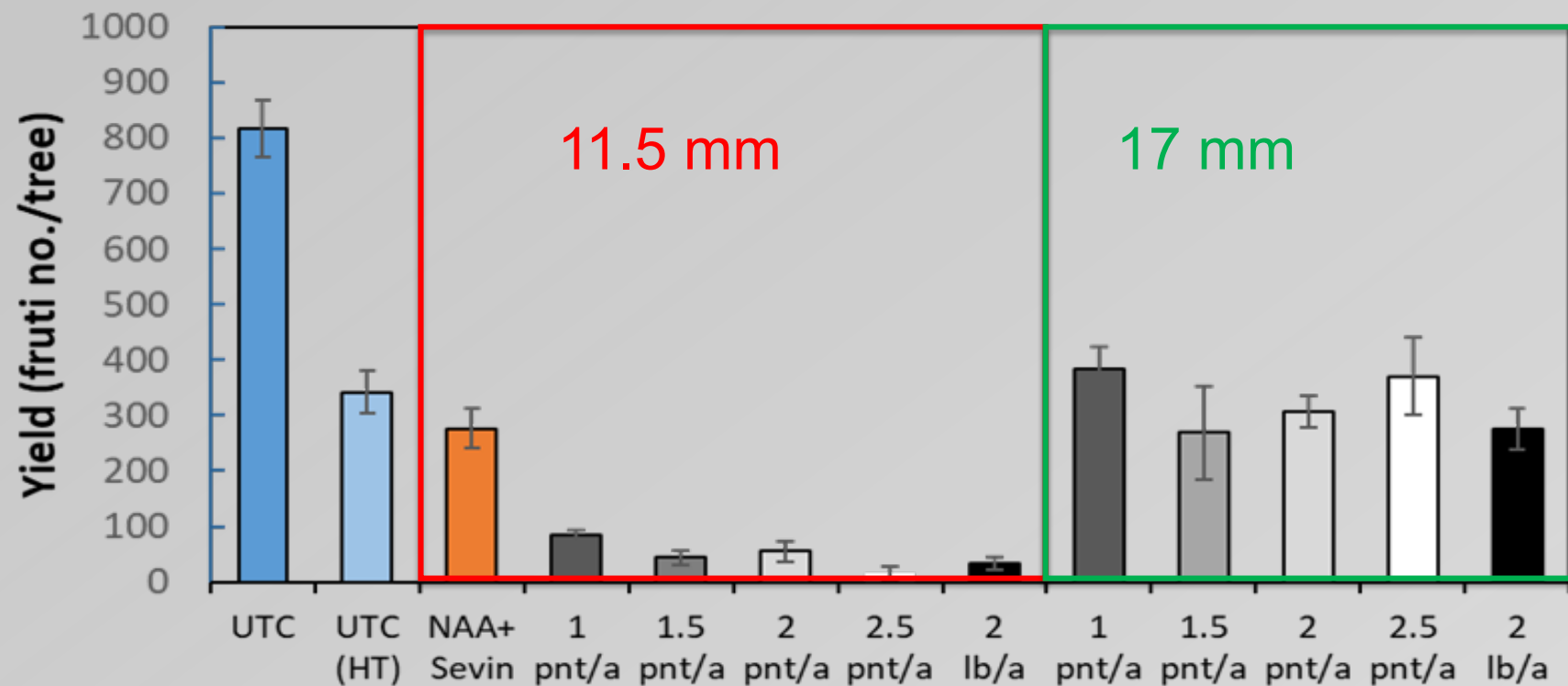
- Orange symbols signify applications (11.5 and 17 mm)
- High temps with first app contributed to over-thinning
- Metamitron should be avoided under high temp conditions

Metamitron: PN



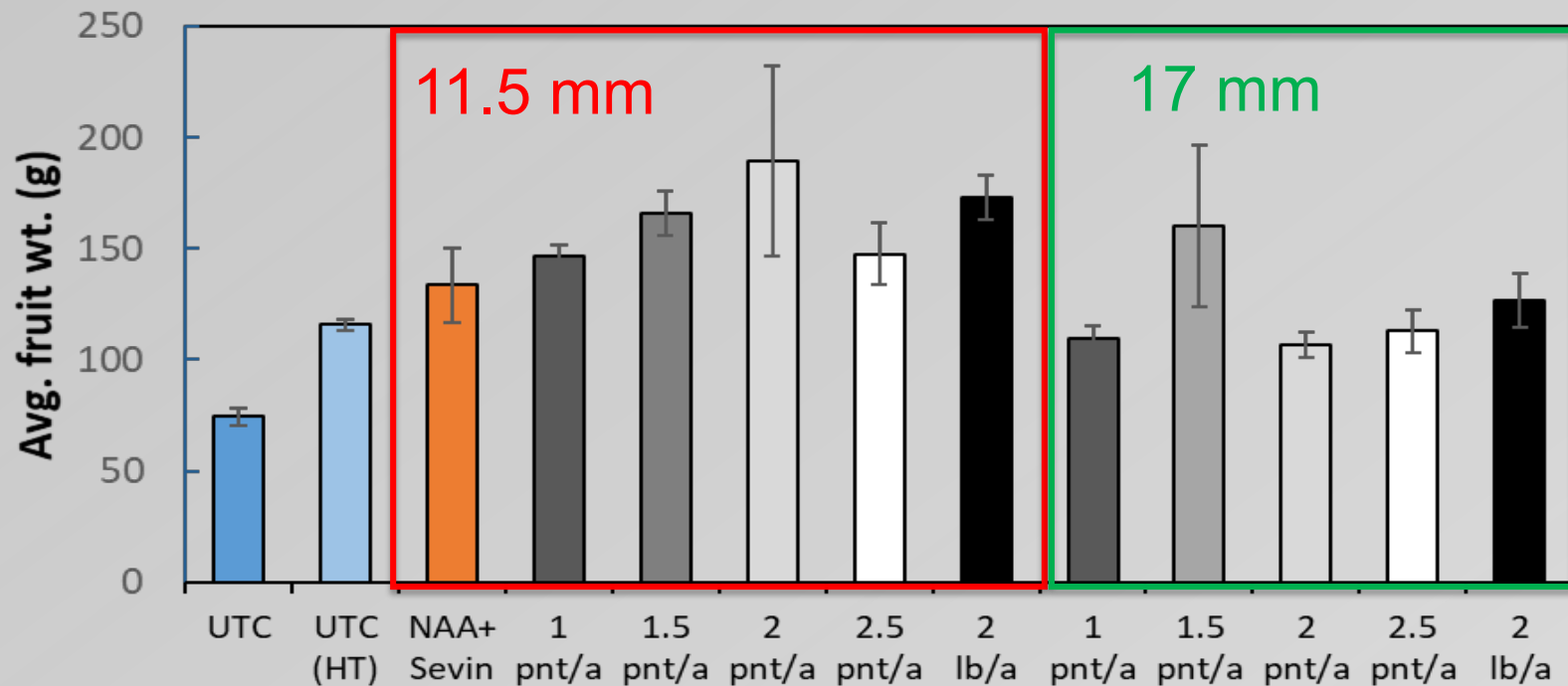
- Mode of action of metamitron is PN inhibition
- No Rate Response
- 11.5 mm timing- persistent for >25 days!

Metamitron: Yield



- Yield response was similar to fruit set

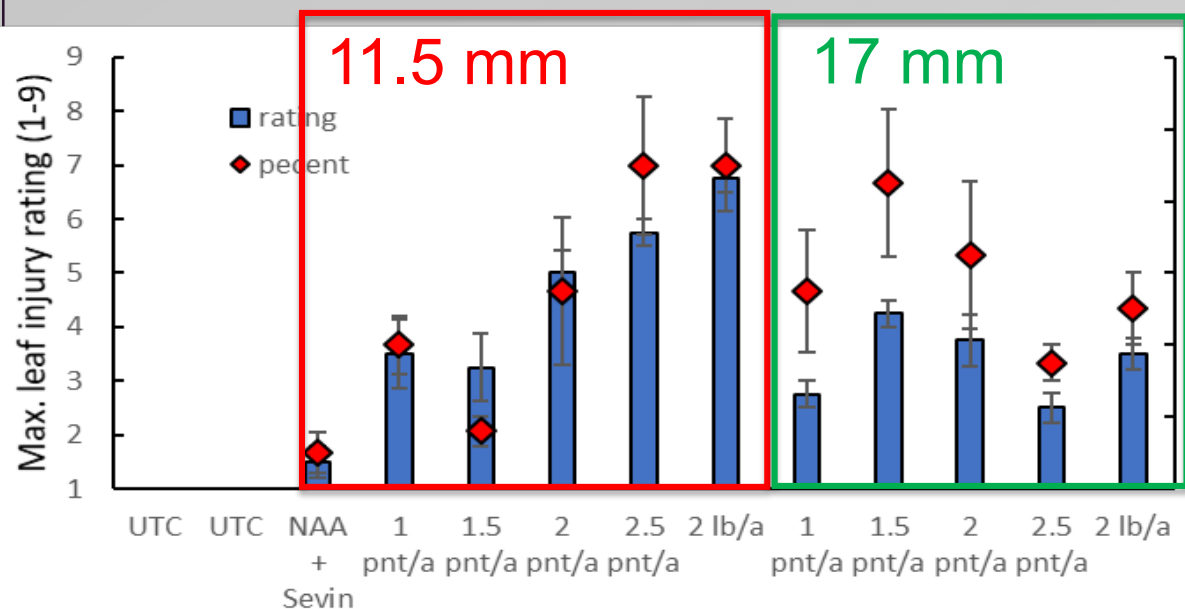
Metamitron: Fruit size



- Fruit weight proportionate to crop load
- Improved size of severely thinned treatments **does not** compensate for lost production

Metamitron: Phyto

Objective 2: Develop new (nonregistered) thinning compounds such as metamitron (early and mid-timings).



- Metamitron applied during heat led to comparatively high levels of phytotoxicity
- Compound does not translocate in plant
- More work needed to optimize metamitron

Metamitron Adama

- **Metamitron**
- Dose dependent
- Mild to moderate thinner
- Moderate to aggressive with MaxCel or NAA.
- Need warm weather.

Precision Cropload Management
Syracuse NY Fruit School
March 26-27 2019

Philip Schwallier

District Horticulture Agent

Clarksville Research Center

Thank you!