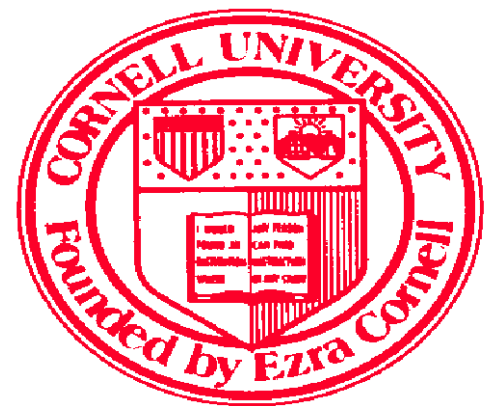


Precision Chemical Thinning - 2014

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Leo Dominguez

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Precision Crop Load Management

PCLM is a strategy to manage the number of fruit per tree to a specific pre-determined target:

1. Prune to a specific flower bud number
2. Chemically thin to a specific fruit number
3. Hand thin to a specific fruit number

Precision Thinning is a strategy to manage the chemical thinning process better by:

1. Identifying a target number of fruit per tree
2. Using the carbohydrate model to predict thinning response
3. Using multiple applications of chemical thinners
4. Assessing results using the fruit growth rate model
5. Re-applying chemical thinners if needed.



Calculation of Desired Fruit Number (Tall Spindle Examples)

Determine desired yield/acre

Determine the desired fruit size acre

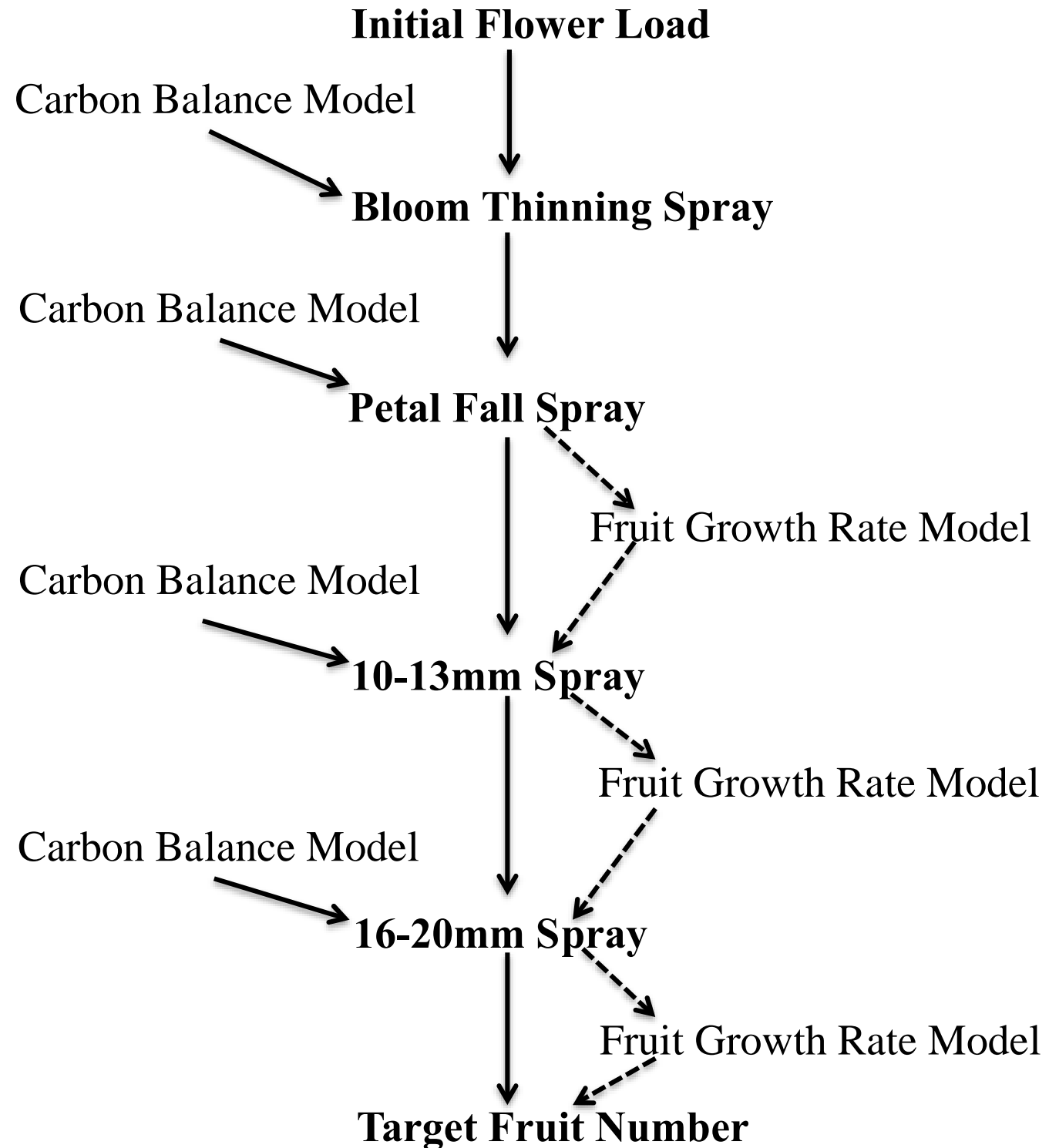
$1500 \text{ bu/acre} * 100 \text{ fruits/bu} = 150,000$
 $\text{fruits/acre} / 1210 \text{ trees/acre} = 124$
fruits/tree

If target yield is 1000 bu/acre then
target fruit number = **83 fruits/tree**

If target yield is 2000 bu/acre then
target fruit number = **165 fruits/tree**



Steps in Precision Thinning



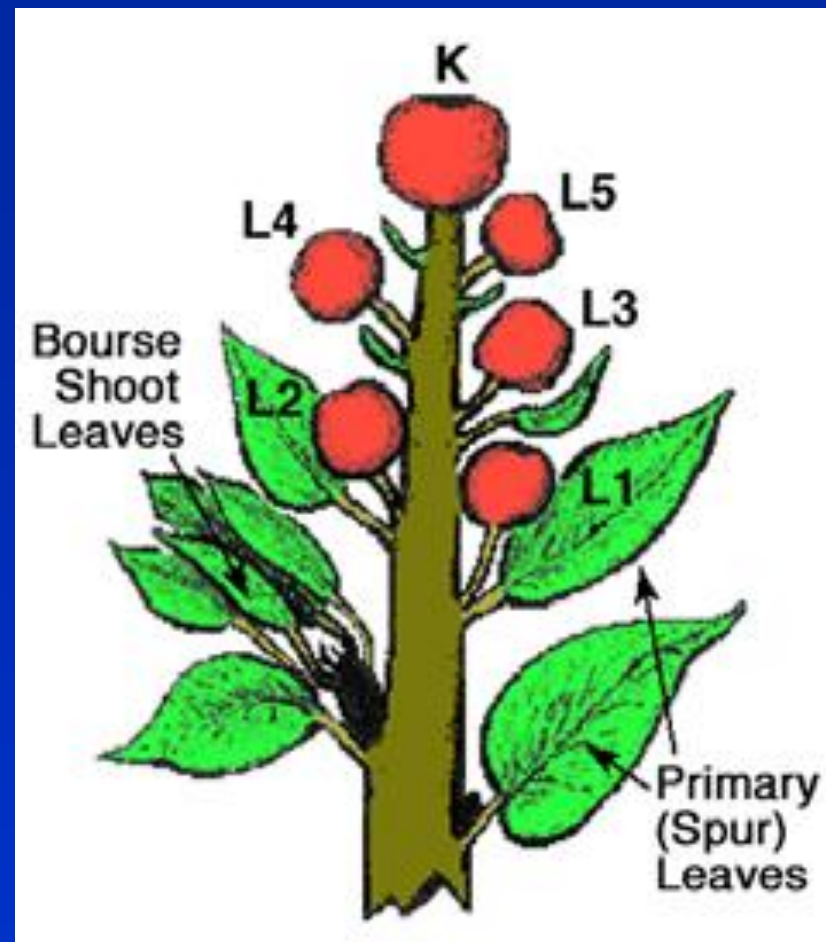
Thinning Windows

- Bloom
 - Ammonium Thiosulfate (ATS) (2-2.5%)
 - Lime Sulfur (2-2.5%) and Fish Oil or Damoil (2%) or Soybean oil (2%)
 - Promalin (2pt/acre)
 - Maxcel (64-128oz/acre)
 - NAA (4-8oz/acre)
- Petal Fall (fruits at 5-6mm)
 - Sevin (2pt/acre)
 - Maxcel (64-128oz/acre) + Sevin (2pt/acre)
 - NAA (4-8oz/acre) + Sevin (2pt/acre)
 - Maxcel + NAA
- Fruits at 10-13 mm
 - NAA (4-8oz/acre) + Sevin (2pt/acre)
 - Maxcel (64-128oz/acre)+ Sevin (2pt/acre)
 - Maxcel (64-128oz/acre) + NAA (3oz/acre)
- Fruits at 16-18 mm
 - NAA (4-8oz/acre) + Sevin (2pt/acre)+Regulaid (1pt/100gal)
 - Maxcel (64-128oz/acre)+ Sevin (2pt/acre) + Oil (1qt/100gal)
 - Ethrel (2-3pt/acre) + Oil (1qt/100gal)

Using the Carbohydrate Model

The Carbohydrate Theory of Thinning:

1. Fruitlets need carbohydrates to grow.
2. The tree allocates carbohydrates first to the shoot then to the fruits.
3. Weather conditions that result in low carbohydrate production often create a shortage of carbohydrates to support the growth of the fruits.
4. The weakest fruits do not receive enough carbohydrates and stop growing and begin to abscise.
5. Chemical thinners magnify the carbohydrate deficit and thus are more effective when applied during periods of natural shortage and are less effective when applied during periods of ample carbohydrate supply.



Web version of Carbohydrate Model

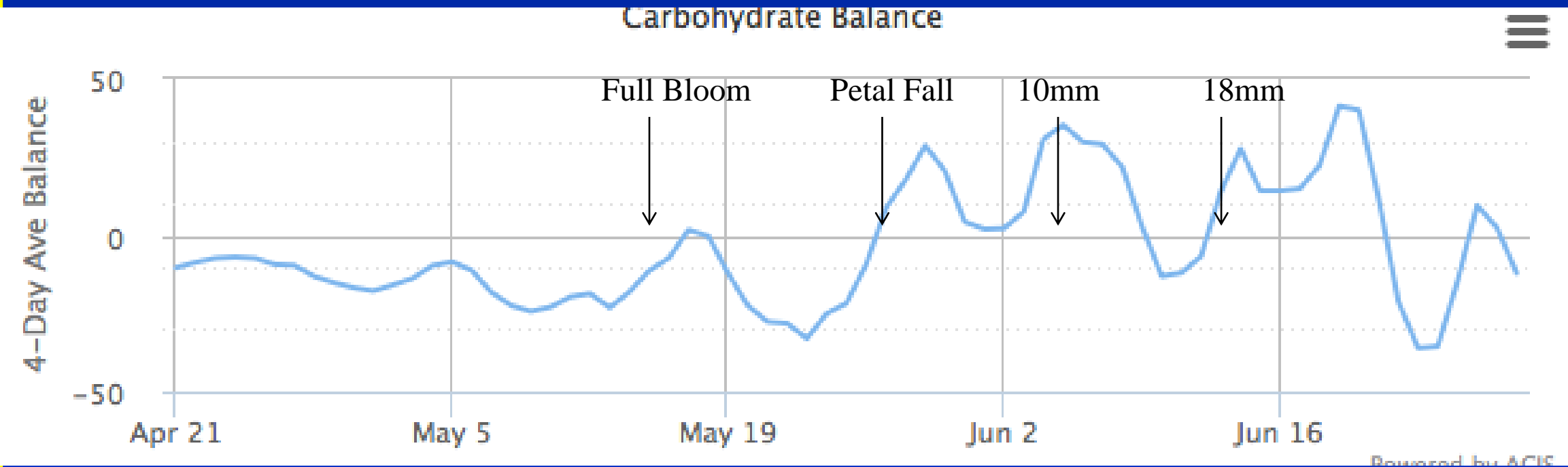
<http://newa.cornell.edu>

5/22	84	54	19.2	61.49	93.99	-32.50	4.37	Increase chemical thinner rate by 30%
5/23	75	49	12.9	54.73	70.94	-16.21	27.3	Increase chemical thinner rate by 30%
5/24	50	40	7.7	39.36	27.10	12.26	42.15	Increase chemical thinner rate by 30%
5/25	56	44	25.1	93.50	39.57	53.93	34.88	Increase chemical thinner rate by 30%
5/26	61	41	27.5	102.02	42.80	59.22	10.59	Increase chemical thinner rate by 30%
5/27	69	45	27.4	103.73	60.54	43.20	-19.91	Apply standard chemical thinner rate
5/28	62	44	6.6	33.54	50.37	-16.83	-45.19	Decrease chemical thinner rate by 30%
5/29	80	59	14.5	58.79	102.04	-43.25	-51.49	Decrease chemical thinner rate by 30%
5/30	90	67	23.9	71.26	134.04	-62.78	-36.33	Decrease chemical thinner rate by 15%
5/31	93	65	23.2	68.42	126.34	-57.92	-4	Apply standard chemical thinner rate
6/1	88	67	20.2	65.97	108.00	-42.02	28.36	Increase chemical thinner rate by 30%
6/2	77	57	20.7	89.22	71.82	17.41	50.57	Increase chemical thinner rate by 30%
6/3	62	51	26.5	114.18	47.65	66.53	34.17	Increase chemical thinner rate by 30%
6/4	67	46	27.2	119.36	47.84	71.52	6.75	Increase chemical thinner rate by 30%
6/5	67	52	22.1	102.98	56.18	46.80		
6/6	58	54	2.3	0.59	48.77	-48.18		
6/7	60	55	3.8	12.10	55.24	-43.15		

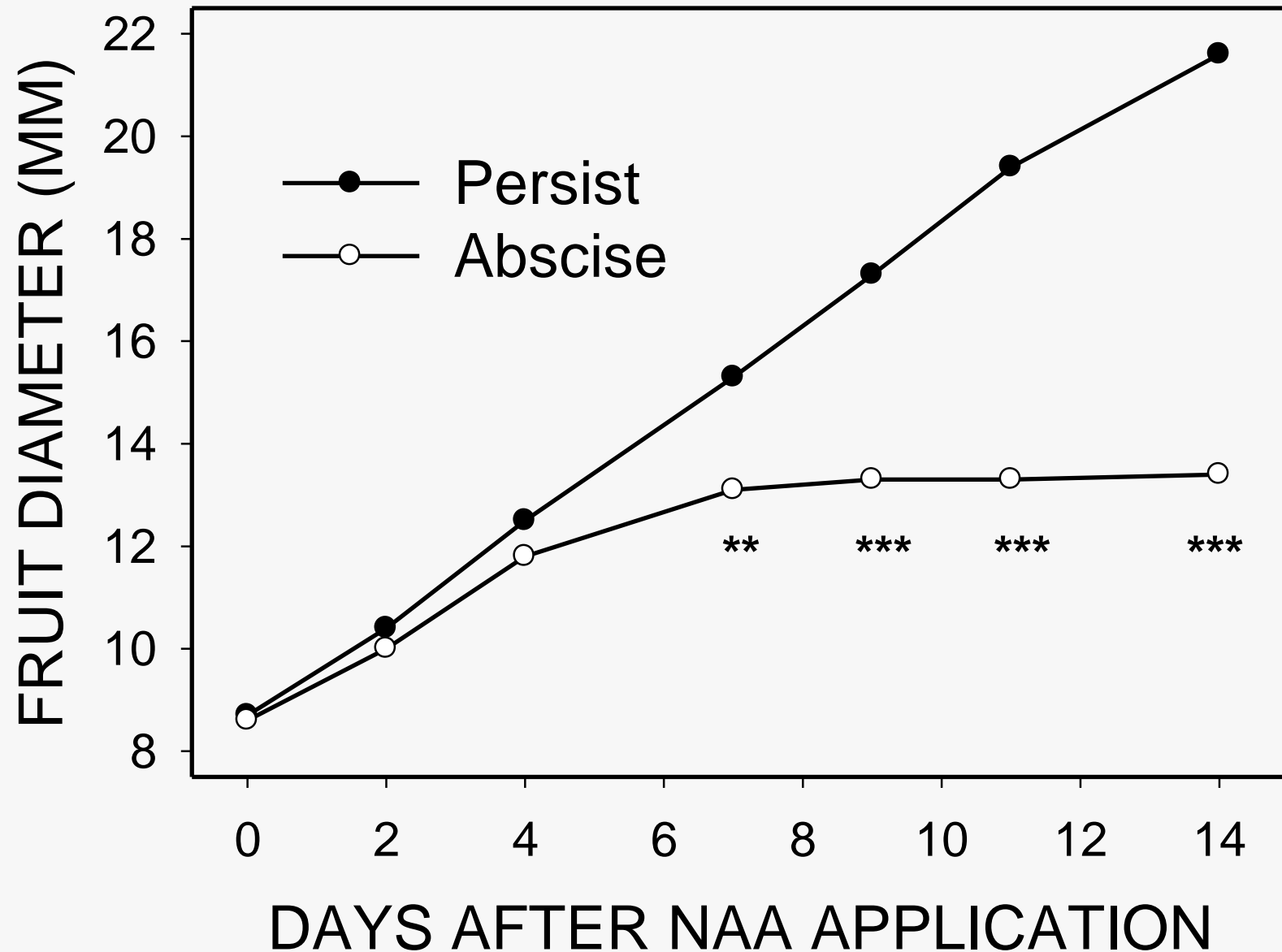
Decision Rules We Use to Make Recommendations with the Carbohydrate Model

4-Day Av. Carb. Balance	Thinning Recommendation
+20g/day to +40g/day	Increase Chemical Thinning Rate by 30%
+20g/day to 0g/day	Increase Chemical Thinning Rate by 15%
0g/day to -20g/day	Apply Standard Chemical Thinning Rate
-20g/day to -40g/day	Decrease Chemical Thinning Rate by 10%
-40g/day to -60 g/day	Decrease Chemical Thinning Rate by 20%
-60g/day to -80 g/day	Decrease Chemical Thinning Rate by 30%
< than -80g/day	Do not thin (many fruits will fall off naturally)

Peru Carbohydrate Balance 2014



Use The Fruit Growth Model to Accurately Assess the Effect of a Thinning Spray



Tagging Spurs and Measuring Fruit Diameter

1. At pink, select and tag 15 representative spurs per tree
 - Location of spurs must represent where the fruit is (top, middle and bottom of tree)
 - Do not tag flowering clusters on 1 year wood
 - Use a strip of orange ribbon and label for easy identification later (spur 1-15)
2. At exactly 3 days after each spray, label each fruit in each cluster with a number (1-5) using a permanent marker.
3. Measure and record diameter of each fruitlet with a digital caliper on day 3 after application
4. Re-Measure diameter of each fruitlet 5 days later on day 8 after application



NY Participants in Precision Thinning Group Effort 2014

Abbott

Buhr

Cahoon

Coene

Dominguez

Farrow

Furber

Hance

Oaks

Reisinger

Russell

Smith

Vandewalle

Chazy

Sullivan

Indian Ladder

Crist

Minard

HVL

Two Options in 2014 for Precision Thinning of Gala

Option 1

1. Apply a Bloom Spray
 - NAA (8oz/acre)
2. Apply a Petal Fall Spray (6mm)
 - NAA (6oz/acre) + Sevin (2pt/acre)
3. Apply a 12 mm Spray
 - Maxcel (96oz/acre) + Sevin (2pt/acre)
4. Apply an 18 mm spray (if needed)
 - Maxcel (96oz/acre) + Sevin (2pt/acre + Oil (1pt/100gal) (directed to the upper part of the tree)

Option 2

1. Apply a Petal Fall Spray (6mm)
 - NAA (6oz/acre) + Sevin (2pt/acre)
2. Apply a 12 mm Spray
 - Maxcel (96oz/acre) + Sevin (2pt/acre)
3. Apply an 18 mm spray (if needed)
 - Maxcel (96oz/acre) + Sevin (2pt/acre + Oil (1pt/100gal) (directed to the upper part of the tree)

Two Options in 2014 for Precision Thinning of Honeycrisp

Option 1

1. Apply a Bloom Spray
 1. NAA (8oz/acre)
2. Apply a Petal Fall Spray (6mm)
 - NAA (8oz/acre) + Sevin (2pt/acre)
3. Apply a 12 mm Spray
 - NAA (6oz/acre) + Sevin (2pt/acre)
4. Apply an 18 mm spray (if needed)
 - Sevin (2pt/acre + Oil (1pt/100gal)
(directed to the upper part of the tree)

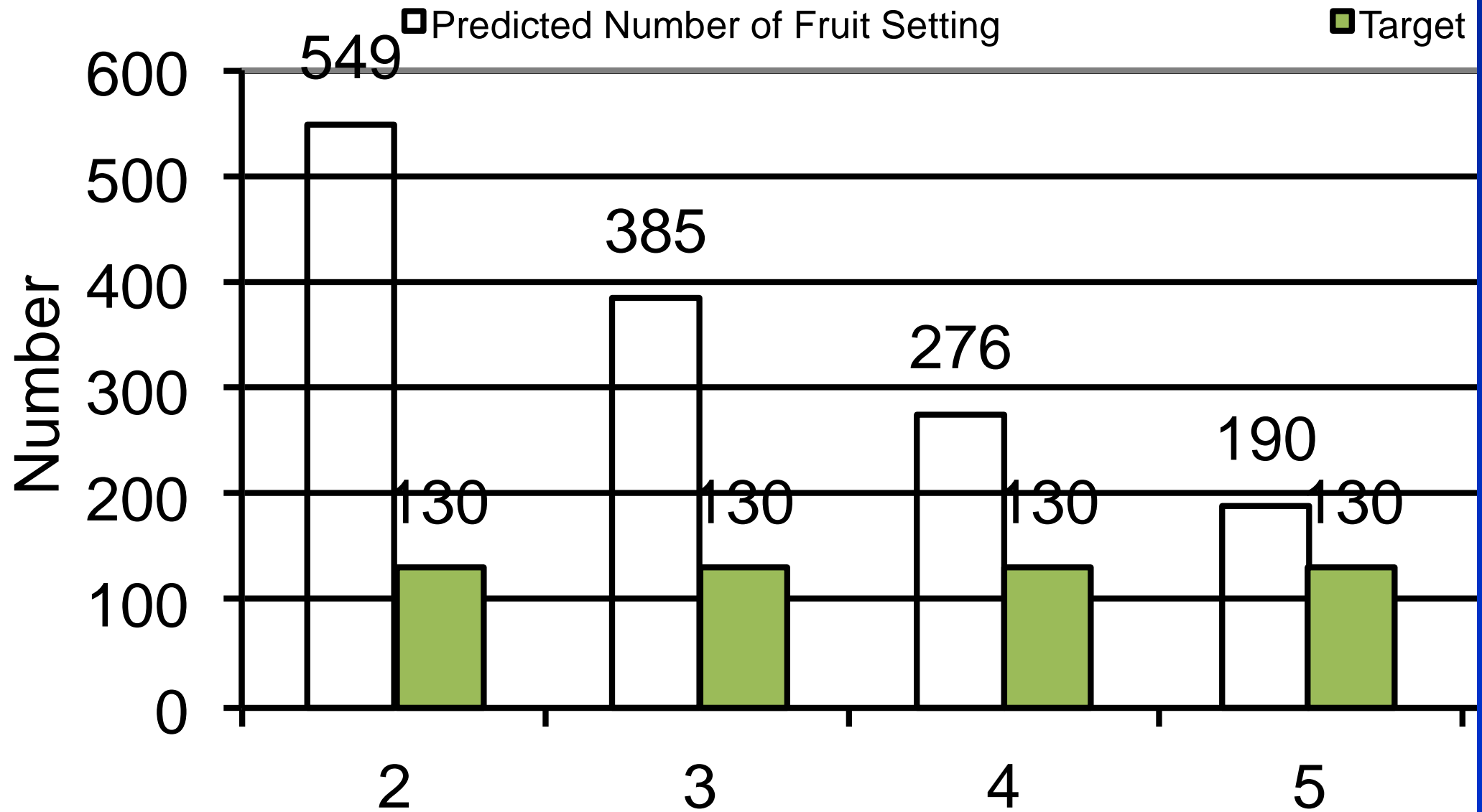
Option 2

1. Apply a Petal Fall Spray (6mm)
 - NAA (8oz/acre) + Sevin (2pt/acre)
2. Apply a 12 mm Spray
 - NAA (6oz/acre) + Sevin (2pt/acre)
3. Apply an 18 mm spray (if needed)
 - Sevin (2pt/acre + Oil (1pt/100gal)
(directed to the upper part of the tree)

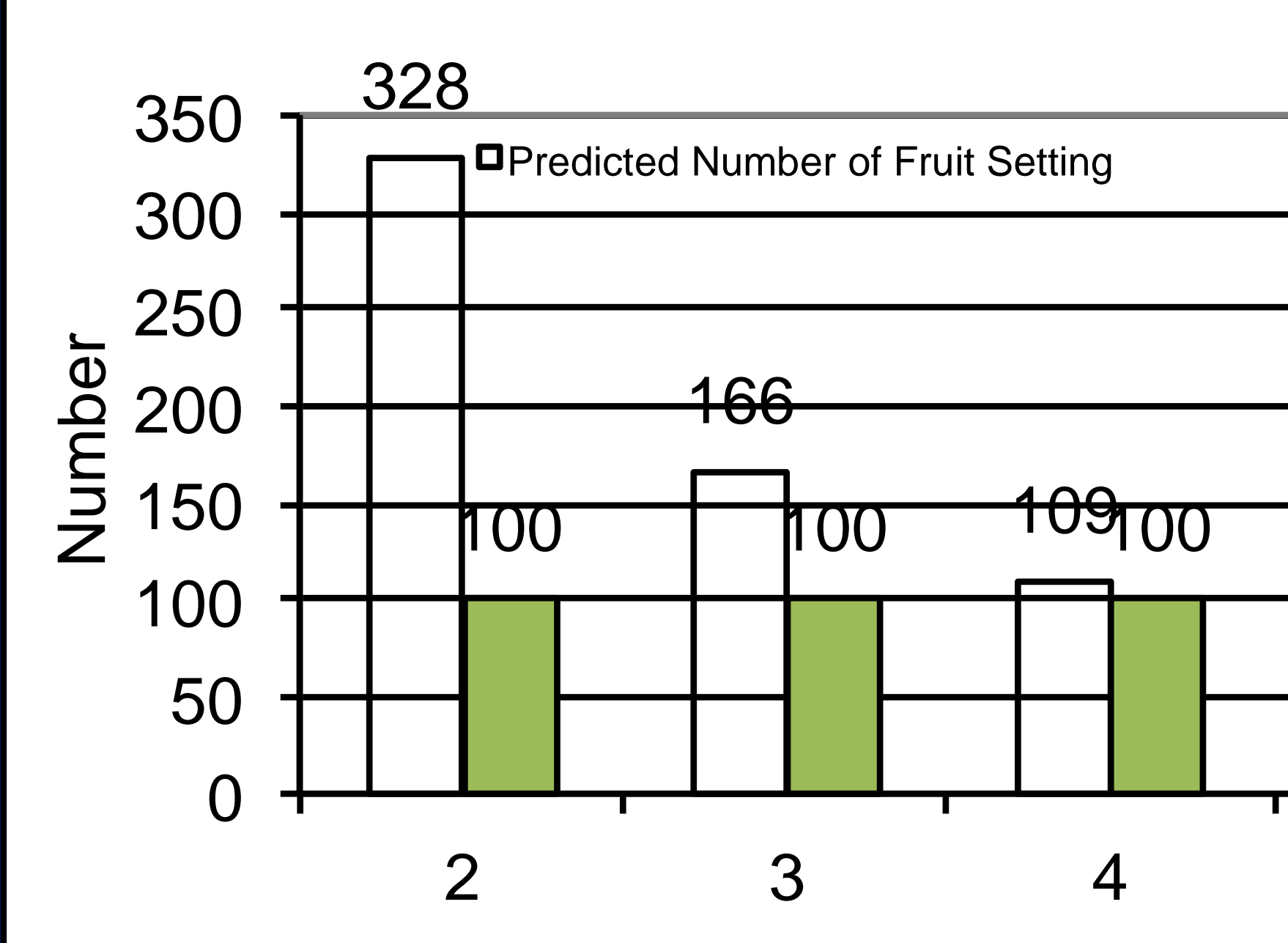
Results of the Precision Thinning Protocol in 2014

Orchard	Variety	Flower Buds	Target Fruit Number	Number of Fruits after 2-3 applications	Number of Extra Fruits	Recomendation
Cahoon	Gala	276	185	500	315	Need another full spray of Maxcel+Sevin Need another 1/2 dose spray of
Geneva	Gala	260	130	276	146	Maxcel+Sevin
Jeff Smith	Gala	451	290	698	408	Need another full spray of Maxcel+Sevin Need another 1/2 dose spray of
Lamont	Gala	94	65	152	87	Maxcel+Sevin
Reisinger	Gala	426	193	562	369	Need another full spray of Maxcel+Sevin
Vandewalle	Gala	292	150	662	512	Need another full spray of Maxcel+Sevin
Vandewalle	Gala	400	150	909	759	Need another full spray of Maxcel+Sevin
Vandewalle	Gala	247	88	369	281	Need another full spray of Maxcel+Sevin
Vandewalle	Gala	519	160	1045	885	Need another full spray of Maxcel+Sevin
Buhr	HC	230	100	98	-2	Thinning is done. Congratulations
Cahoon	HC	454	185	424	239	Need another full spray of NAA+Sevin
Geneva	HC	260	100	114	14	Thinning is done. Congratulations
Hance	HC	385	130	246	116	Need another 1/2 dose spray of NAA+Sevin
Jeff Smith	HC	906	177	411	234	Need another full spray of NAA+Sevin
Lamont	HC	83	35	95	60	Need another 1/2 dose spray of NAA+Sevin

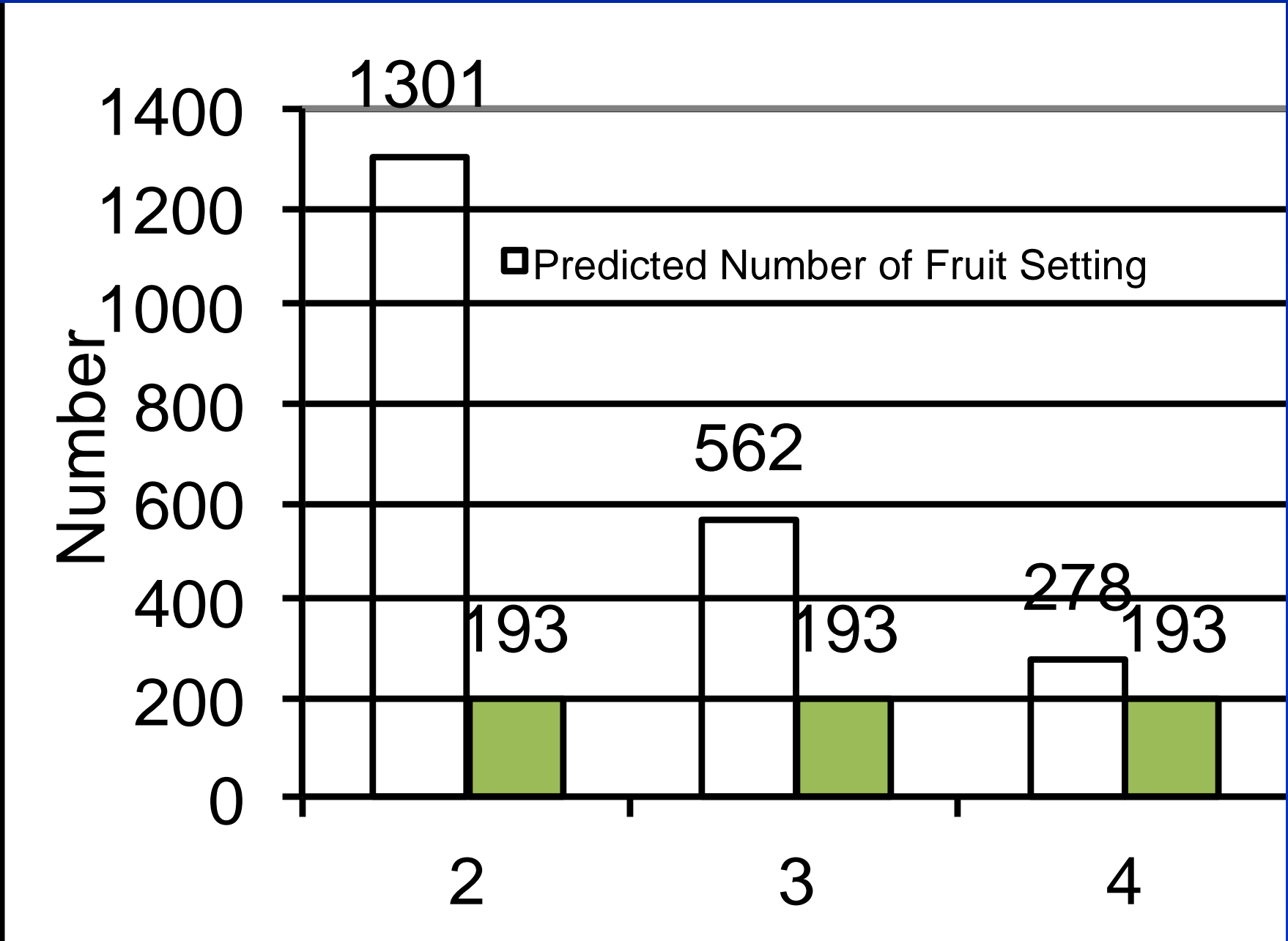
Gala fruit set at Geneva after 4 sprays with an initial bud load of 2 (1300 flowers)



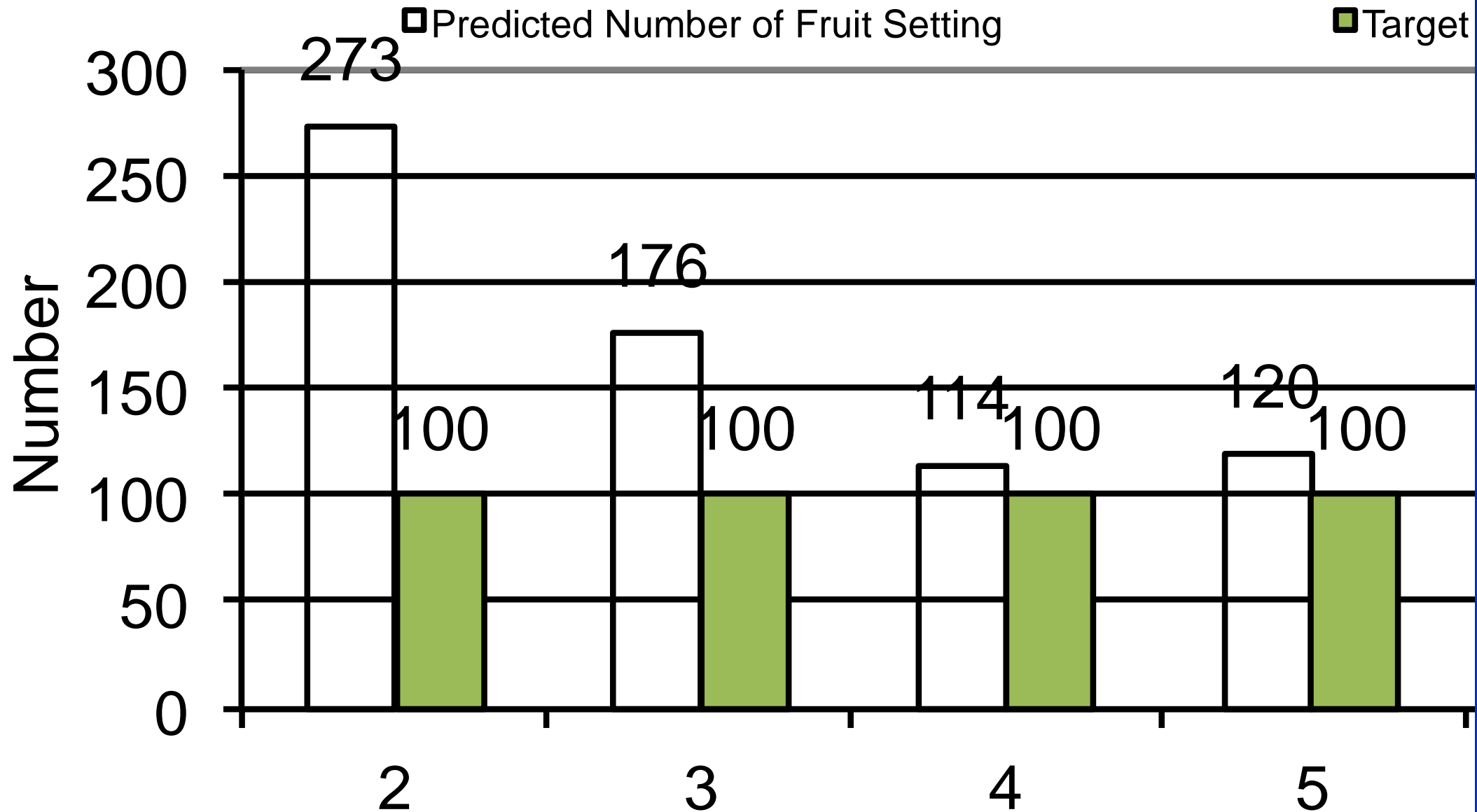
Gala fruit set at Lyndonville after 3 sprays with an initial bud load of 1.38 (690 flowers)



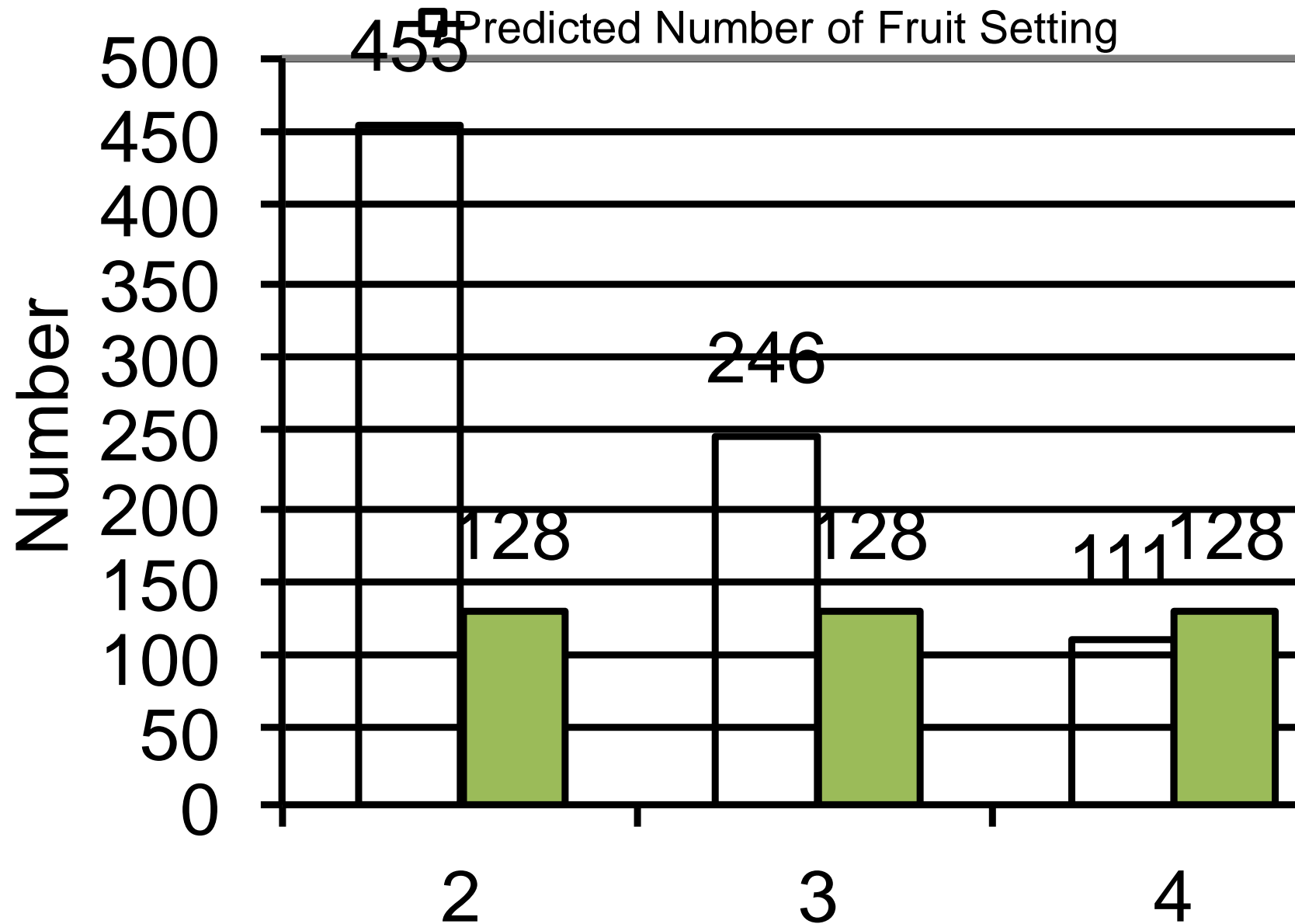
Gala fruit set in CNY after 3 sprays with an initial bud load of 2.2 (2130 flowers)



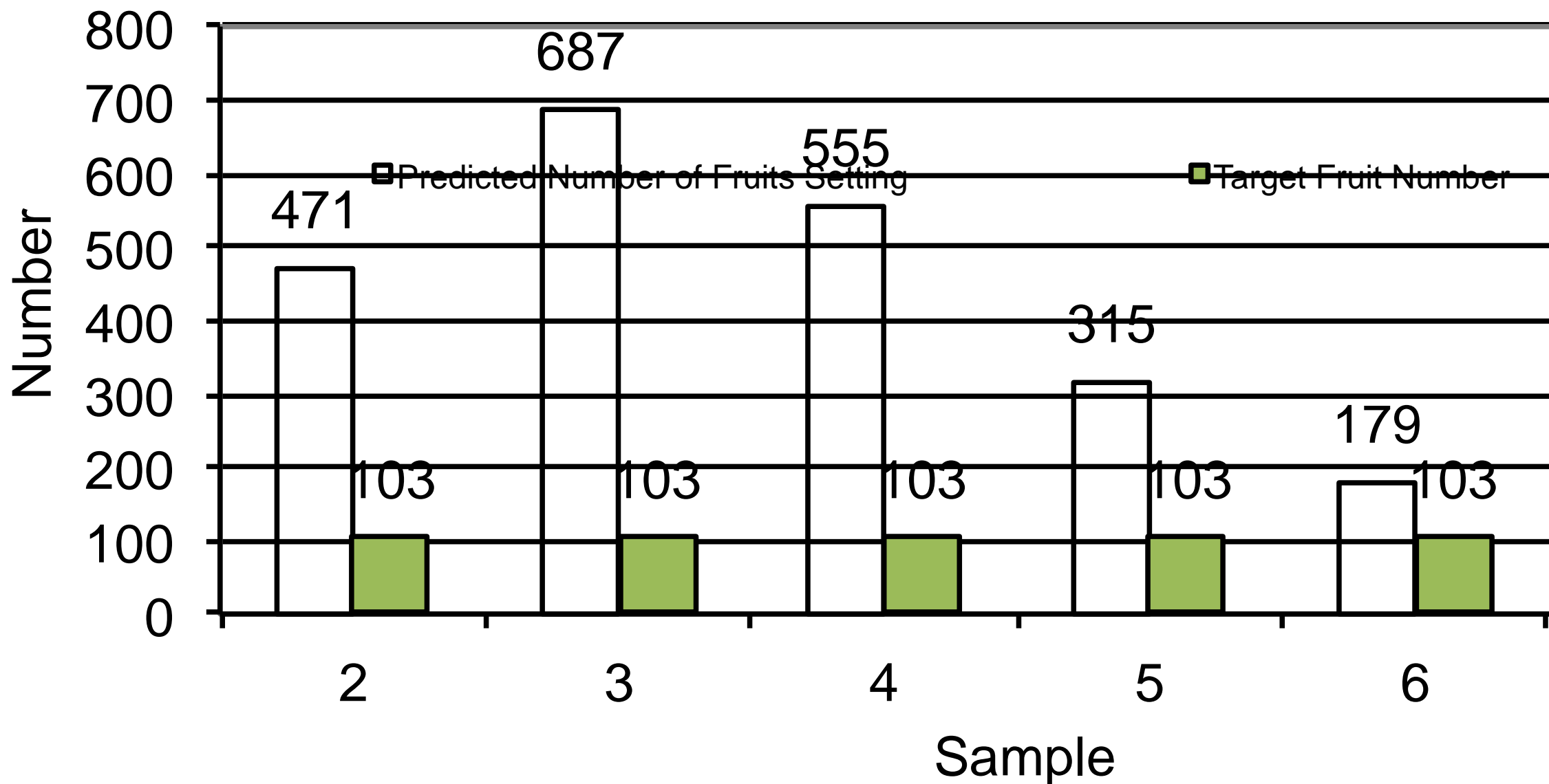
HC fruit set at Geneva after 4 sprays with an initial bud load of 2.6 (1300 flowers)



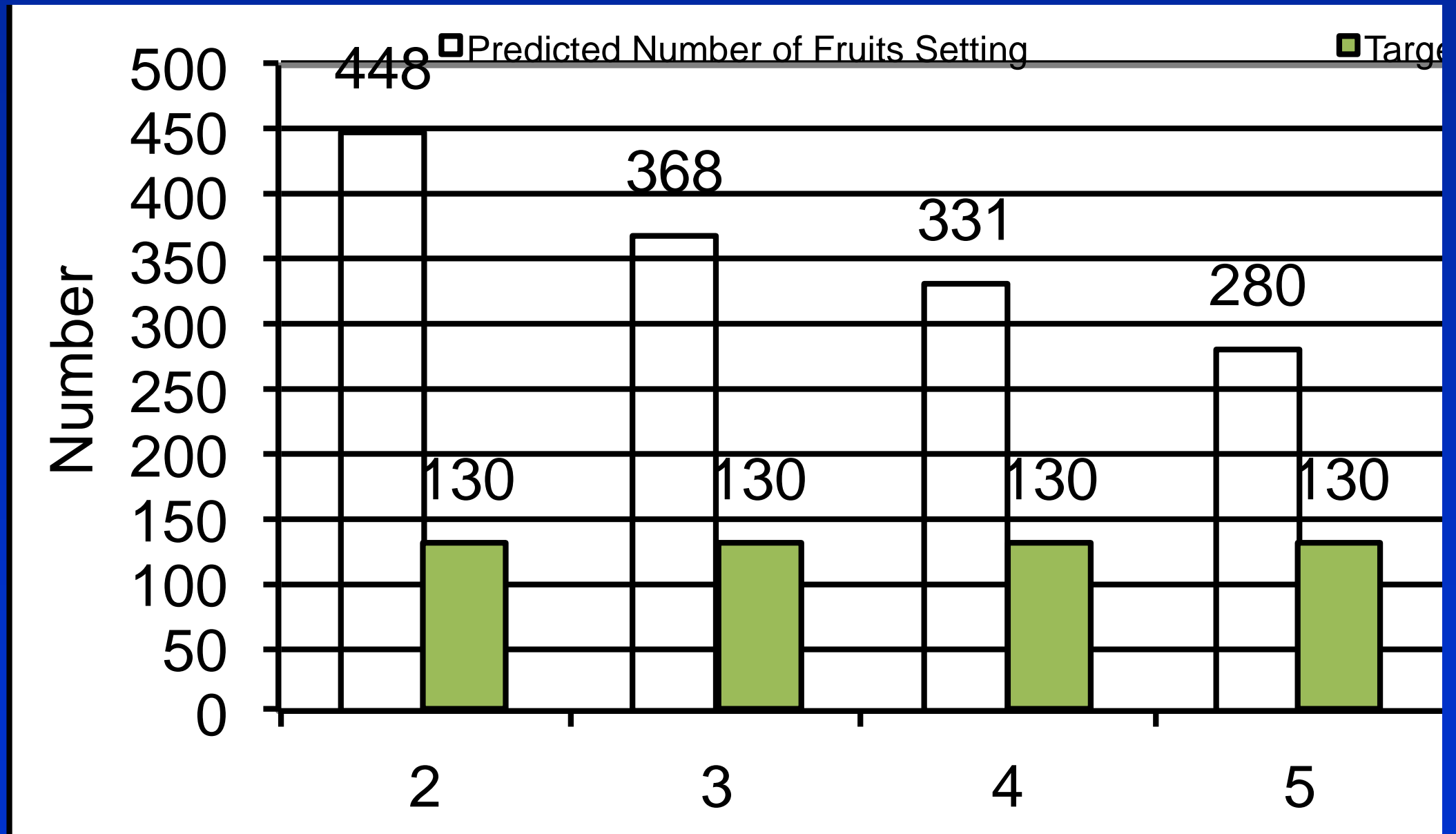
Honeycrisp fruit set in CNY after 3 sprays with an initial bud load of 1.8 (1185 flowers)



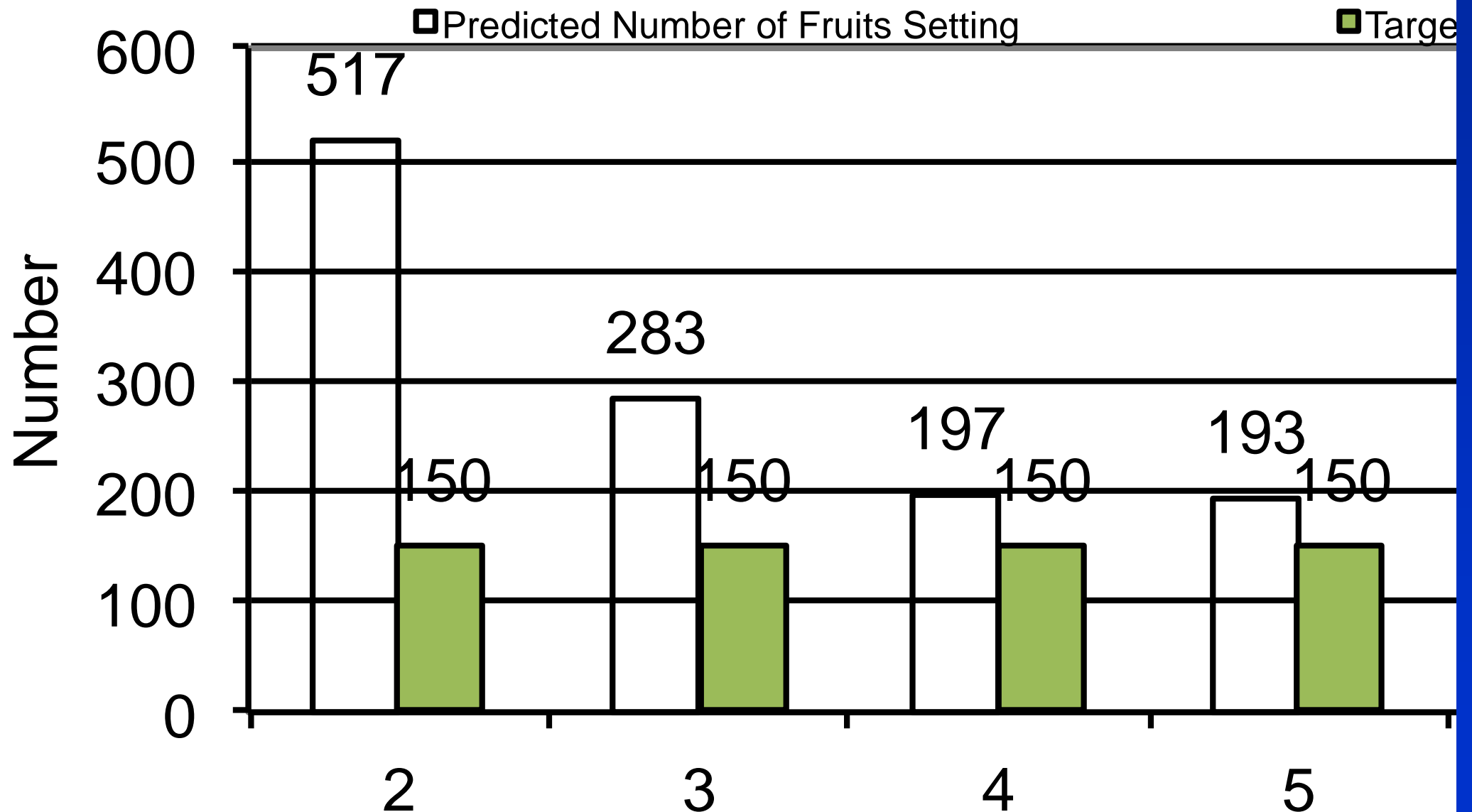
Honeycrisp fruit set at Chazy after 4 sprays with an initial bud load of 3.4 (1765 flowers)



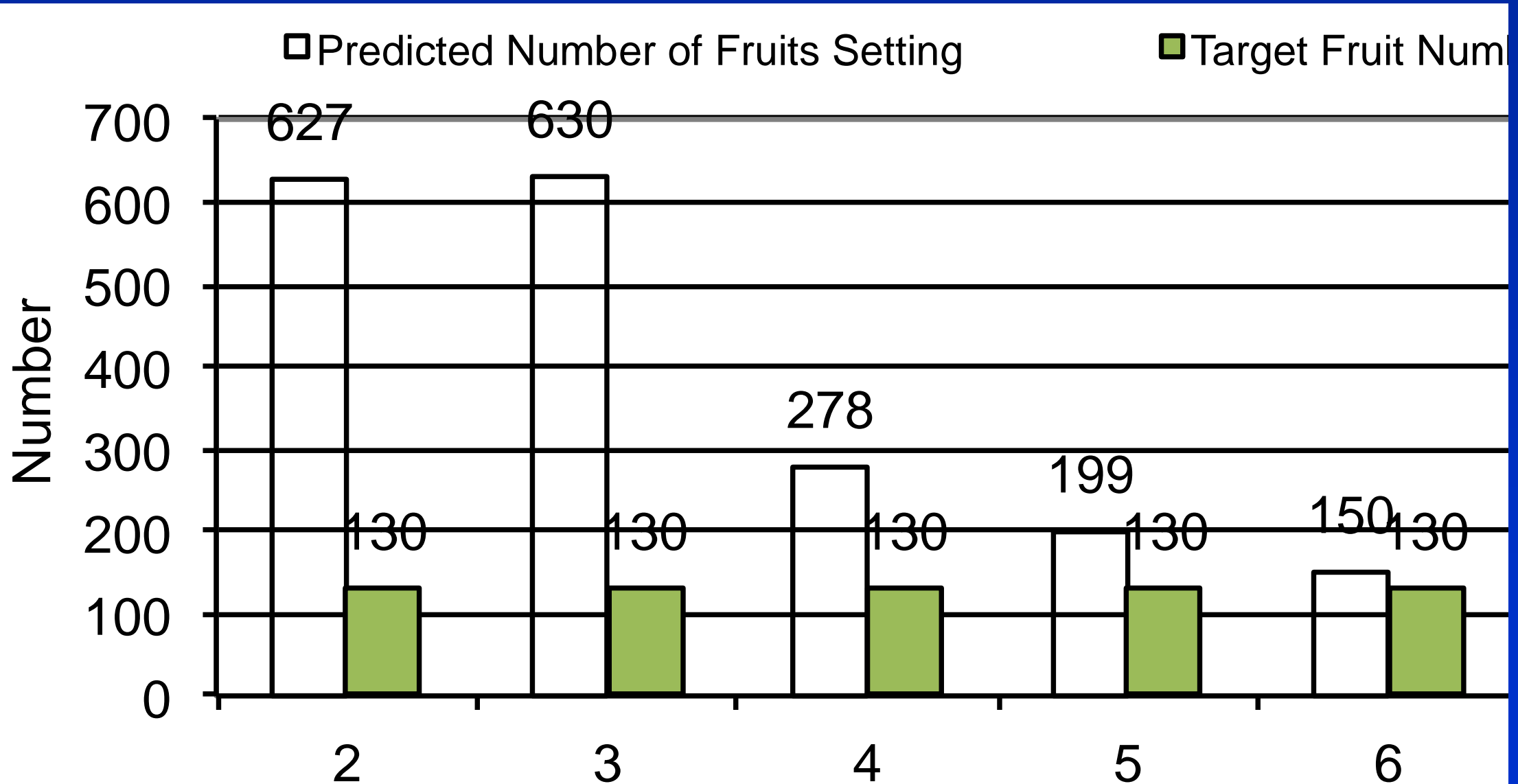
Honeycrisp fruit set at Peru after 3 sprays with an initial bud load of 1.5 (1000 flowers)



Honeycrisp fruit set at Sullivins at Peru after 3 sprays with an initial bud load of 1.7 (1250 flowers)



Gala fruit set at Albany after 4 sprays with an initial bud load of 1.9 (1225 flowers)

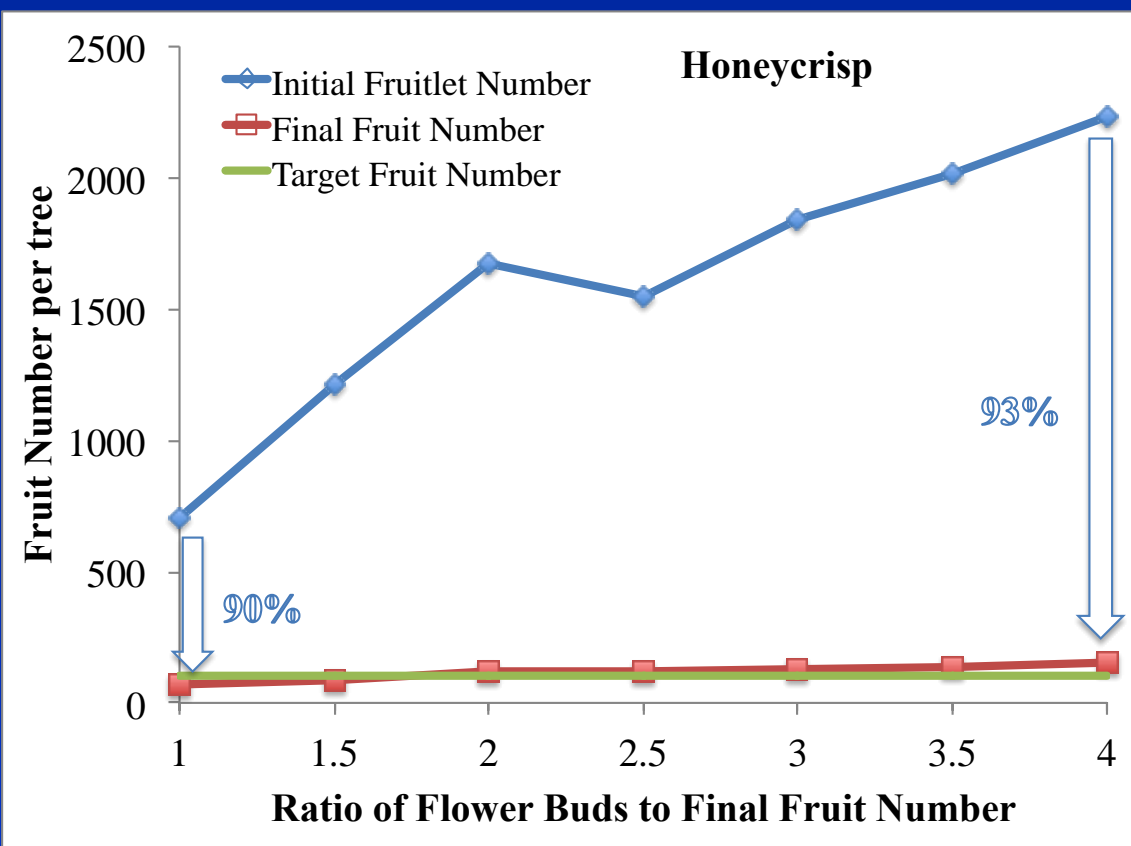
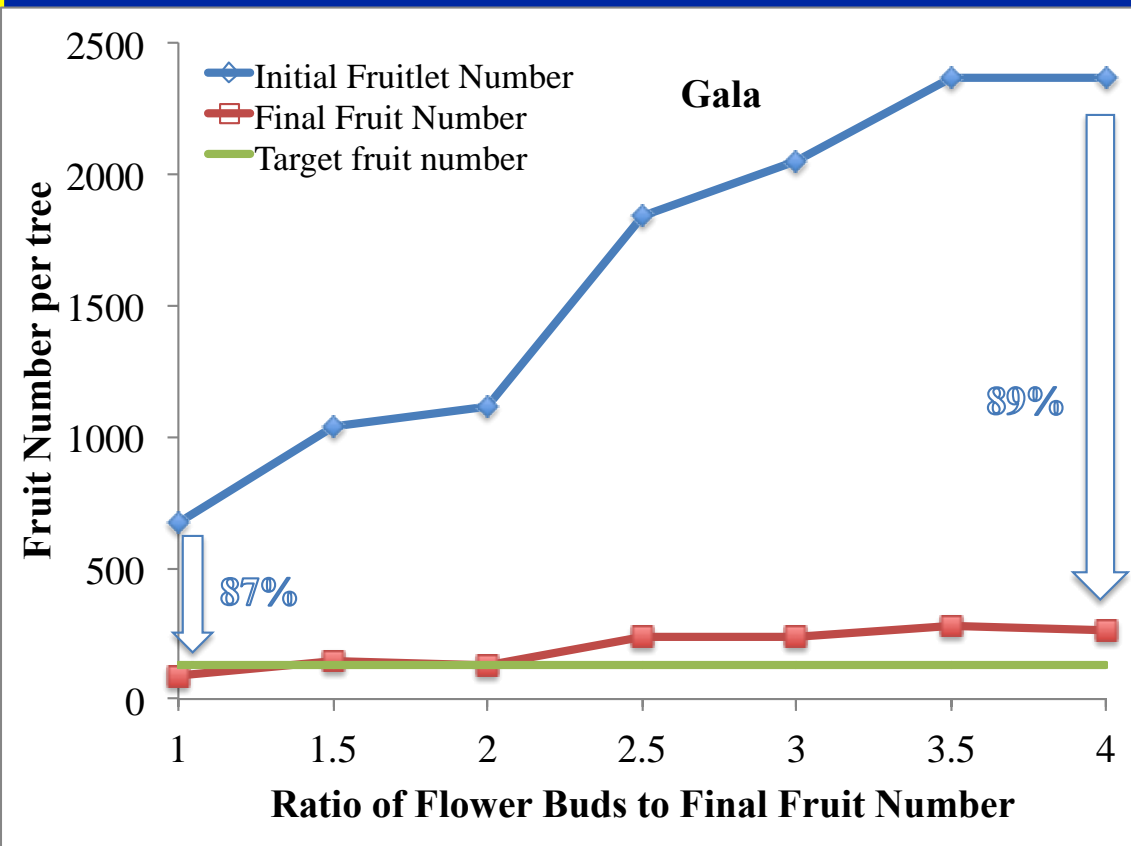


Pruning to Reduce Bud Load

Target 1.5 flower buds : 1 final fruit

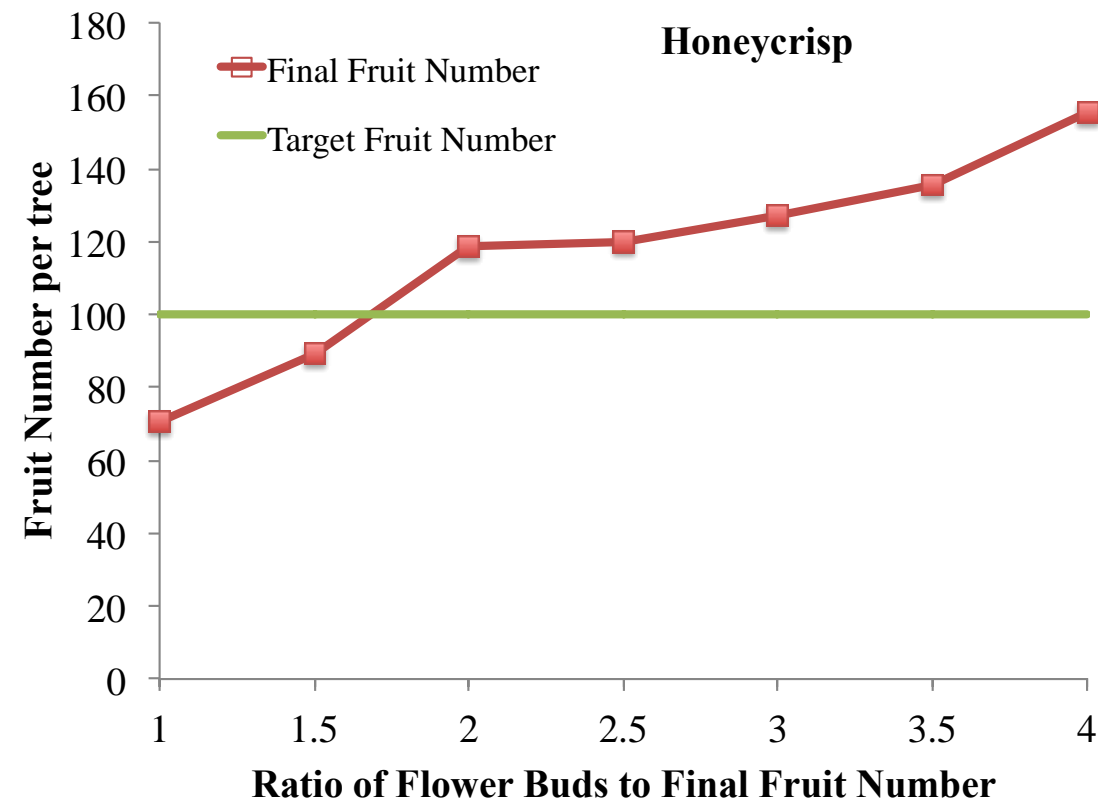
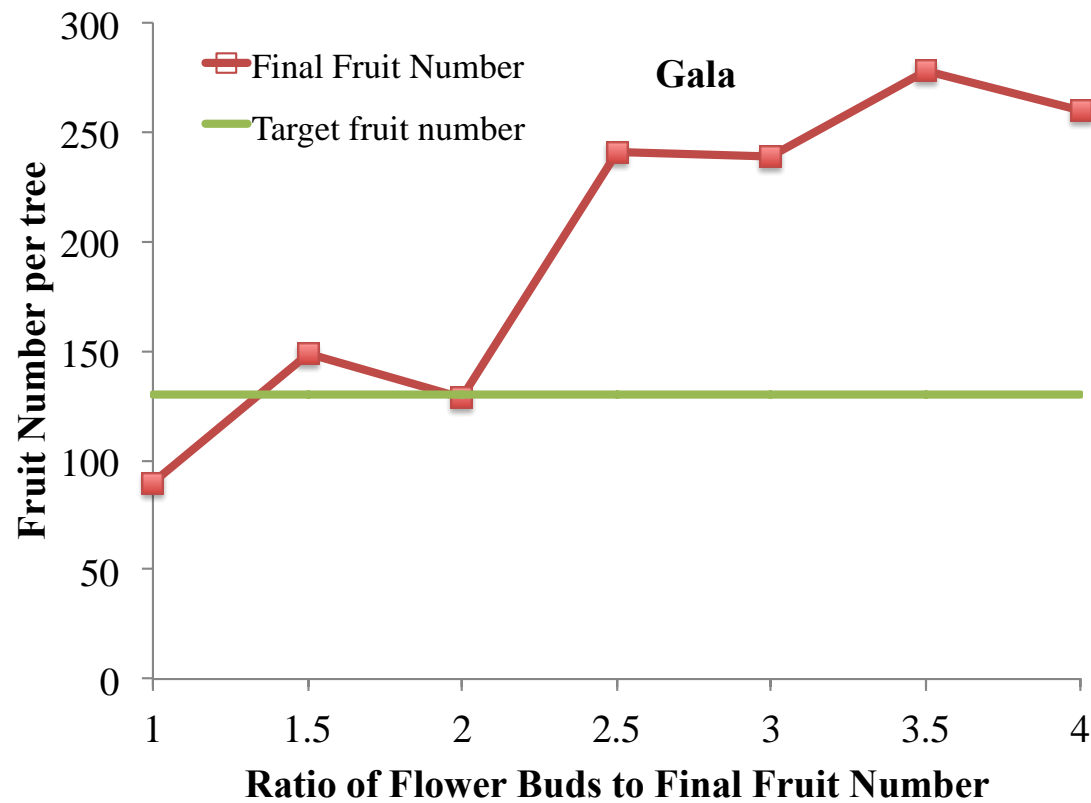


Gala and Honeycrisp Bud Load Study



- Leaving more buds resulted in more final fruit/tree
- The percent reduction in fruit numbers with and aggressive thinning program was quite similar regardless of initial flower bud load.

Gala and Honeycrisp Bud Load Study



- Leaving more than 2 buds : final fruit resulted in a large job of hand thinning
- Was my target right?

Conclusions from the Group Precision Thinning in 2013 and 2014

1. Both Gala and Honeycrisp needed more pruning to reduce bud load to 1:1.5
2. Most Gala blocks did not thin enough in both 2013 and 2014 and had significantly more fruit than the target fruit number
 - This required significant hand thinning
3. Most Honeycrisp blocks did not thin enough in 2013 but some slightly overthinned in 2014
4. Bloom thinning sprays were quite effective in 2013 but not in 2014
 - Bloom sprays of Maxcel did a nice job
5. The 10-12mm spray was not effective in 2013 but gave good thinning in 2014
6. The sequential sprays gave excellent crop load control.

Precision Thinning Group Effort in 2015

Protocol for group effort of willing participants in 2015

1. Select a mature orchard of either Gala or Honeycrisp.
2. Count flowering clusters on 5 representative trees at pink.
3. Calculate target fruit number for a high yield.
4. Tag 15 spurs per tree on each of 5 representative trees (75 total spurs) at pink.
5. Apply one of two spray protocols of thinning sprays
6. Use the carbohydrate model to adjust rates up or down based on model recommendations
7. Measure fruit diameters on 75 spurs 4 times (3 and 8 days after petal fall spray, 8 days after 12mm spray and 8 days after 18 mm spray)
8. Send the data within 24 hours after each 8 day measurement to Terence Robinson
9. Get back an assessment within 24 hours of thinning progress before next spray

Take-Home Plan to Manage Crop Load in 2014:

1. Precision Prune

1. Count flower buds on 5 representative trees per variety.
2. Prune to 1.5 buds per desired fruit number by removing 1-3 of the larger limbs
3. Columnarize (simplify) all remaining branches

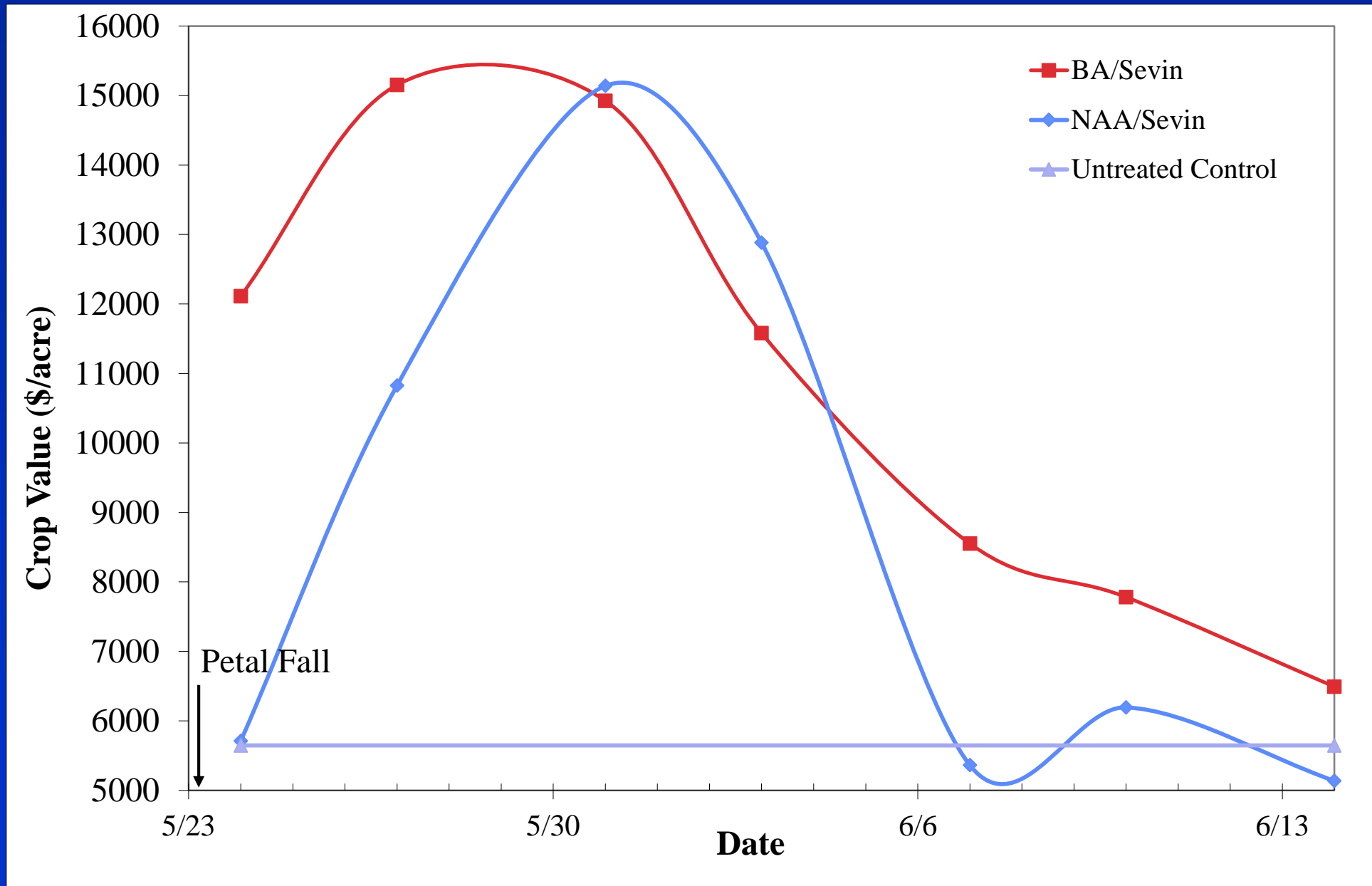
2. Chemically thin using the “Precision Thinning Program”

1. Begin with a full bloom spray
2. Apply a petal fall thinning spray
3. Assess response
4. If necessary, apply a thinning spray at 10-13mm
5. Re-assess response
6. If necessary apply a thinning spray at 18-20mm

3. Hand thin with Precision Hand Thinning

- Count number of fruits per tree
- Calculate target fruit number
- Zone thin using multi-level platform with each person removing his assigned number of fruits.

Is Precision Thining Worth the Effort?





Thank You for Your Attention

Questions?

Plan to attend:

- **Pruning workshop Mar. 3, 2015 Peru**
- **Precision Thinning Training in Early May 2015**