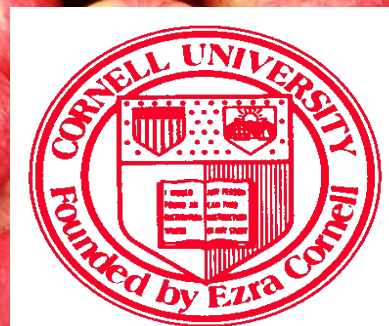


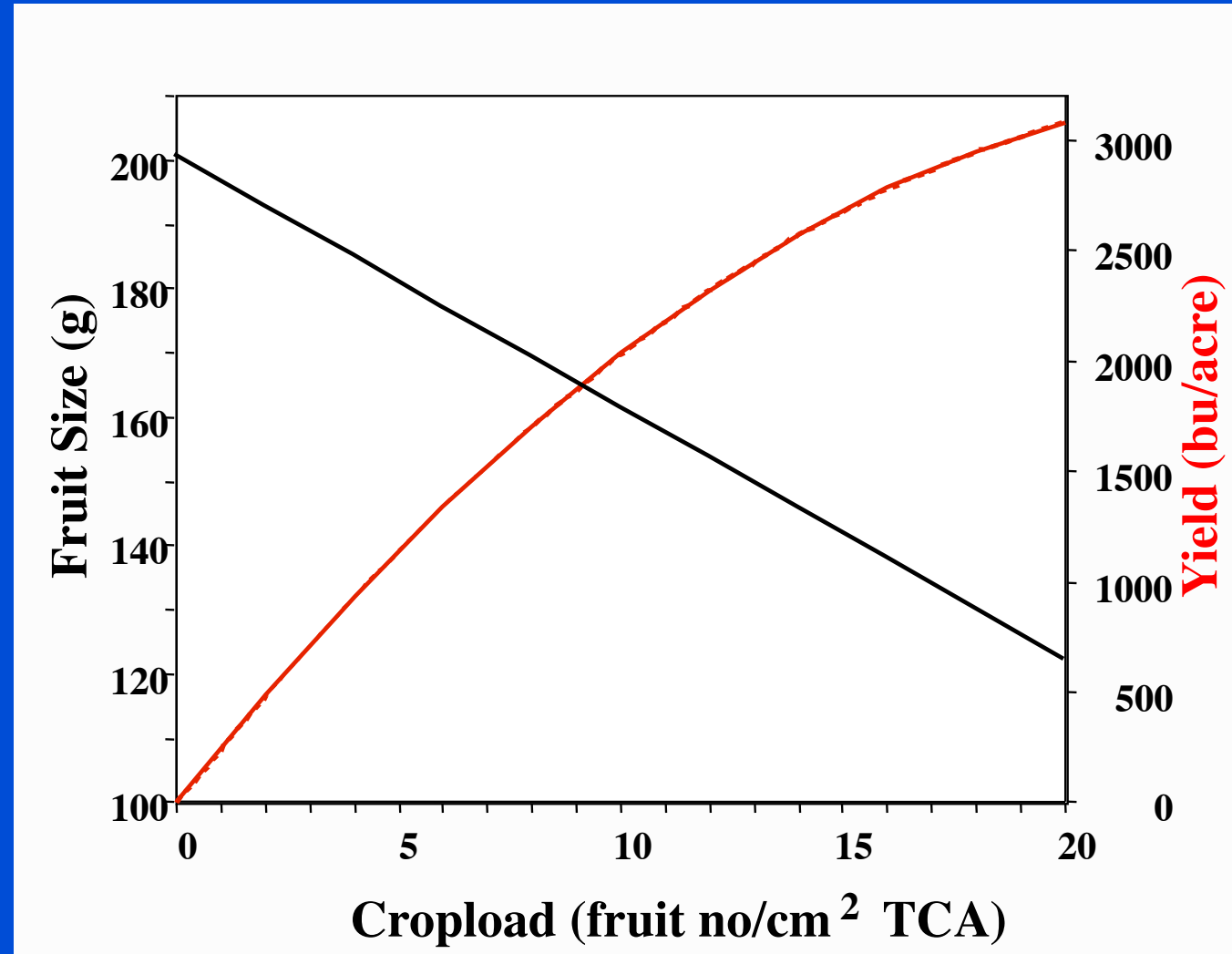
Thinning Strategies for Best Economic Results

Terence Robinson, Alison DeMarree,
Steve Hoying and Mike Fargione
Dept. of Horticulture
Cornell University
Geneva, NY 14456

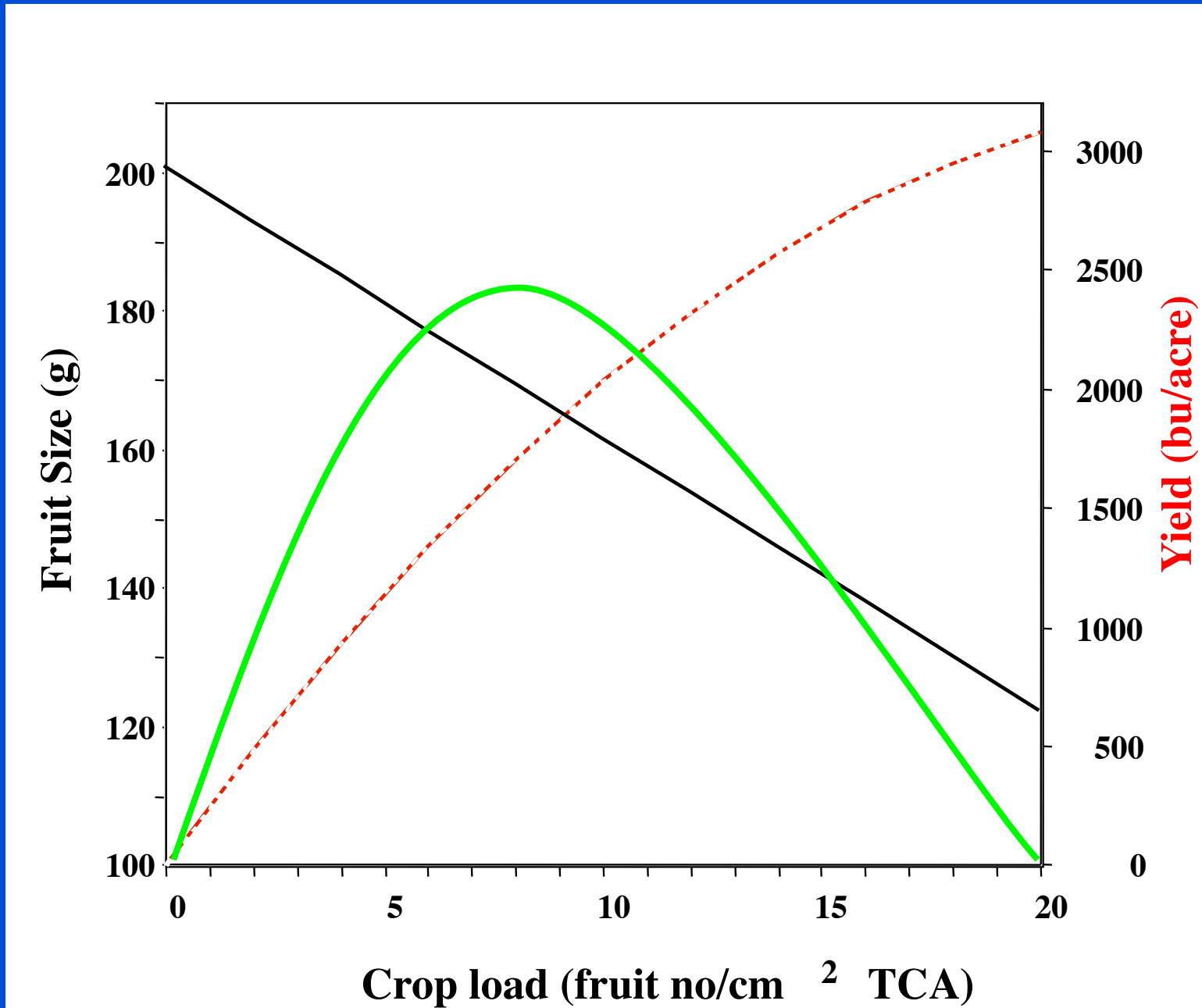


The Counter Balancing Responses to Crop Load Adjustment

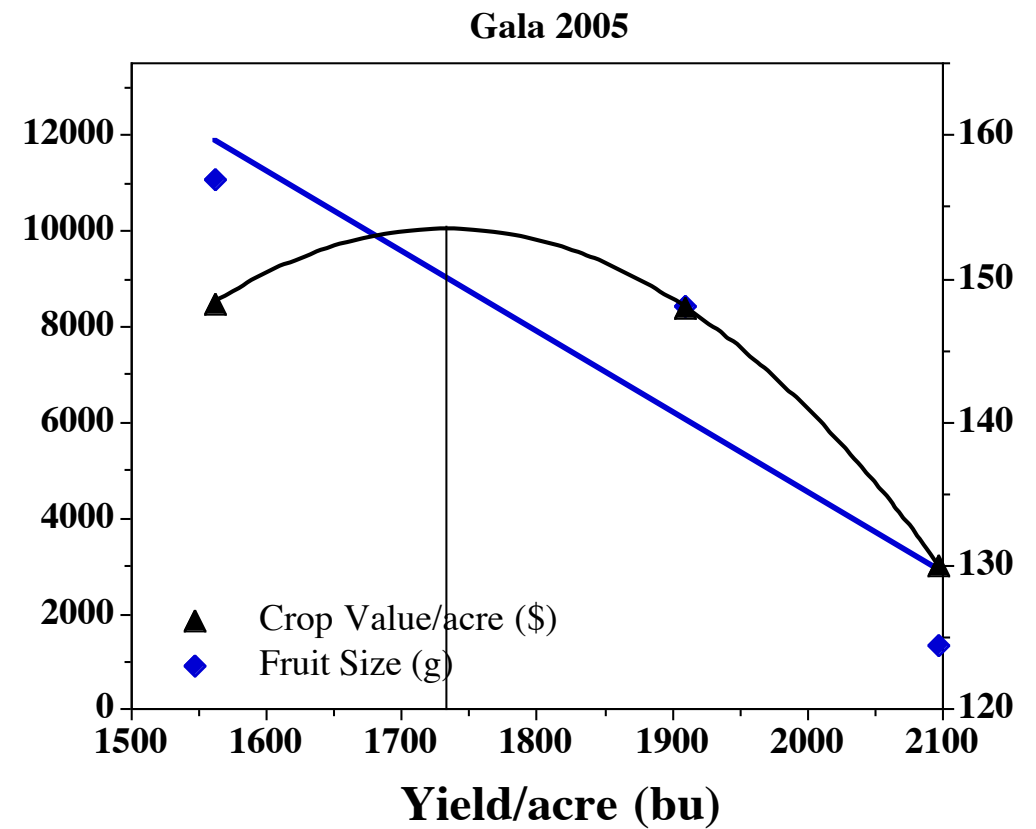
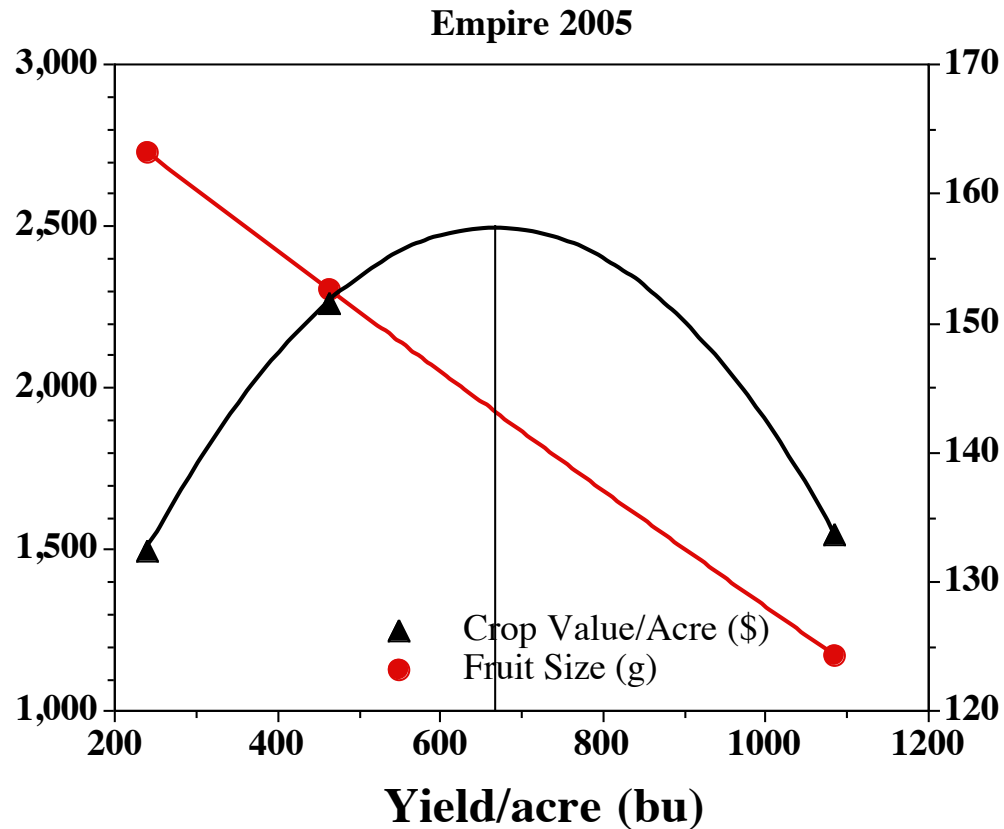
- As crop load is reduced by thinning (or by pruning) fruit size of the remaining fruits increases.
- As crop load is reduced by thinning (or by pruning) yield is also reduced.
- The best way to evaluate the benefits or costs of thinning is to convert yield/acre to crop value/acre taking into consideration fruit size.



The Optimum Crop Load is When Crop Value is Maximized



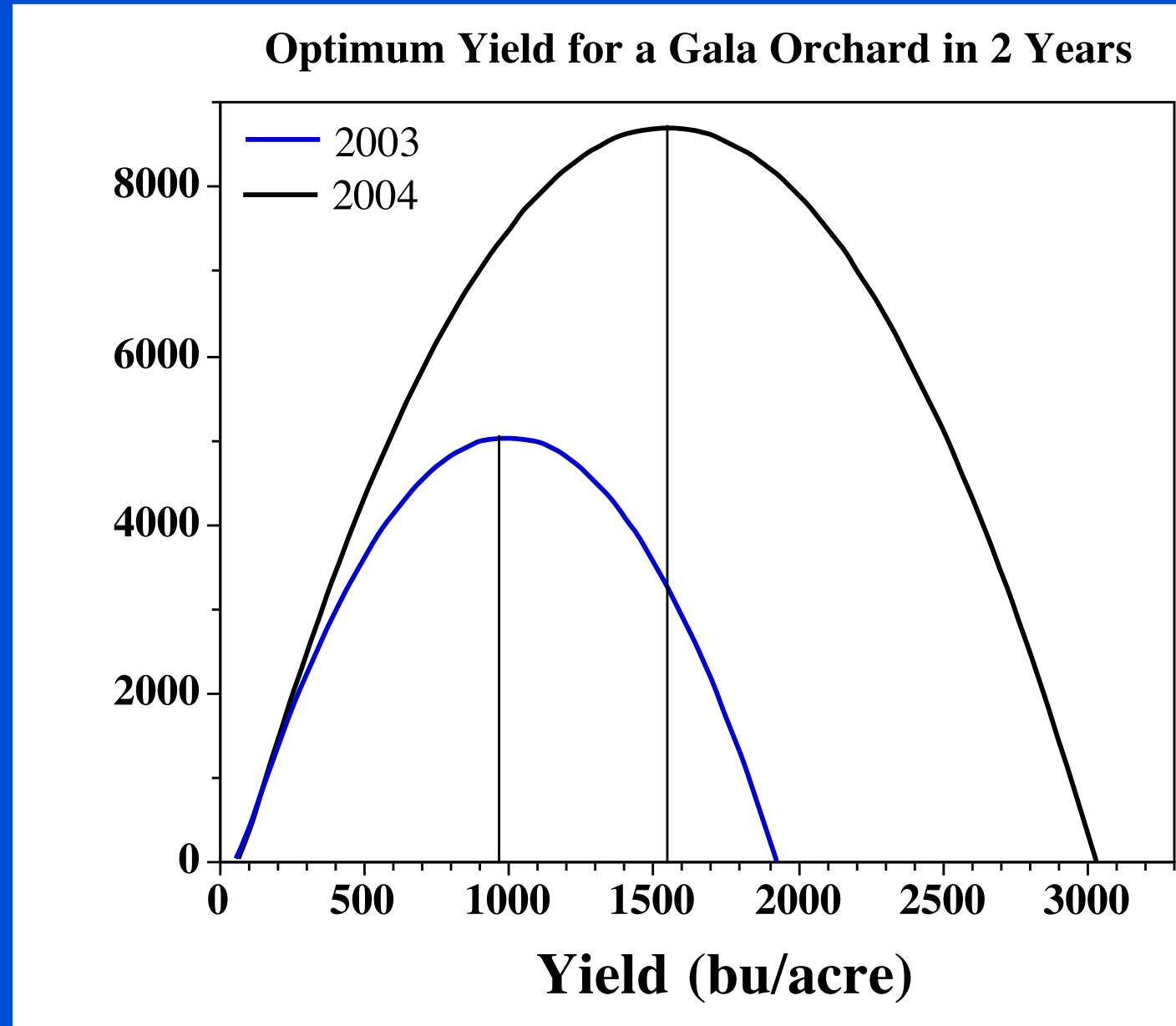
The Optimum Yield Varies with Variety



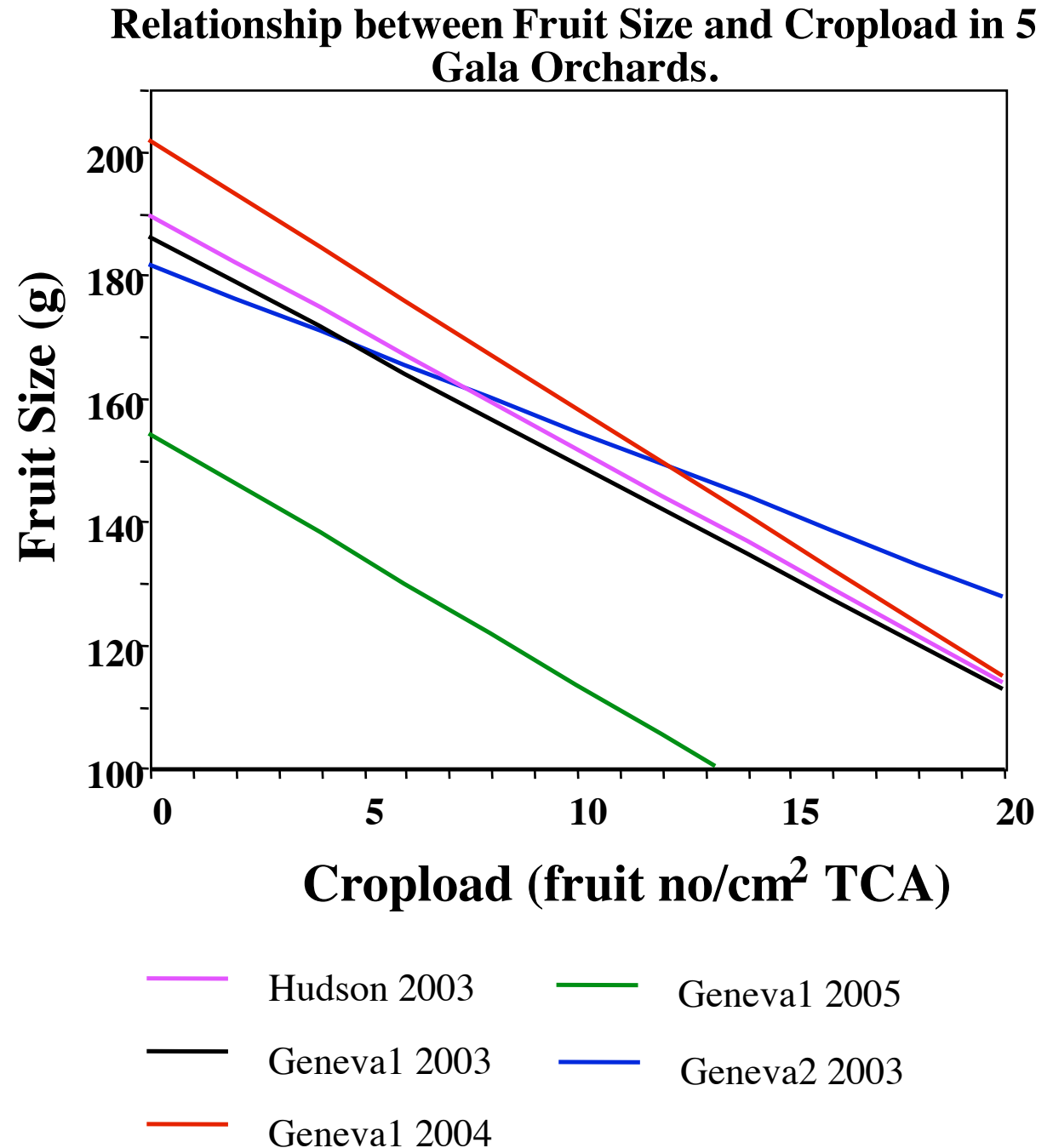
For small fruited varieties (Gala) optimum yield is ~1500 bu/acre (with a Tall Spindle)
For large fruited varieties (Jonagold) optimum yield is ~2000 bu/acre
For biennial bearing varieties (Honeycrisp) optimum yield is ~1200 bu/acre

The Optimum Yield Varies Between Years

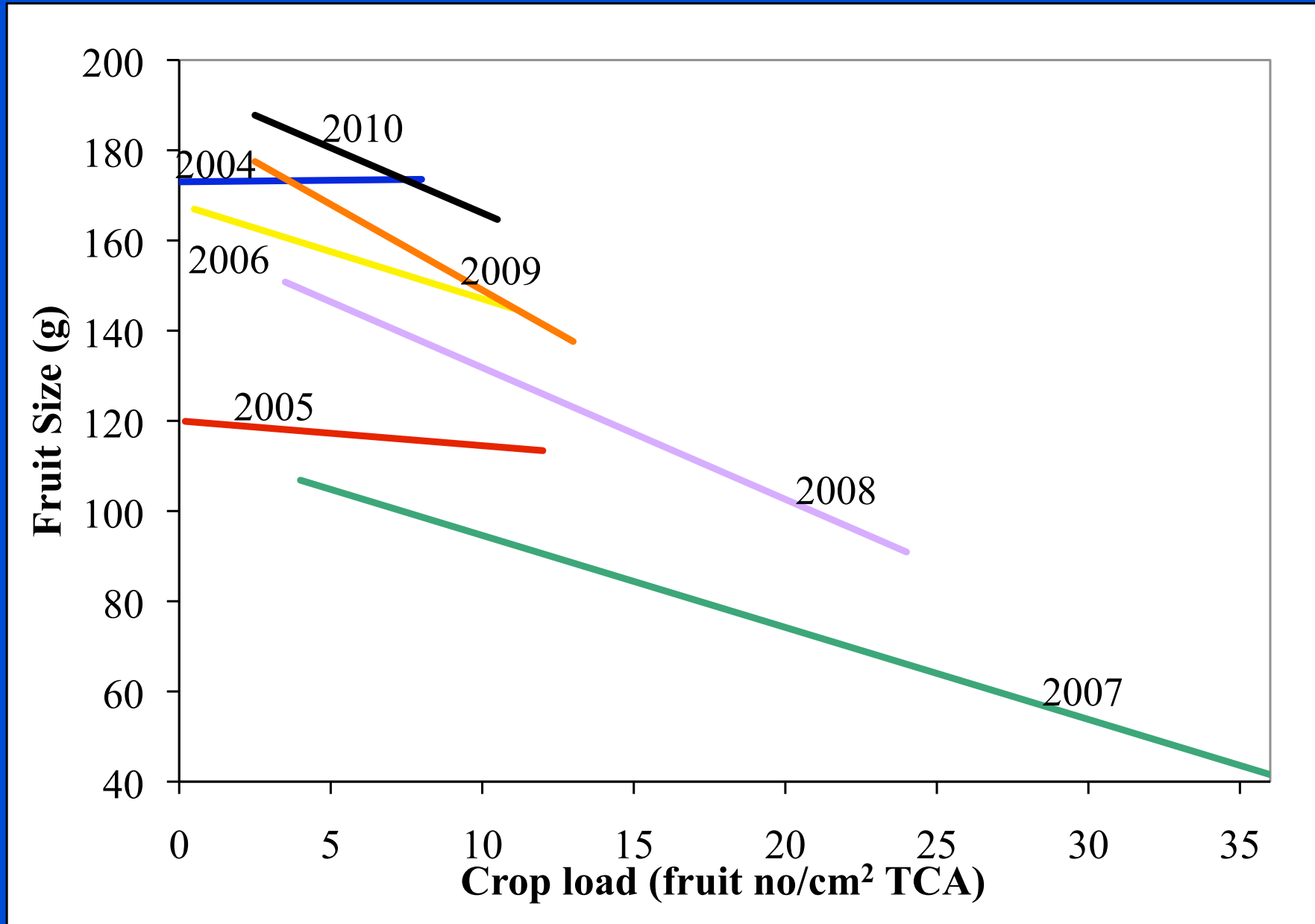
- In 2004 the optimum yield for a Gala orchard was 1500 bu/acre
- In 2003 the optimum yield for the same orchard was 1000 bu/acre per acre.
- 2004 was a very rainy year, 2003 was drier



In most years there is a strong relationship between fruit size and crop load.



Fruit Size in the Severe Drought of 2007

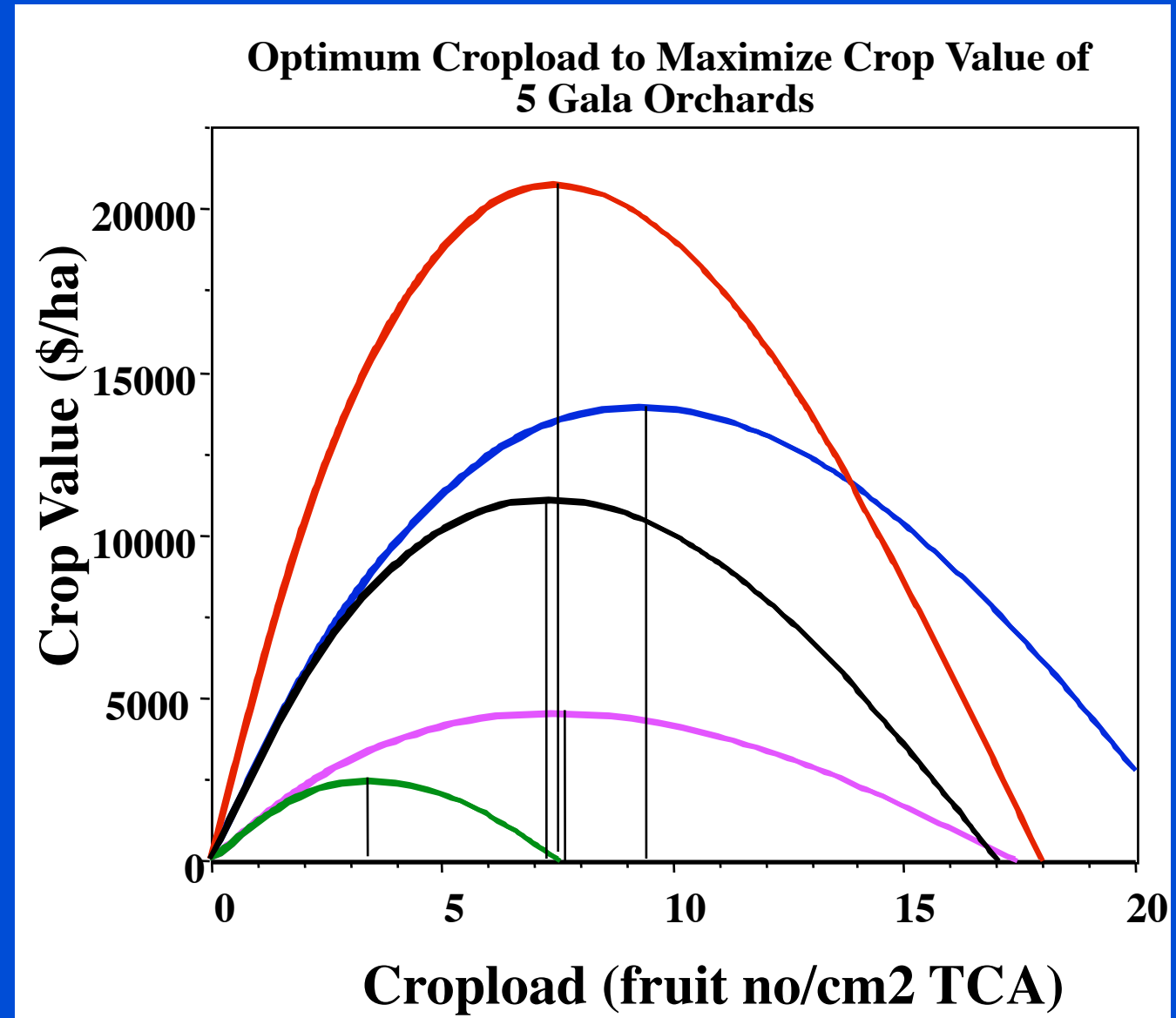


Fruit size of Gala in 2007 was 70g less than in 2010 (2 inch vs. 3 inch Gala

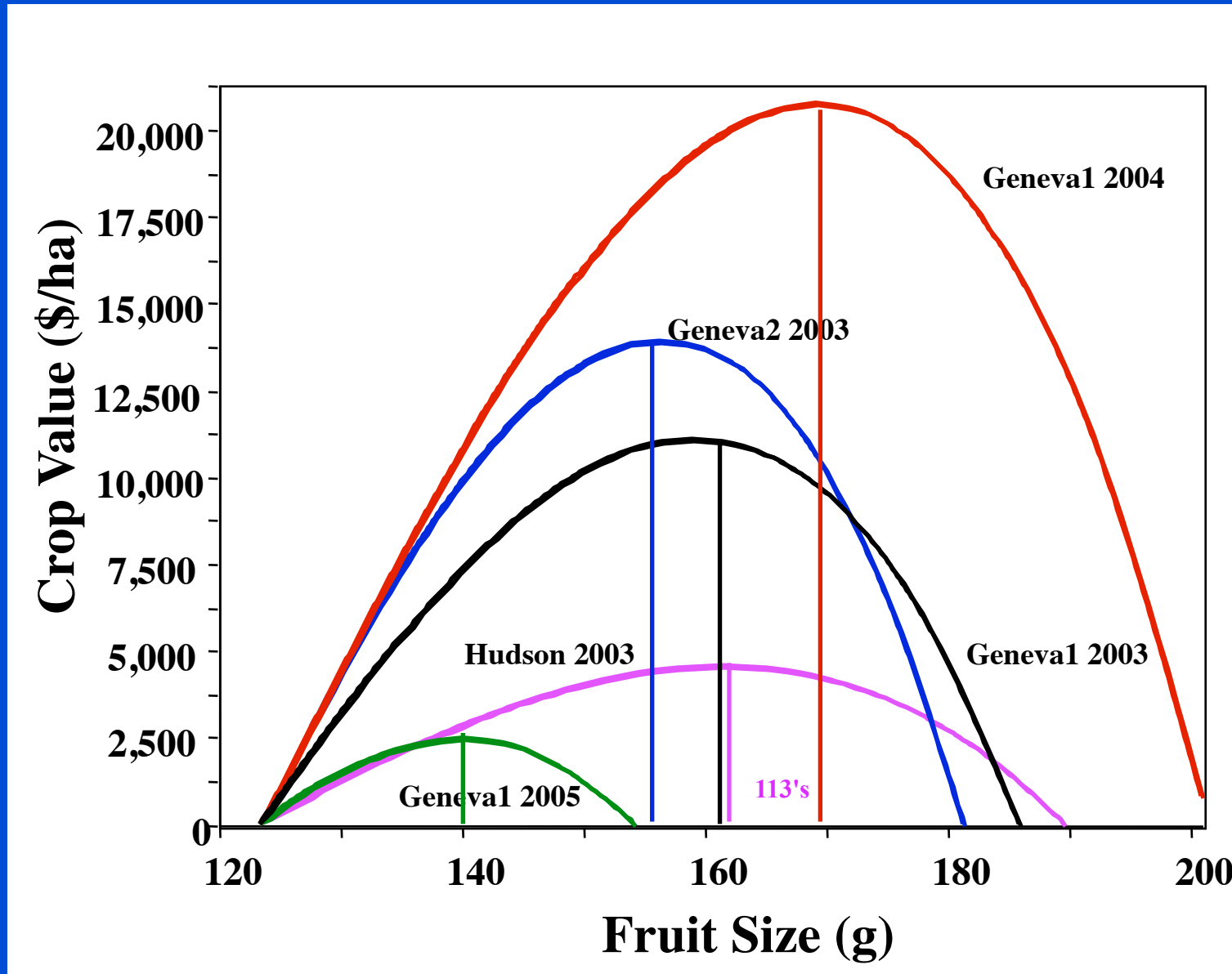
What is the Optimum Crop Load?

What is the Optimum Thinning Level?

- In 2003-2004 four Gala orchard of the same age but with different tree sizes had optimum croploads of 7-10.5 fruits/cm² TCA.
- In 2005 which was a dry year the optimum was significantly lower.

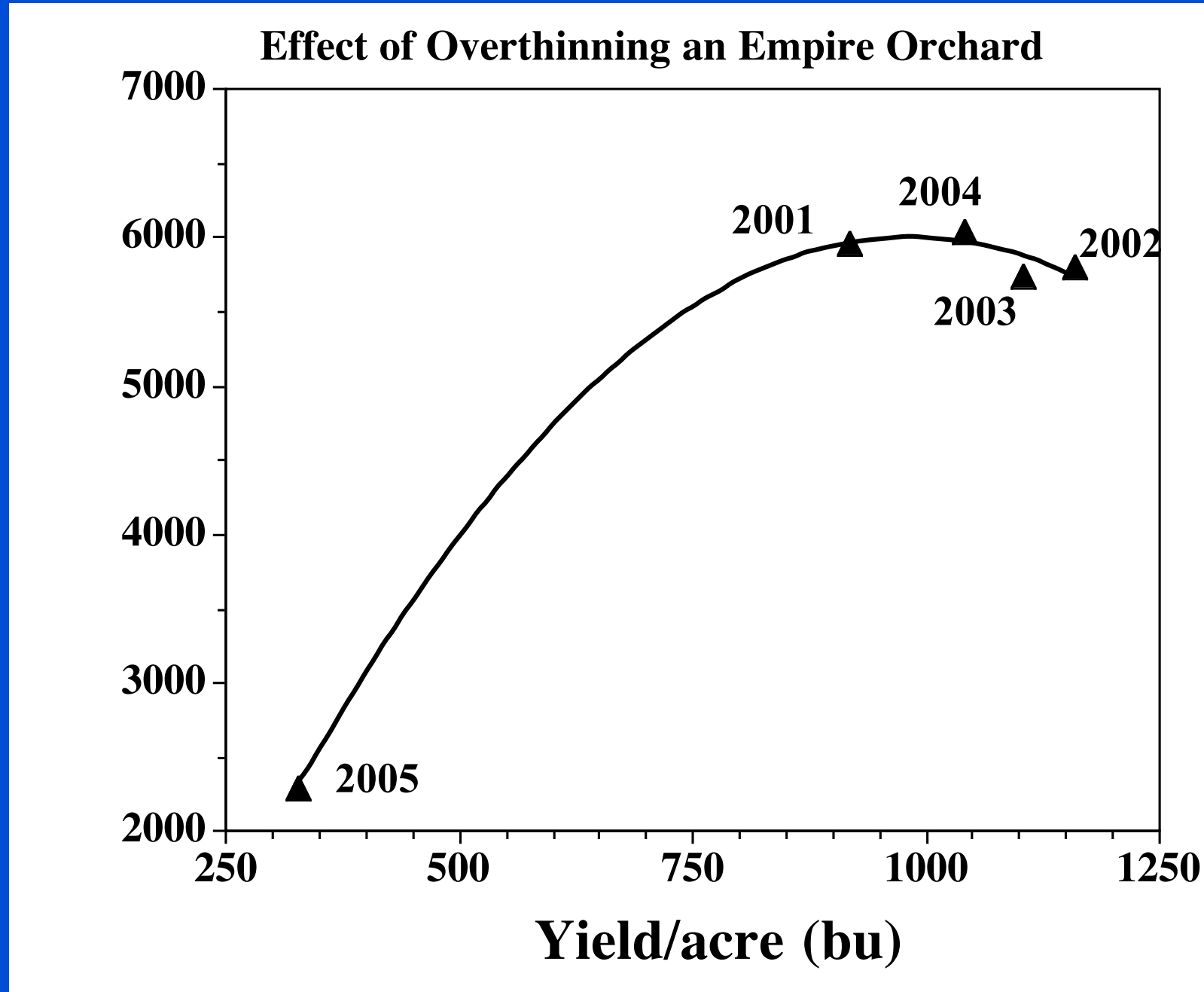


What Fruit Size will Give the Greatest Returns?



The optimum fruit size for Gala appears to be 100 count fruit (~170g) except in dry years.

There is a Huge Financial Cost of Over Thinning



An Improved Approach to Managing Crop Load with Chemical Thinning – Precision Thinning

Can we do chemical thinning more precisely?

- Although we have 50 years of experience with chemical thinning it remains variable and difficult to predict
- The carbohydrate model allows more confidence in predicting the results of chemical thinning

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

- Use multiple applications of thinner
- Apply thinner then assess results and then re-apply



Precision Thinning

1. Calculate the desired fruit number per tree (This defines the target).
2. Use the **carbohydrate model** to assess tree sensitivity to a chemical thinning spray before application.
3. Apply a chemical thinner spray.
4. Use the fruit growth rate model to assess the effect of the chemical thinning spray after application.
5. Use the **carbohydrate model** to assess tree sensitivity before re-application of a second chemical thinning spray.
6. Use the fruit growth rate model to re-assess the effect of the second thinner.



1. Calculation of Desired Fruit Number (Tall Spindle)

1. Determine desired yield/acre (1500 bu/acre) and desired fruit size (100 count)=150,000 fruits/acre
(150,000 fruits per acre / 1210 trees/acre = 124 fruits/tree)
2. Count flowering spurs on 5 representative trees at pink.
(Count = 200 flowering spurs X 5 flowers per spur = 1,000 potential fruits/tree)
3. Calculate percent of fruits needed = thinning task
(124 desired fruits per tree/1000 potential fruits per tree = 12.4%)



Chemical Thinning Windows

- Bloom
 - Ammonium Thiosulfate (ATS)
 - Lime Sulfur and Fish Oil
 - Promalin
 - Maxcel
 - NAA
- Petal Fall (fruits at 5-6mm)
 - Sevin
 - Maxcel + Sevin
 - NAA + Sevin
 - Maxcel + NAA
- Fruits at 10-13 mm
 - NAA + Sevin
 - Maxcel + Sevin
 - Maxcel + NAA
- Fruits at 15-20 mm
 - NAA + Sevin
 - Maxcel + Sevin + Oil
 - Ethrel + Oil

Example of Precision Thinning of Gala

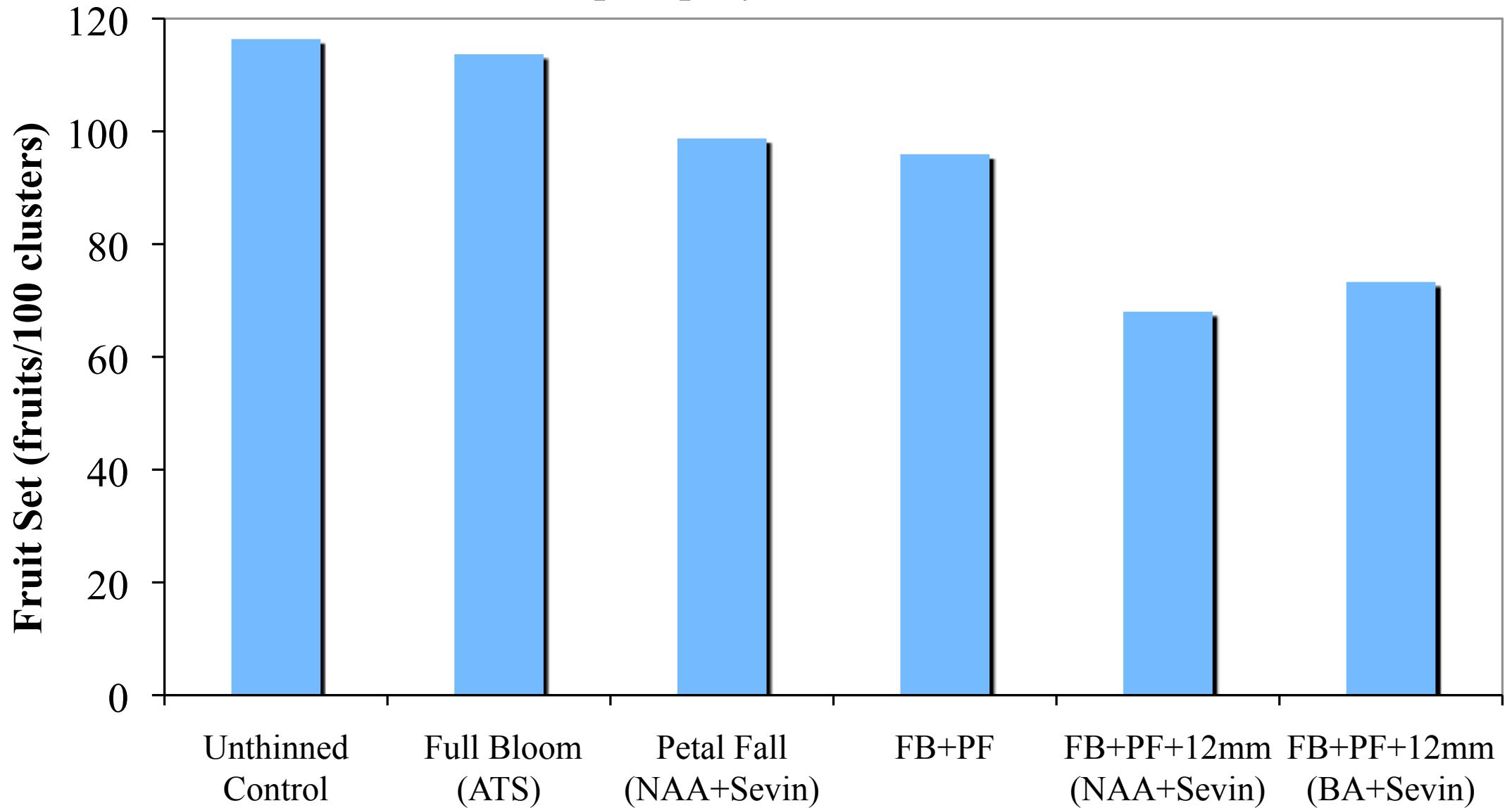
- Bloom
 - ATS (2.%)
- Petal Fall (5-6mm)
 - NAA (7.5ppm) + Sevin (1pt/100gal)
- 10-13 mm fruit size
 - Maxcel (96oz/100gal) + Sevin (1pt/100gal) (directed to the upper part of the tree)
- 18-20 mm fruit size (desperation spray)
 - Maxcel (96oz/100gal) + Sevin (1pt/100gal) + Oil (1pt/100gal) (directed to the upper part of the tree)

Best Thinning Strategies for Improving Gala Fruit Size

- 2003
 - 2 gal ATS /100 @ Full Bloom + 1 pt Carbaryl/100 @ PF + 100ppm BA/Carbaryl @ 10mm fruit size. (av. size=185g)
- 2004
 - 2 gal ATS /100 @ Full Bloom. + 1 pt Carbaryl/100 @ PF + 100ppm BA/Carbaryl @ 10mm fruit size. (av. size=191g)
 - Promalin @ Full Bloom + 50ppm BA/Carbaryl @ PF + 50ppm BA/Carbaryl @ 7DAPF + 50ppm BA/Carbaryl @ 14DAPF. (av. size=194g)
- 2005
 - 2 gal ATS /100 @ Full Bloom. + 1 pt Carbaryl/100 @ PF + 7.5ppm NAA/Carbaryl @ 10mm fruit size. (av. size=166g)
 - 2 gal ATS /100 @ Full Bloom. + 1 pt Carbaryl/100 @ PF + 100ppm BA/Carbaryl @ 10mm fruit size. (av. size=164g)

Can we thin Gala in a Carbohydrate Surplus Year?

Effect of Multiple Sprays in Gala Fruit Set-2009



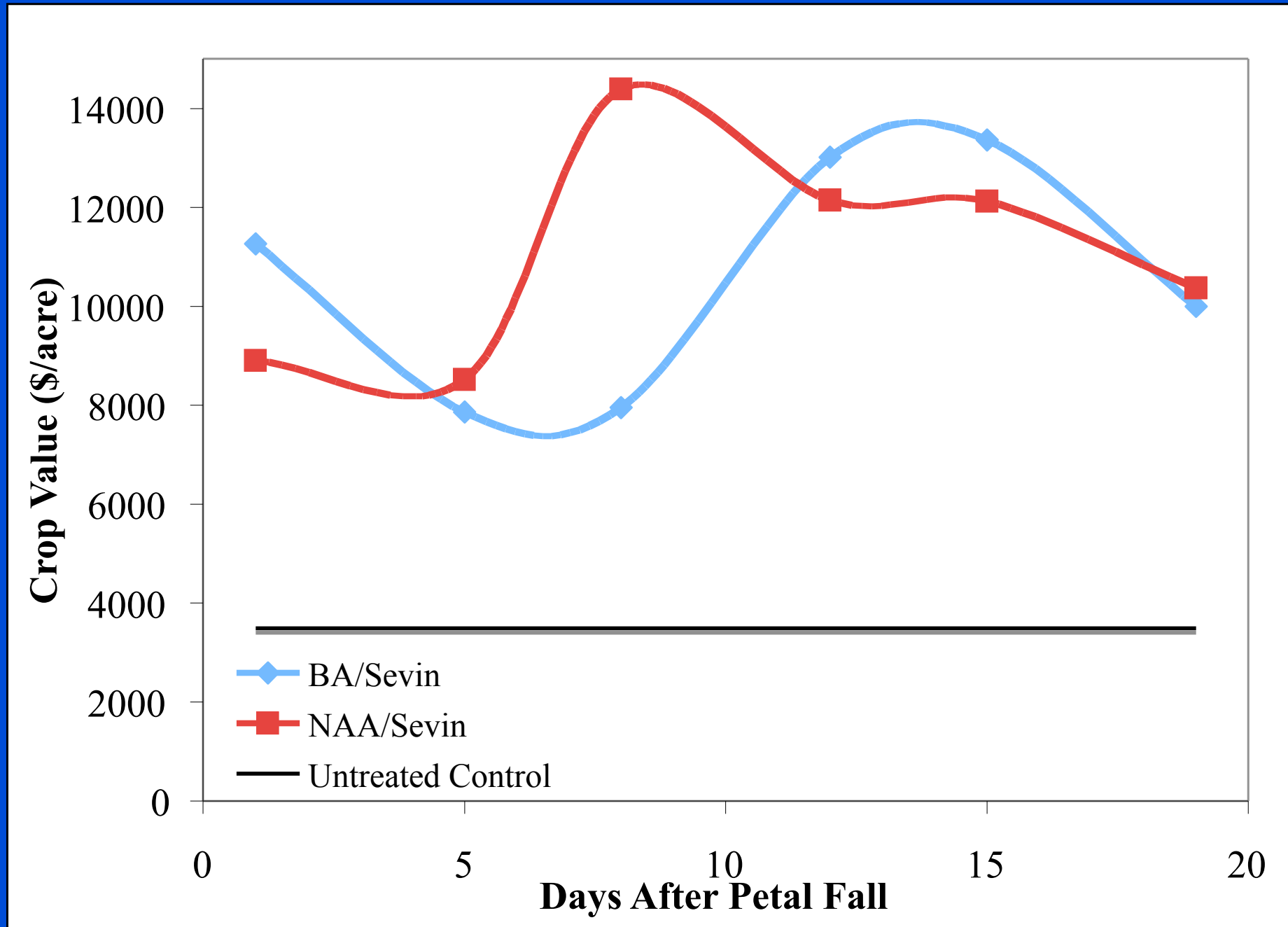
Precision Crop Load Management and Follow-up Hand Thinning

Use the Target Fruit Number to precisely hand thin

1. Count representative trees before and after hand thinning
2. Review the results with hand thinning crew
3. Simple trees are easier to manage precisely.
4. Tall Spindle/Fruiting Wall with 4 wires= ~30 fruits between each wire
5. Super Spindle with 4 wires= ~17 fruits between each wire



Is it Worth the Effort to Precisely Manage Crop Load?



A large pile of red apples, likely Fuji or Gala, filling the entire frame. The apples are densely packed and show various shades of red and yellow. A single green leaf is visible on the left side.

Thank You for Your Attention

Questions?

See you in Geneva