

Precision Thinning and Crop Load Management

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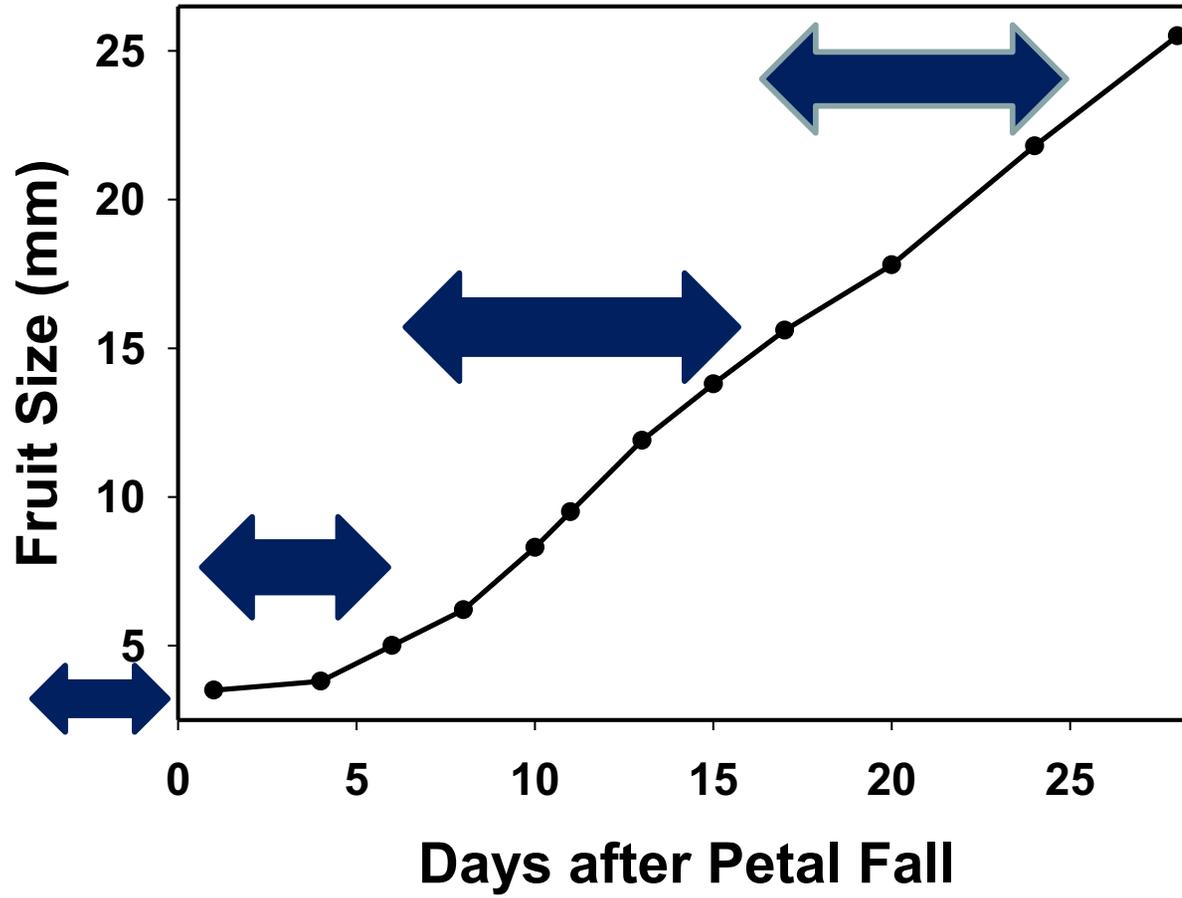
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Precision Thinning

- Precision thinning is a process of improving accuracy of thinning that has evolved over time.
- We now realize and can appreciate that thinning can occur over a wide range of physiological stages, all of which provide us with opportunities.

Fruit Growth



Different Thinning Times Require different strategies

- Dormant Pruning
- Bloom
- Petal fall
- 6 mm
- 7-14 mm
- 15-18 mm
- 20-25 mm
- Hand Thinning

Precision Thinning – An Evolving Process

- Precision thinning strategies have been and are being developed to help make thinning more accurate.
- Precision thinning takes different forms but with the same overall goal- achieve the desired and predetermined crop load at the end.
- This process is also intended to reduce applicator stress level.

The 2019 Thinning Season

- I will suggest approaching the coming season using multiple thinner applications and the aid of predictive tools that we have at our disposal.
- My goal is try to do as much thinning early in the season and avoid the need to do the major thinning during the traditional thinning time when fruit are most sensitive to thinners and excessive and erratic thinning is more likely.

Dormant Pruning

- **The more flowers present on a tree the more difficult it will be to thin trees down to the proper crop load.**
- Only thinning at dormant pruning and hand thinning time do growers have complete control of precise thinning.
- Doing thinning at dormant pruning time requires conviction and intestinal fortitude.

Establishing Crop Load Goal

- Determine the desired final crop load
- This is made easier in tall spindle plantings- but possible with others.
- Assumptions must be made about fruit size desired and number of fruit/tree.
- In a mature tall spindle planting it is common to have 80 to 110 fruit per tree.
- In precision thinning, this figure must be arrive at for the success of the process.

The Process

- Count all flower buds on 5 representative trees and calculate the mean.
- If you have an average of 250 buds per tree and 100 fruit is desired, then 100 buds is all that will be needed for a full crop.
- It is unwise to prune to exactly the target level because of:
 - Freezes or frost
 - Poor pollination
 - Poor flower quality

The Process

- Generally it is a good idea to leave at least 1.5 to 2 times as many buds as is needed.
- Accurately counting flower bud in February may be a challenge because of the difficulty of differentiating bud types.
- Pruning, then counting buds remaining is an important early check to assure consistency and that you are achieving your goal.

The Process

- If you determine that you have 300 buds per tree and you want 100 fruit per tree you would leave either 150 or 200 flower buds per tree to achieve the 100 apples per tree level.
- Reduce flower buds using the standard method for pruning tall spindle trees.

Pruning Process

- Remove 1-3 whole limbs
- Remove secondary lateral branches on remaining limbs
- Shorten pendant branches to remove weak buds back to where limbs are about pencil size.
- Stop when desired bud number is achieved.

Bloom

- Bloom is not a time when trees are traditionally thinned in the Northeast.
- However, this opportunity should not be overlooked. There are two different thinning options that should be considered.
 - Blossom thin using the Pollen Tube Growth Model
 - Hormone sprays- NAA, NAAm and/or ethephon. This is uncommon but a viable option.

Pollen Tube Growth Model

- This is now used in Washington
- This model will help make thinning at bloom, using caustic thinners, safer and more predictable.
- This model should be posted on the NEWA site this coming thinning season.
- It would be useful to have it tested and evaluated by growers.

Bloom-Hormone Sprays

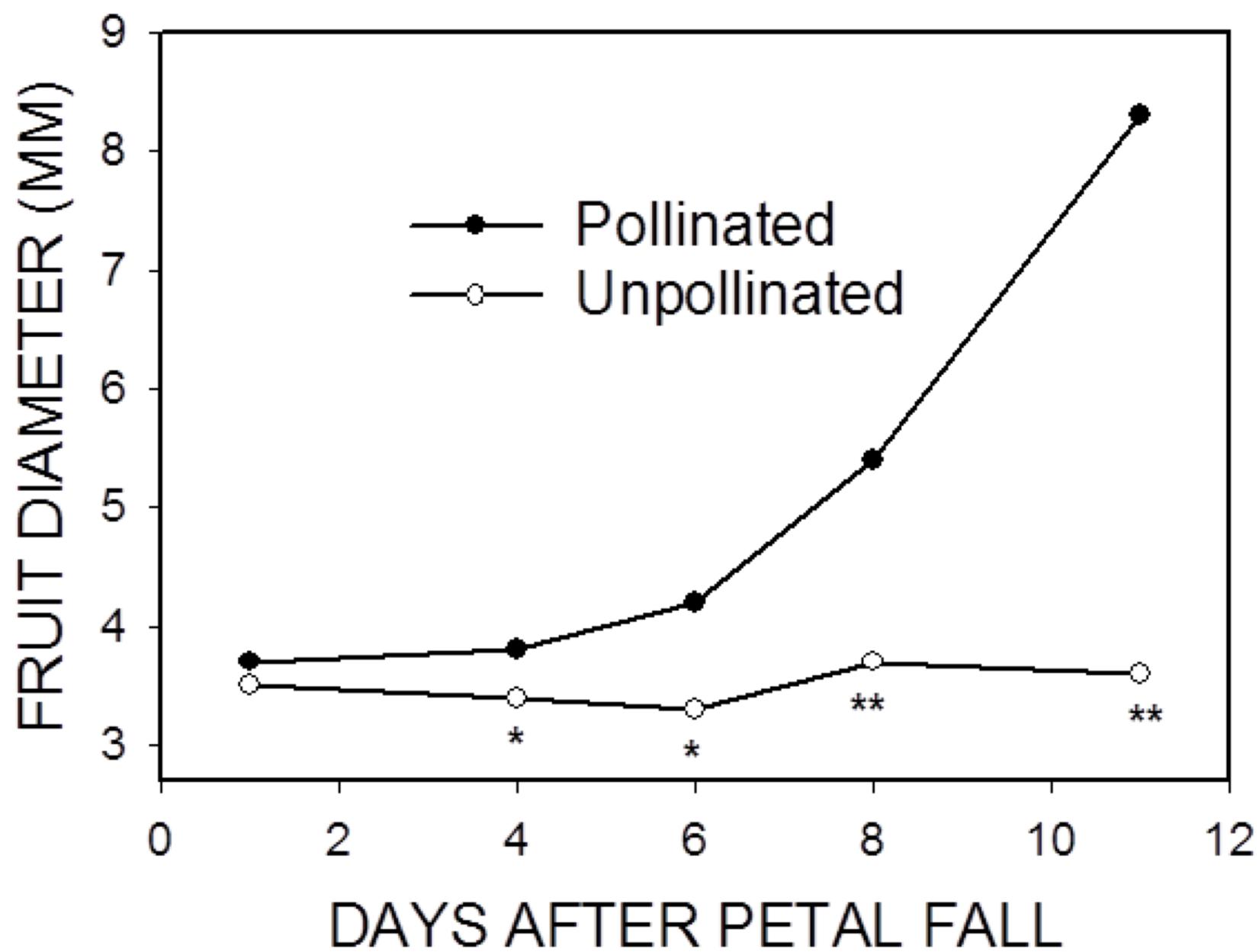
- Ethephon- 300 ppm (1 pint/100 gal).
 - Used in Australia
 - Increase return bloom
- NAA 12 to 15 ppm.
 - Only half as potent or less when applied early.
- It is important to remember that application of hormone sprays applied at this time is not as potent as when used later.

Petal Fall

- This is a traditional time for growers to start to thin, often with carbaryl.
- Growers can and should be more aggressive at this time because trees are not as susceptible to standard thinners.
- Fears are fueled by thoughts of greater thinning when similar rates are used at the 10-12 mm fruit size stage.

Assessing Thinning after Pruning, Bloom and Petal Fall

- The earliest that it is possible to assess potential thinning response as a result of early thinning is the 6 mm stage.
- It is not until this growth stage that you can get a good idea about initial set and see how many fruit have been pollinated.
- Assessment of subsequent thinner applications and persistence of those fruit that have initially set is by using the Fruit Growth Model.



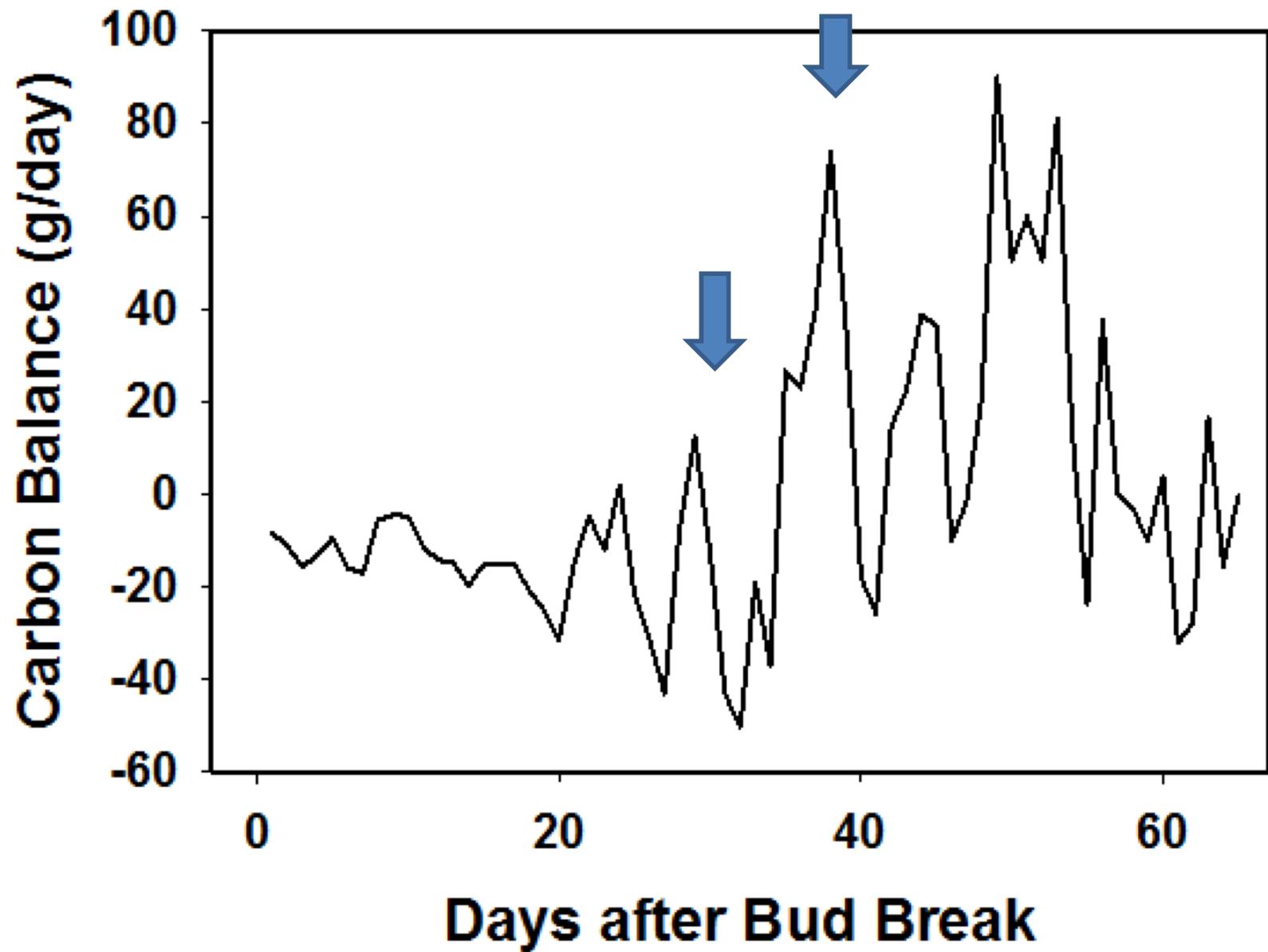
Carbon Balance Model

- At the 6 mm stage decisions are made about further thinning treatments.
- Generally, an additional thinning spray(s) are made. At this growth stage fruit are entering the log growth phase where there is a large demand for carbohydrate. The carbon balance model, available on the NEWA site, is used to determine the carbon balance status of a tree based upon temperature and solar radiation. The greater the carbon balance deficit the easier it will be to thin.

Carbon Balance Model

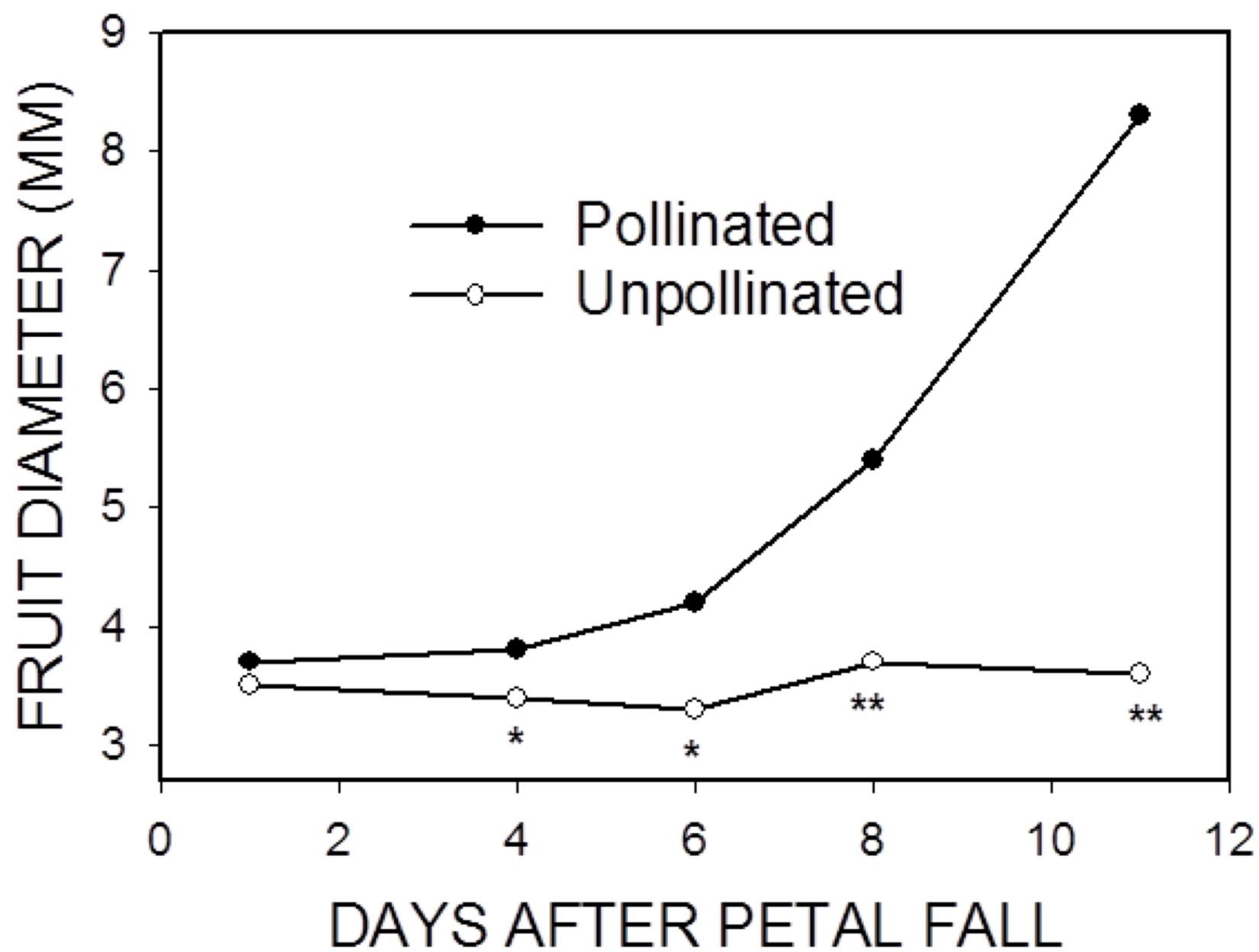
- The projected carbon balance is calculated using the temperature and solar radiation data from the orchard 1 day before and 4 days after thinner application.
- A negative carbon balance of -30 grams generally means that thinning may be easy and it would be appropriate to reduce the amount of thinner applied.
- Conversely, a positive carbon balance of +30 g/day and above would mean the rate of thinner should be increased.

Carbon Balance Belchertown 2015



Carbon Balance Model

- The model is intended to reduce thinning errors by providing a warning signal. Use it as a guide to avert disasters.
- It should be only used when fruit are growing. For example, it is not too useful around petal fall even though the model provides data and makes recommendations.



Brevis- Metamitron

- Brevis is a thinner that is on track to be registered in the US in about 3 years.
- Phil has talked about this I am certain.
- Its mode of action is by inhibiting photosynthesis thus it has the potential to lower the carbon balance in a tree and bring about fruit abscission. I used the carbon balance in 2017 and 2018.

Basic Treatments 2018

- Metamitron (lb/acre)
 - Control 0
 - Metamitron 1.0
 - Metamitron 1.5
 - Matamitron 2.0
 - Metamitron 2.5
- Thinning standard
 - MaxCel + carbaryl 64 oz. + 1 quart

Treatments Timing in 2018

- Timing 1- Fruit size 7.5 mm
- Timing 2- Fruit size 13.2 mm

Carbon Balance at the time of following first timing of thinner application

Days after Application	Carbon Balance
	24 May- 7.5 mm
0	-22.5
1	-21.0
2	-2.0
3	-7.0
4	11.0
5	-3.0

Reduce thinning spray by 15%

Thinning cause by Metamitron when applied at 7.5 mm.

Metamitron (Lb/acre)	Fruit Set
	Fruit/cm LCSA
0	9.7 a
1	8.6 abc
1.5	6.3 de
2.0	5.9 de
2.5	7.5 bcd
MaxCel + carbaryl (64 oz + 1 Quart)	9.2 ab
Significance	I***q**

Carbon Balance at the time of and following second timing of thinner application

Days after Application	Carbon Balance
	30 May- 13.2 mm
0	-5
1	8
2	4
3	22
4	35
5	23

Apply Standard Thinning Rate

Thinning cause by Metamitron when applied at 13.2 mm.

Metamitron (Lb/acre)	Fruit Set
	Fruit/cm LCSA
0	9.7 a
1	6.4 bc
1.5	5.2 cd
2.0	3.9 d
2.5	3.6 d
Significance	I***q*

Interpretation

- The carbon balance model should be used only as a guideline.
- Over the years, given favorable weather, fruit are more susceptible to thinners around the 12 mm stage.
- There is data supporting this. Do not put yourself in the position where you must aggressively thin at this time to achieve adequate thinning.

Caution using the Carbon Balance Model is advised. 2017

Date	Temp Max.	Temp Min.	CHO Balance
May 23*	68	50	2
May 24	73	52	0
May 25	56	50	-19
May 26	58	48	-17
May 27	69	51	24
May 28	70	55	-4

*Apply standard thinning rate. 10 mm

Influence of metamitron rate on fruit set of Summerland McIntosh

Metamitron (Lb/acre)	Fruit/cm LCSA
0	12.7 a
1	12.1 a
1.5	12.1 a
2	12.2 a
MaxCel + carbaryl 64 oz + 1 qt	10.0 a

Applied May 23- fruit size 10 mm

Interpretation

Regardless of what the carbon balance indicates, TEMPERATURE is important.

In order for thinners to work they must have adequate high temperature to set into motion the steps necessary to trigger fruit abscission.

Carbon balance is part of the story.

Fruit Growth Model

- This the only model we have available now that can show, with accuracy, if a fruit will set or abscise.
- It has been available to you for at least 4 years and many have used it.
- The major criticism is that it is very time consuming. Valid!
- I spoke about improving accuracy of this at the Expo a little over a year go, so I will duplicate that effort.

Fruit Growth Model- Updates and Improvements

- You may measure a reduced number of spurs, perhaps 15, and not run the model.
- After measuring thousands of fruit over the years it does not take very long to interpret what is happening.
- This experience is invaluable in helping you make “what’s next?” decisions.
- Our orchard manager does this, even with pears.

Fruit Growth Model- Improvements

- The model is sound and suggestions made previously are appropriate to improve accuracy.
- The major criticism is the time required, and improvements are coming. Relief is on the way.
 - Directly enter the data into the I-phone. Poli Francescatto has an app to allow an I-phone to be used in the orchard.
 - A graduate student is working with Carnegie Mellon scientists to develop an app where photos are taken of each fruit and this software then enters growth data into the program and comes up with a projected percent set.

Conclusions

- Four Models have been discussed or mentioned.
 - Dormant Pruning
 - Pollen Tube Growth Model
 - Carbon Balance Model
 - Fruit Growth Model
- Each has their place.
- All may or may or may not all be used in any one year.
- They are guides but they do not eliminate the “you” from the thinning equation.