

Fruitlet Model for Assessing Thinner Response

Duane W. Greene

University of Massachusetts

Alan Lakso and Terence Robinson

Cornell University

Phil Schwallier

Michigan State University

Predicting Thinning Options

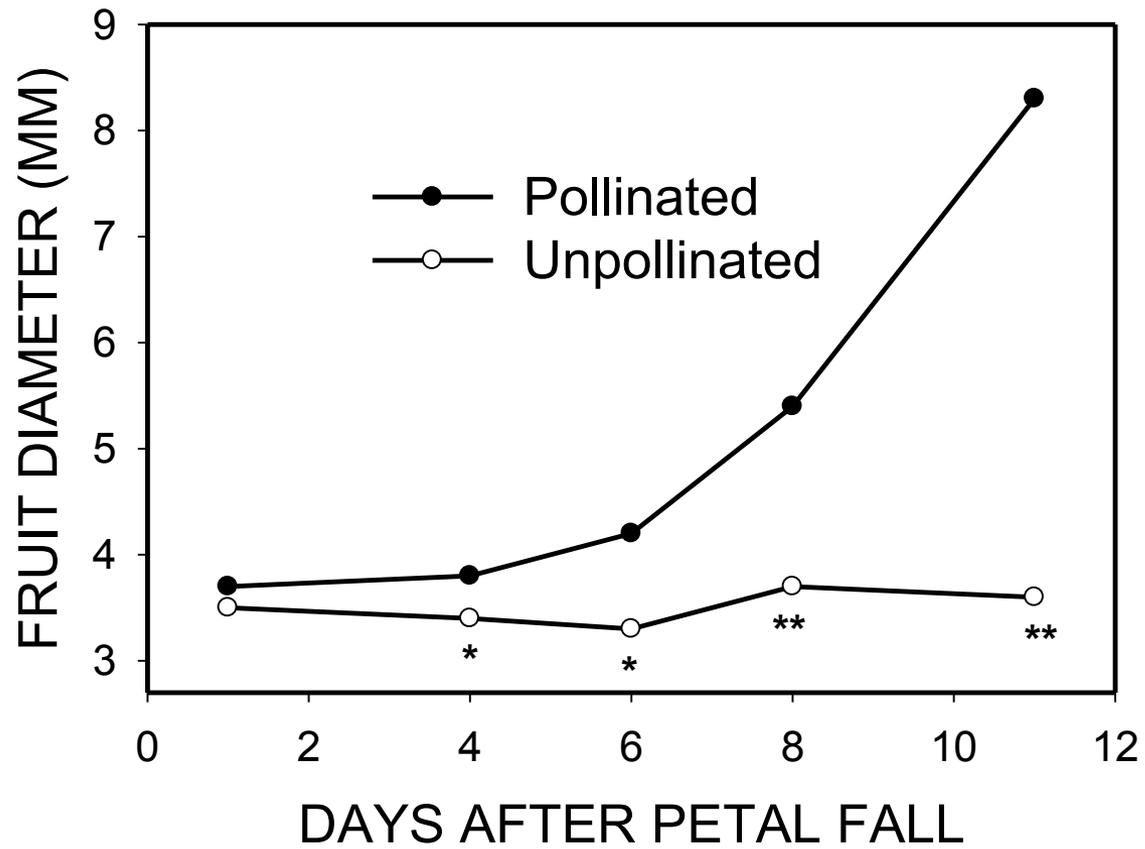
- This afternoon you will be exposed to two options to predict thinner response.
 - I will spend the next few minutes explaining the use of the fruitlet model which is a system that predicts thinner response after thinner application.
 - Terence Robinsons has just presented the carbon balance model which is based upon prediction of thinner response before a thinner is applied.

It would be very useful to be able to accurately assess thinner response

- Unfortunately, we have not had a system available that would allow orchardists to assess the crop load potential and to determine the effectiveness prior thinner applications in time to make a follow up thinner application during the thinning window of opportunity.

Fruitlet Model is Based on Two Observations

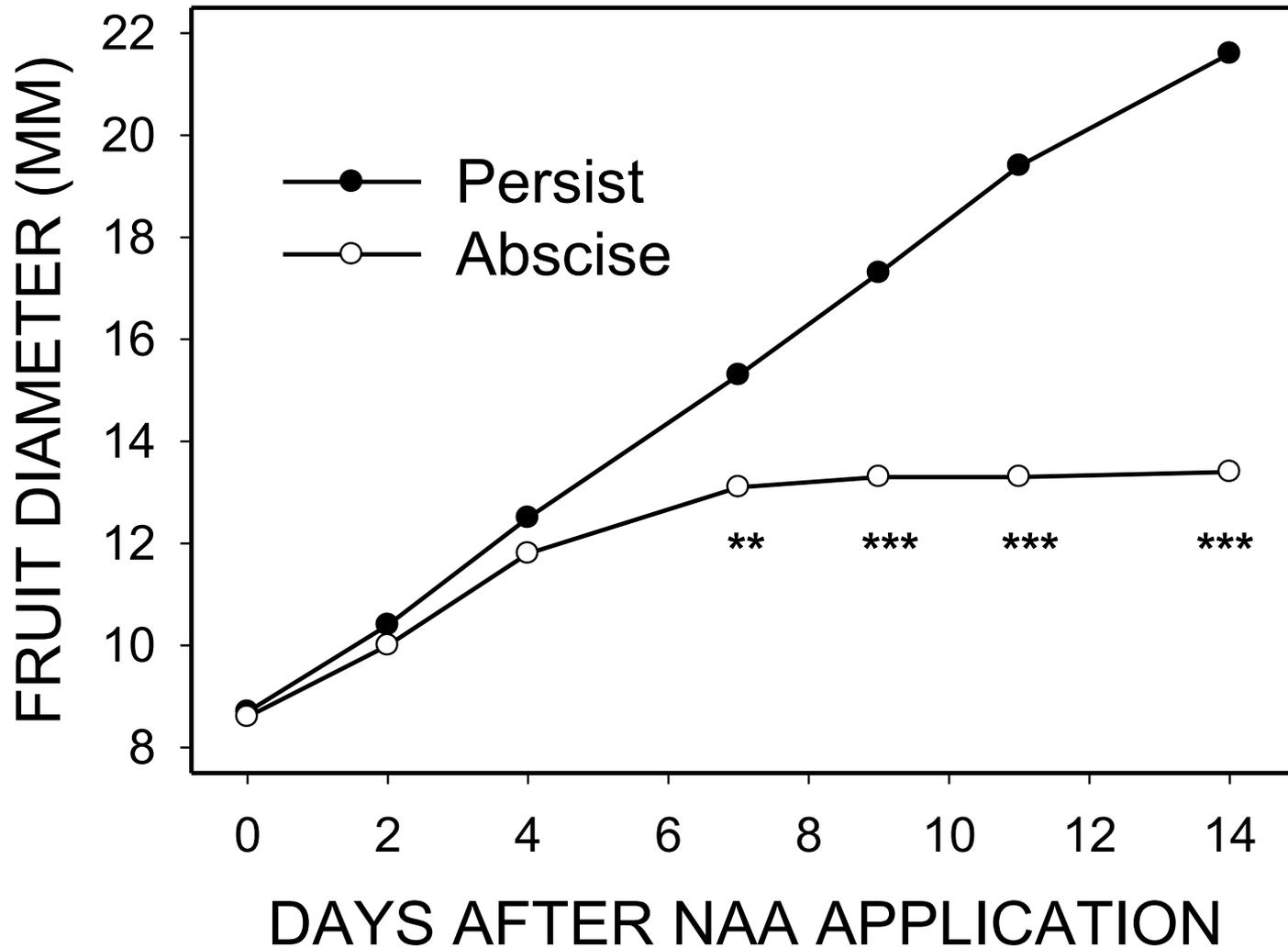
1. The fruit growth model is based upon the assumption that fruit that persist will start to grow rapidly a few days after fertilization and their growth will continue somewhat regularly and without interruption throughout the season.



Fruitlet Model is Based on Two Observations

2. The observation made over a several year period showed that fruit destined to abscise slowed growth well in advance of the time when fruit actually abscise.

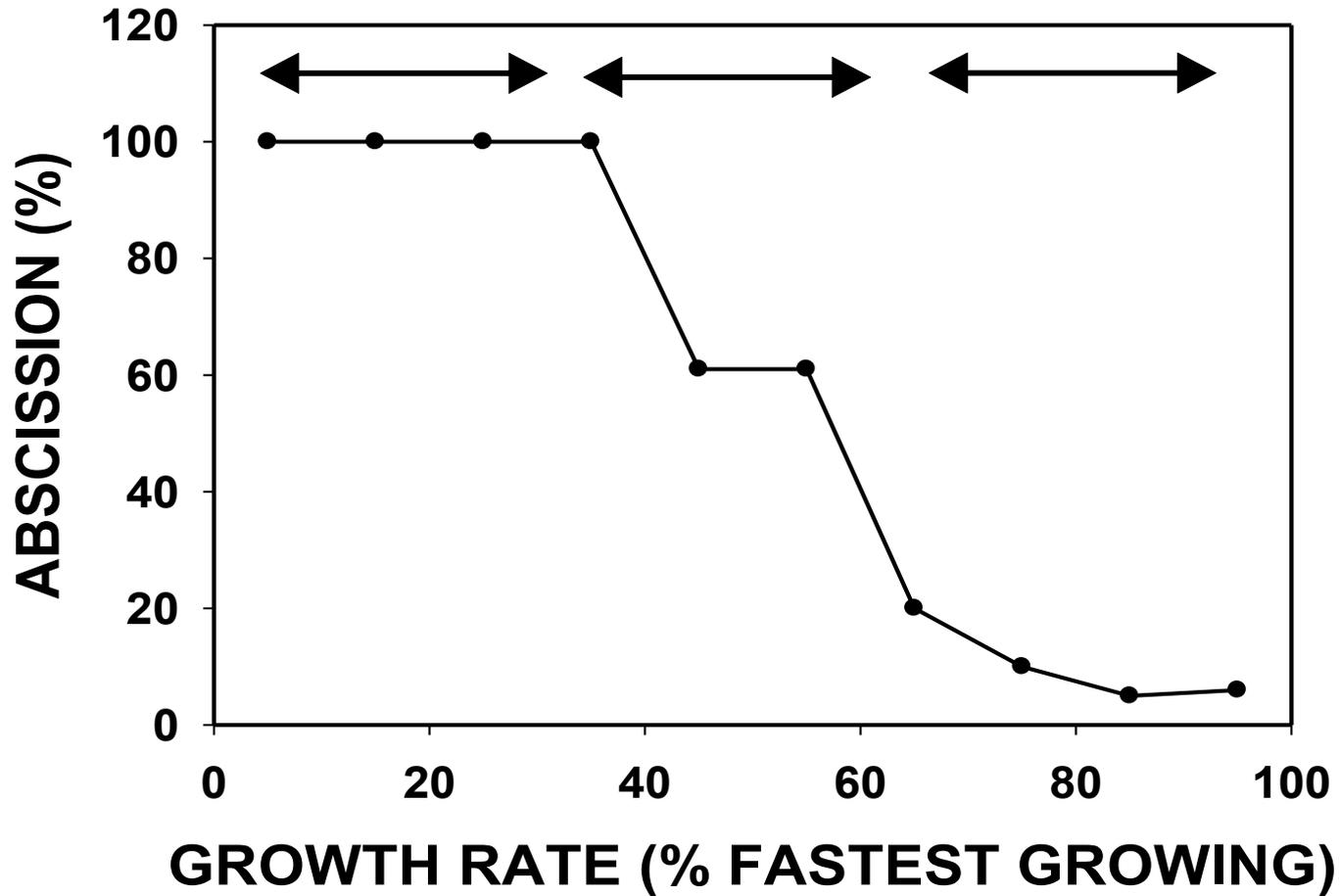
Under most circumstances measuring the reduction in fruit growth between 4 and 7 days after thinner application has proved sufficient to determine if a fruit will continue to grow or will abscise.



Which Fruit Will Persist and Which Fruit Will Abscise?

- How fast must fruit growth be to assure that it will persist?
- Fruit growth, how slow is too slow?
- Fruit growth can be separated into 3 generalized fruit growth categories.

GROWTH RATE INFLUENCES ABSCISSION



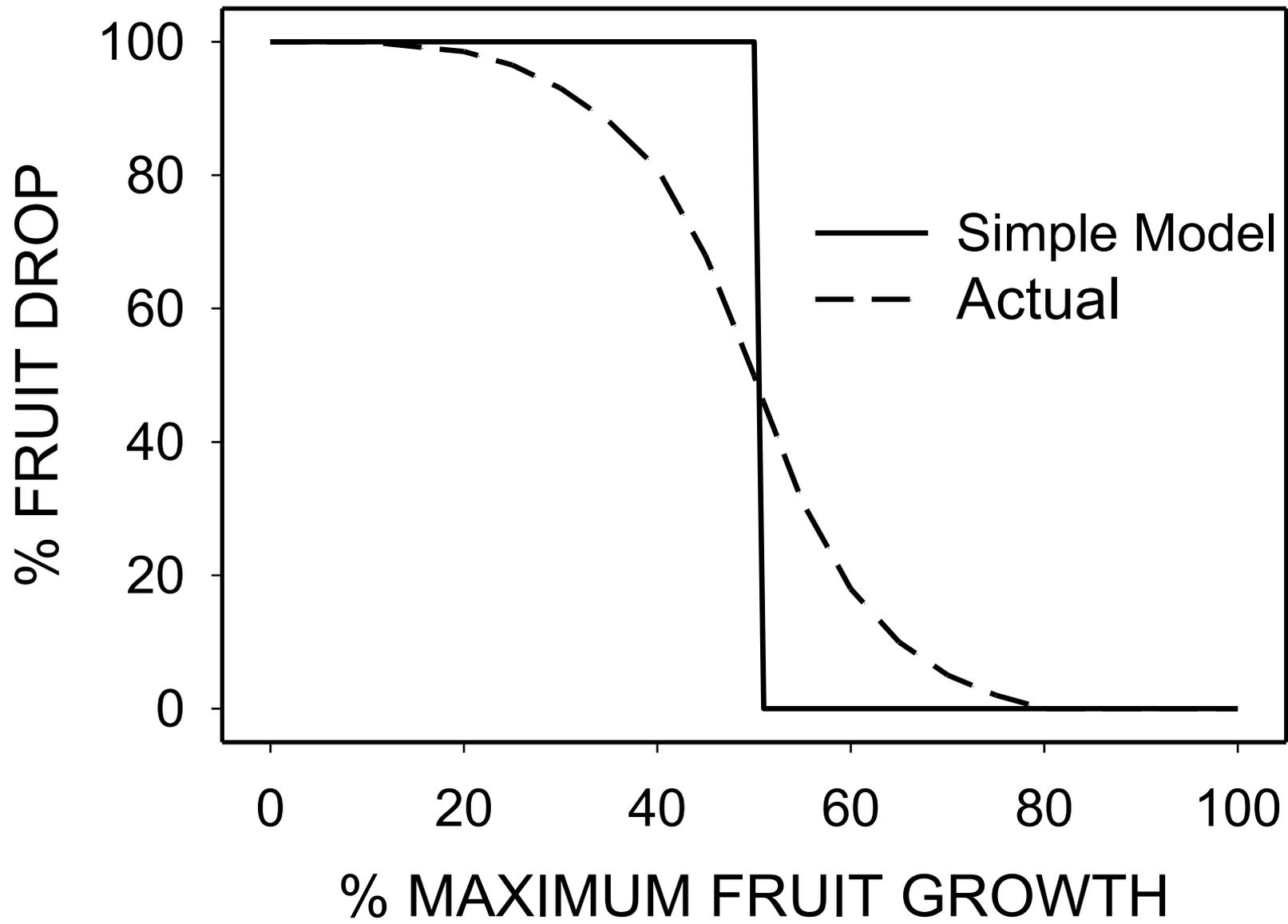


- Which category do each of these fruit fall in?



Hypothesis

- All fruit that slow to a growth rate of 50% or less of the growth rate of the fruit that persist to harvest, will ultimately stop growth and abscise.



Key Elements in Predicting Early Thinner Response

- **Identify fruit that will persist to harvest to use as a standard to determine a reduction in fruit growth rate.**
- Measure fruit individually to establish a fruit growth rate for each fruit.

Which Fruit Will Persist to Harvest?

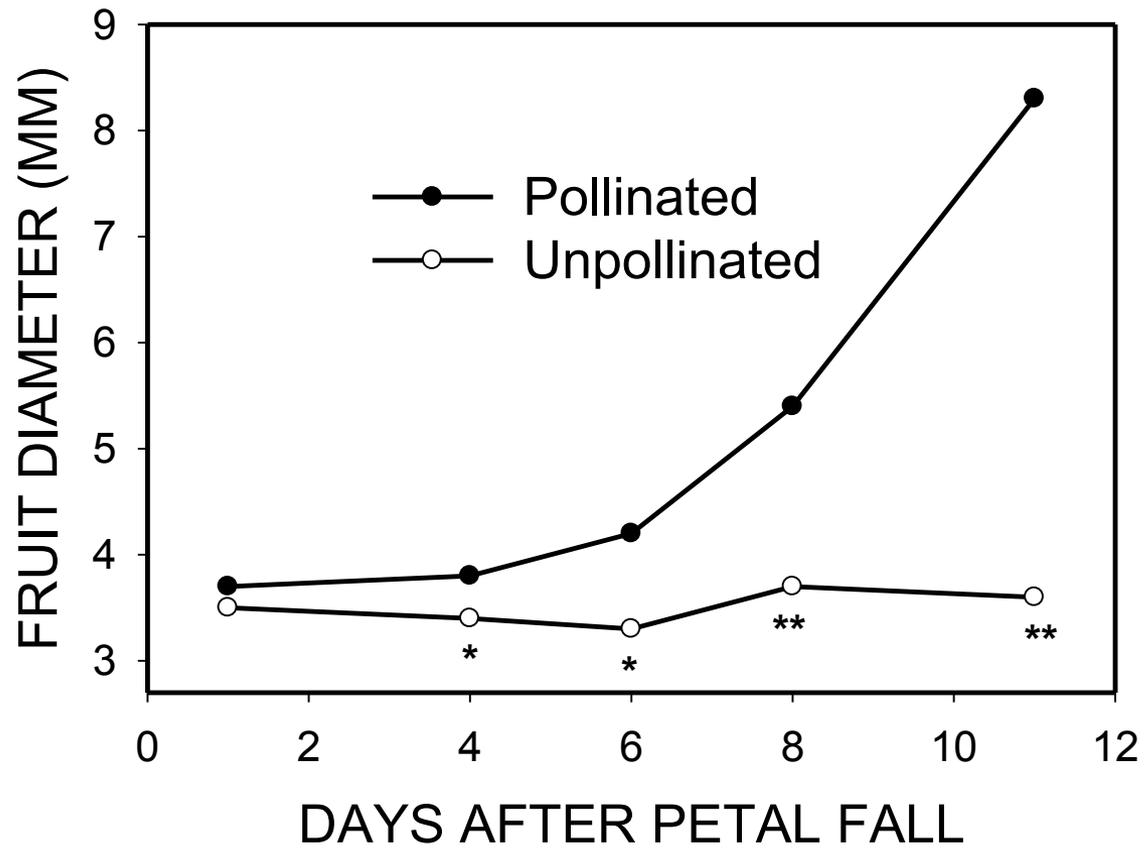
- This is relatively easy and quite predictable.
- The fastest growing fruit in a spur or on a tree are the most likely to persist.
- It is nearly 99% accurate.
- We select 3 fruit per tree on 7 trees for a total of 21 fruit (for calculations).

Key Elements in Predicting Early Thinner Response

- Identify fruit that will persist to harvest to use as a standard to determine a reduction in fruit growth rate.
- **Measure fruit individually to establish a fruit growth rate for each fruit.**

Procedure

- 10 to 20 (15) spurs per tree are tagged with about 100 (105) total spurs required.
- Distribution on the trees should reflect bloom density on a tree.
- Individual fruit in a spur are marked and measured before a thinner is applied.
- Fruit are measured at 2-3 day intervals but as few as two measurements may be adequate, 4 and 7 to 8 days after application.
- Fruit must be at least 6-7 mm in diameter.



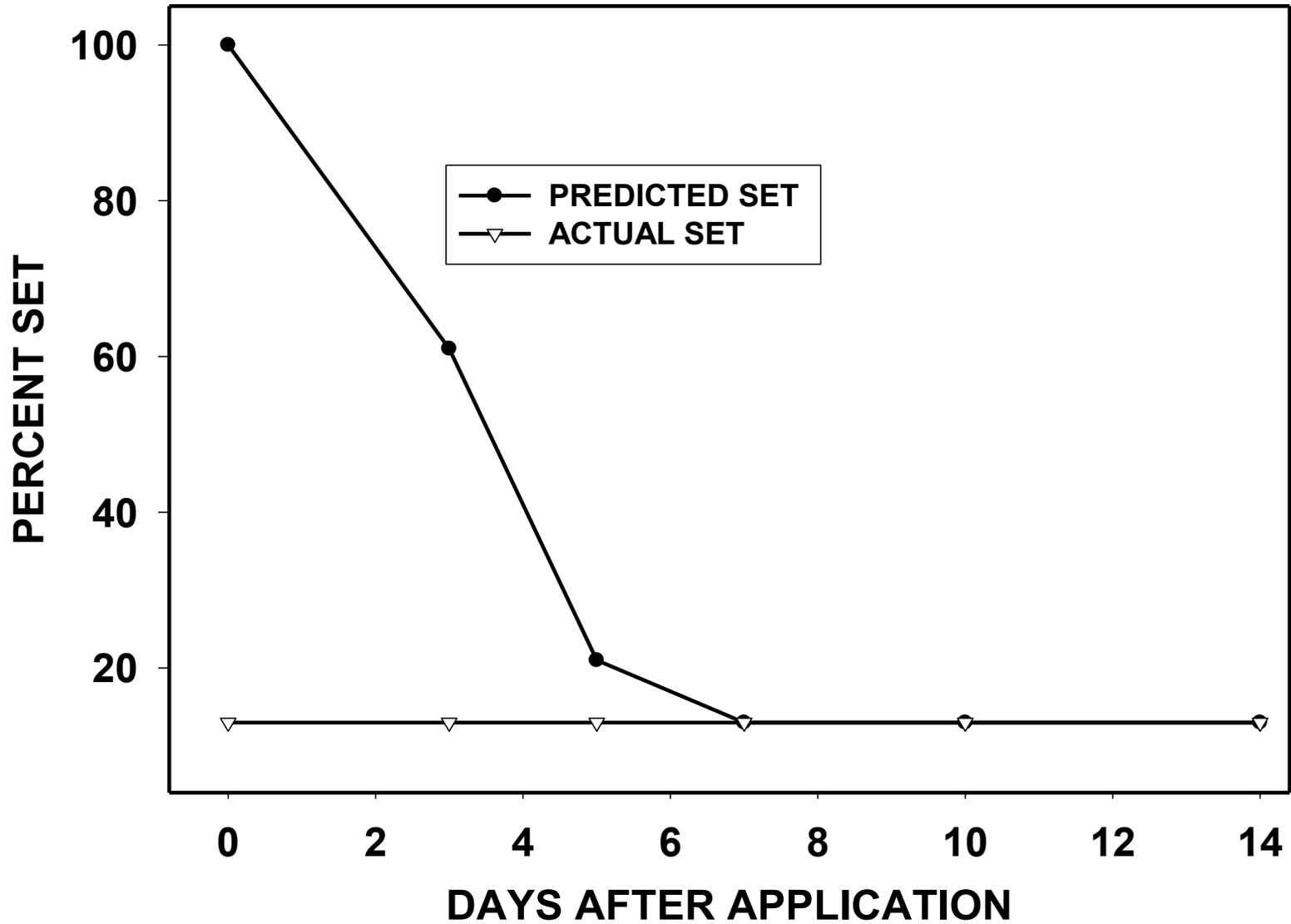




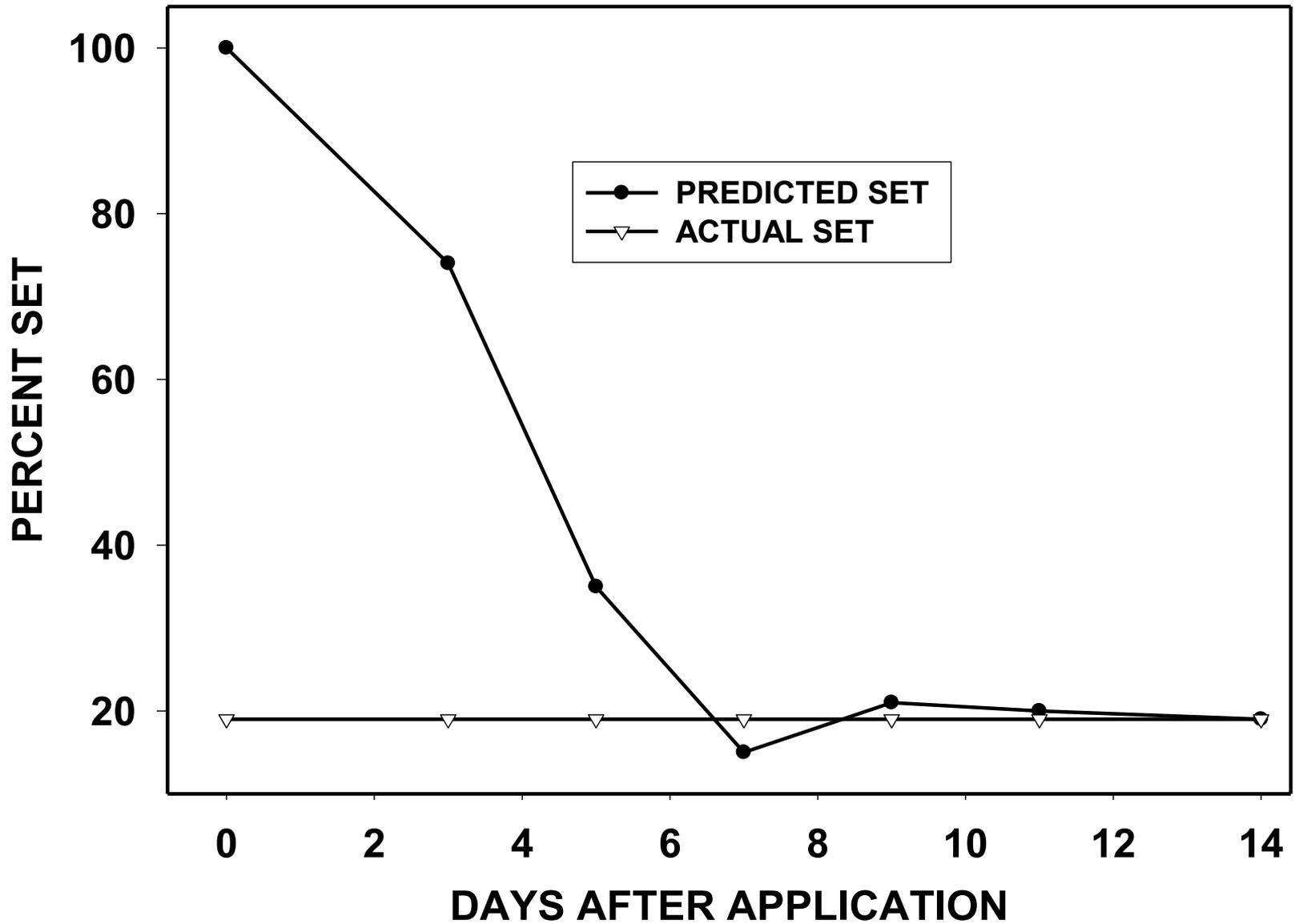
Predict if a Fruit Will Persist or Abscise

- 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.

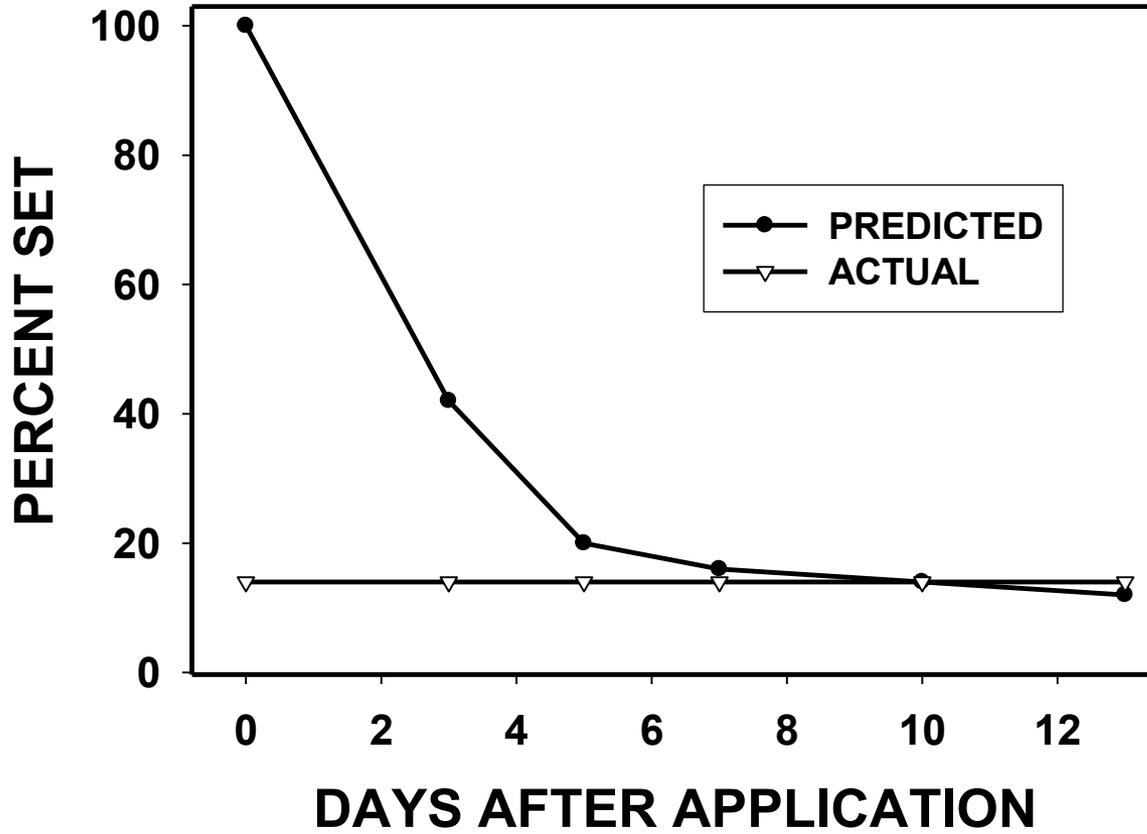
GOLDEN DELICIOUS- NAA 10 + CARBARYL



MCINTOSH- NAA + CARBARYL

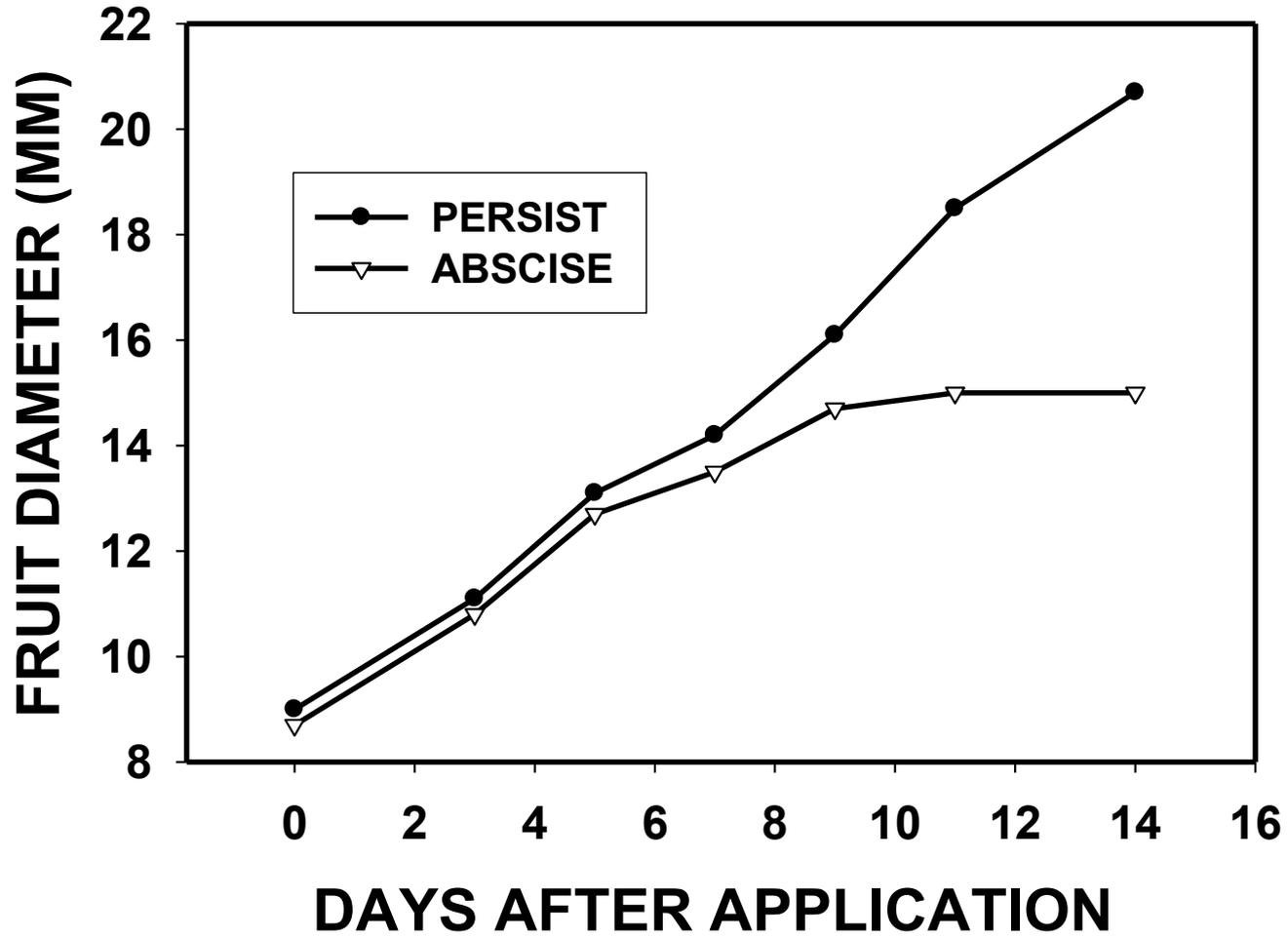


BRAEBURN- NAA + CARBARYL

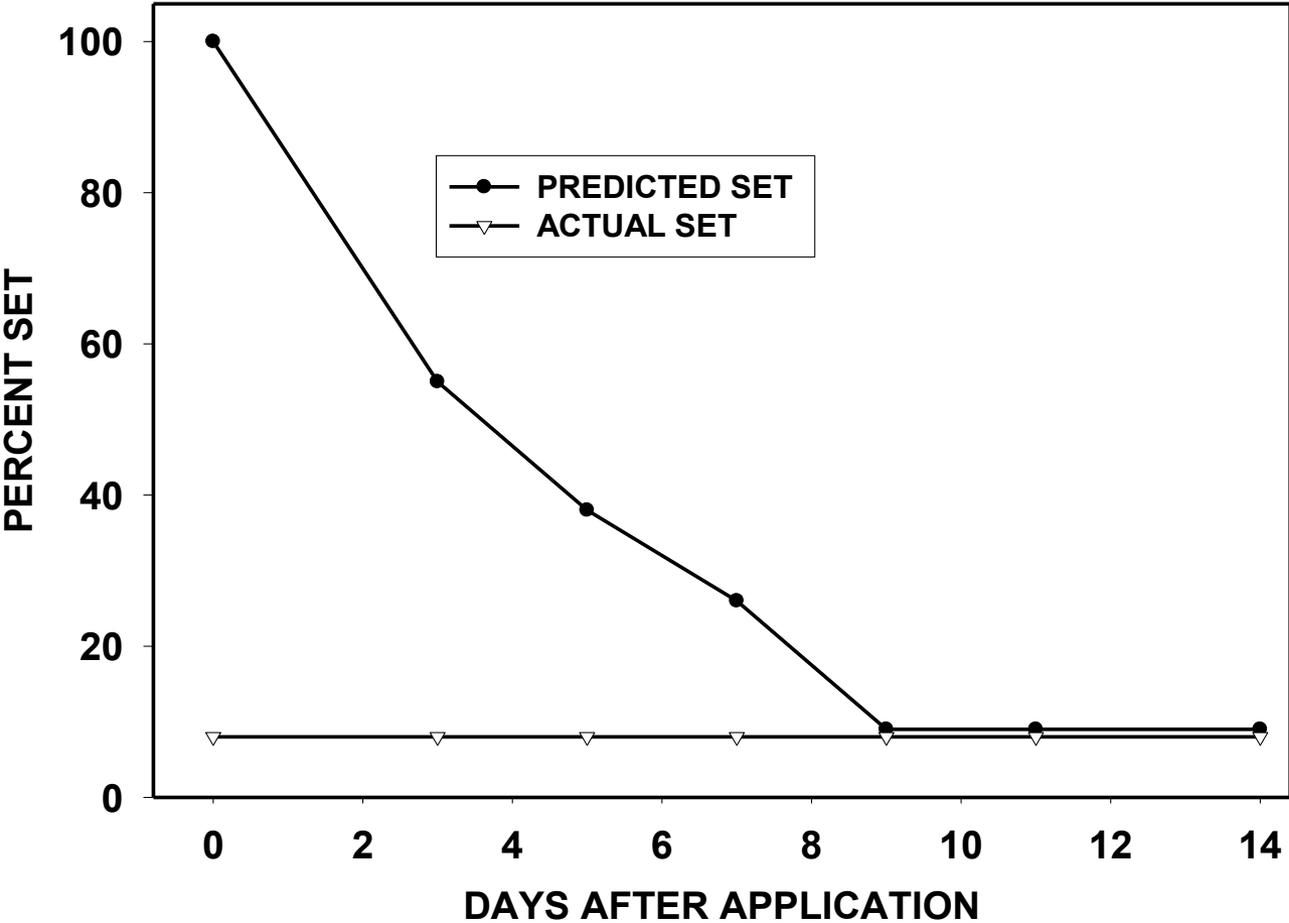


There are some years when predictions can not be made within 7 to 8 days. In these years temperature following application were generally cool thus slowing the response to thinners.

COOL THINNING YEAR



DELICIOUS- NAA + CARBARYL



Temperature Following Application is a Key Factor

- Fruit must be exposed to 100 to 130 heating degree units (Base 41° F) before a reliable prediction can be made.
- Thinning predictions from 13 experiments over 4 years confirmed that a prediction can be made with 90% or greater accuracy if 100 to 130 unit have been accumulated.
- In two instances it required 11 to 12 days to accumulate 130 units.

When Can an Accurate Prediction of Final Set be Made?

- Normally within 7-8 days after application.
- If weather is cool you must wait until trees have been exposed to 100 to 130 heating degree units base 41° F.
- The starting time for measuring fruit is not before the fruit reach 6-7 mm diameter.
- Thinners can be applied before but the measurement and count time start at 6-7 mm.

Greater Precision is Possible?

- It is quite well established that temperature and light conditions after thinner application play a dominant role in thinner response.
- Run the CHO model 4 days after application using actual weather data for that period.
- This can then be used to more accurately determine the time for a final measurement.

How to Use This Model

- Set a target final fruit set.
- Establish early how many fruit on a tree or unit that you would like to see persist at the end of June drop.
- This is a different approach from what most have done in the past.
- I am certain many of you are doing this now, especially on smaller trees.

Determine Bloom Density and Establish a Target Fruit Set

- 200 blossom clusters on a tree-want 100 fruit
 - **1 fruit for each 2 spurs**
- 100 spurs tagged (representative of the tree)
 - **430 developing fruit on the spurs**
 - **$50/430 \times 100 = 11.9\%$**
- The Excel spreadsheet will give you a % set. If it is 11.9%, you are done. If it is higher set, it is time to thin again.

The Excel Spreadsheet

- The Excel spreadsheet has been constructed with macros to make all of the necessary calculations.

Predicting Thinning Braeburn 2007 Data

Rep	Spur	Fruit	5/25/07	5/29/07	6/1/07
1	1	1	7.5	11.3	13.4
1	1	2	6.1	6.6	6.8
1	1	3	6.8	7.0	7.4
1	1	4	6.4	9.6	12.3
1	1	5	6.5	8.0	9.8
1	2	1	10.5	12.9	13.4
1	2	2	8.0	7.9	7.9
1	2	3	8.6	10.2	10.4
1	2	4	6.4	6.4	6.5
1	2	5	3.8		
1	3	1	8.7	11.0	11.1
1	3	2	7.1	9.0	9.1
1	3	3	7.0	7.0	7.2
1	3	4	4.1		
1	3	5	3.8		
1	4	1	9.3	10.8	11.0
1	4	2	7.1	7.2	7.6
1	4	3	5.6	5.6	5.8
1	4	4	4.5	4.2	

Predicting Fruitset

This spreadsheet will help estimate the degree of thinning that will occur after a thinner application.

The YELLOW areas on the INPUT sheet is for data entry.

The INPUT sheet is the only sheet you can change, Do not change the other sheets.

This program expects a minimum of data from 7 trees. It uses the 3 fastest growing fruit from each tree.

The total of 21 fruits (3 fastest on 7 trees) are used to calculate the fastest growing fruit mean.

The EXAMPLE sheet is an example of data from a 2007 test,

You can enter fruitlet measurements directly on the INPUT sheet or cut and paste from another sheet.

The program will number fruitlets automatically if you enter the tree and cluster numbers in the INPUT sheet.

After data entry, click to SUMMARY sheet.

On the SUMMARY sheet click the control buttons or use the shortcut keys to perform the task disired.

The YELLOW areas on the INPUT sheet is for data entry.

The STAGE sheet prepares your data for sorting and counting.

The COUNT sheet counts fruitlets in each category.

The FASTEST sheet finds, counts and calculates the 21 fastest growing fruit.

The other sheets (TREE1, TREE2, etc.) are used to sort and count each tree seperately.

Input

INPUT DIAMETERS			Variety, Strain:				2008		
Treatment:							Block: 1		
Average Fruitlet Diameter									
# of Fruitlets measured			0	0	0	0	0	0	
Input diameters and dates into this sheet.									
Tree	Cluster	Flower	1	2	3	4	5	6	7
Tree	Cluster	Flower	5/1/08						
1	1	1							
1	1	2							
1	1	3							
1	1	4							
1	1	5							
1	1	6							
1	1	7							
1	1	8							
1	1	9							
1	1	10							
1	1	11							
1	1	12							
1	1	13							
1	1	14							
1	1	15							
1	1	16							
1	1	17							
1	1	18							

Summary Sheet

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	Based on Current # of Fruit
1	5/28	0	10.05	7.04					505		
2	5/31	3	13.21	7.55	3.54	1.77	64	419	483	12.7	13.3
3	6/2	2	15.98	8.27	3.32	1.66	50	368	418	9.9	12.0
4	6/5	3	17.56	8.89	1.88	0.94	43	329	372	8.5	11.6
5	6/7	2	19.88	10.60	2.72	1.36	38	173	211	7.5	18.0
6	6/9	2	21.31	12.13	1.68	0.84	41	112	153	8.1	26.8
7	6/12	3	23.53	14.28	2.43	1.21	41	66	107	8.1	38.3

The Excel Spreadsheet

- We will make available to anyone interested, the Excel spreadsheet and the instructions.

Instructions and Excel Spreadsheet

- <http://www.umass.edu/fruitadvisor/2008/predictfruitset2008.xls>
- <http://www.umass.edu/fruitadvisor/2008/predictthinprocedure.pdf>
- <http://www.apples.msu.edu>

Conclusions

- The Fruitlet Growth Model may be a useful tool to predict thinner response.
- In most years a reasonably accurate thinning prediction can be made with 7 to 8 days of application.
- The strength of this model is that it will give you a very good ideas if the thinner worked in time to apply an additional thinner if it is warranted, hopefully when fruit size is 13 mm or less.