MSU Agriculture Innovation Day

Focus on Fruit and Vegetable Technologies

Precision Management of **Tree Fruit Orchards**

Using technology to modify plant growth / manage the growing environment

Overhead Misting

Overhead misting can delay tree growth 3 to 10 days which may increase the chances of avoiding frost damage on sensitive green tissue and bloom.

Bloom delay is maximized by beginning mist-cooling prior to budbreak, but misting is eff ective even when started as late as ½" green.

More frequent misting is needed at higher temperatures to provide more cooling.

Computer-control based on air temperature and relative humidity helps to minimize water use and maximize evaporative cooling.

Overhead misting can be used to cool apples and increase red blush development.

With the addition of extra nozzles and an injection system, the system could be used to apply growth regulators or pesticides.

Wind Machines

Wind machines can potentially increase temperatures in orchard by up to 4 °F

Wind machine are most eff ective when relatively calm because chances for an inversion layer are greater. Inversion tower temperature readings are invaluable for detecting an inversion layer.

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Wind Machines cont.

The eff ective range of warming depends on the machine design, the terrain, and machine placement.

Place the machine to take advantage of the natural air fl ow.

Use smoke or balloon to fi nd air fl ow direction.

Ideally, the machine should be 1/3 from the top of the hill.

Microsprinklers for Frost Control

Microsprinkers provide both water for the trees and some protection against frost.

More heat is conducted from the ground to the air when the soil has been pre wetted by the microsprinklers compared to trickle lines which provide little or no frost protection.

Additional heat is released by water as it cools and freezes. Ice from microsprinklers is less damaging than ice from overhead sprinklers.

Typically temperature will be raised 3 to 5 degrees at ground level, 0 to 2 degrees at chest height, and 0 to 1.5 degrees higher in the trees with microsprinklers.

Integrating bio-regulators and predictive models

ReTain (AVG) growth regulator for increasing fruit set

Application of ReTain is particularly useful for sweet cherry and pear cultivars that are typically light croppers

ReTain inhibits natural production of the 'sensescence' homone, ethylene, which has a limiting eff ect on fruit set

Trials throughout the US indicate application of a half to full pouch per acre of ReTain to 'Regina'sweet cherry at ~20-50% full bloom and several cultivars of pear at ~ 7-10 days after full bloom will maximize yield per tree

Use of Growth suppressing plant growth regulators

Prohexadione-Ca (P-Ca; commercial products Apogee & Kudos) eff ectively controls vegetative growth of apple and pear trees

Improving fruit quality, Reducing pruning costs

Reducing susceptibility to fi re blight

Use of Growth suppressing plant growth regulators cont.

Eff ects of P-Ca are localized and can be very dramatic. Limited translocation throughout the tree allows users to specifi cally target areas of the canopy that are overly vigorous (i.e., tops).

Timing of P-Ca is very important.

Application to apple is earlier than pear, occurring between ‘pink’and petal fall.
It takes approximately 1-2 weeks to observe the results of the spray
Typically requires re-treating after an additional 2-4 weeks.

Apple shoots suppressed by P-Ca have thickened cell walls that appear to help slow down internal movement of fi re blight bacteria and disease spread.

Use of predictive models to inform timing, rate and selection of apple thinning sprays

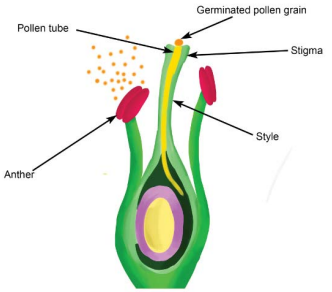
The Pollen Tube Growth Model, developed at Virginia Tech University to estimate the timing of fl ower fertilization will:

indicate early fl owers that have been fertilized

identify timing for growers to apply caustic chemical thinners to ‘burn off ’ the less advanced fl owers

reduce hand thinning costs,

optimize fruit size, quality, yield and return bloom.



The Cornell apple carbohydrate model estimates carbohydrate (sugar and starch) supply in the tree and demand by the fruit. The model:

Requires solar radiation (light) and temperature measurement. From these variables, predictions of the carbohydrate defi cit or surplus are generated.

Young developing fruit with low carbohydrate supply and/or high demand are more easily thinned by chemical thinners.

Conversely, during high carbohydrate surplus conditions fruit are difficult to thin.

Helps growers optimize application timing and the appropriate rates and thinning chemical types for their situation.

Is available online.

The Precision apple thinning model, developed at UMass, estimates the proportion of fruit that will 'drop' after a thinner has been applied.

This information allows growers to calculate the percentage of drop they can expect.

If too much crop remains, growers can re-apply thinners before the thinning window closes.

Grower get information much earlier than waiting to see the drop.

To use the model in an orchard:

Select 75 spurs and number each fruitlet

Beginning at 6 mm fruit diameter, measure fruit diameters every 3-4 days

Typically, in about a week some of the fruitlets will grow slower

These fruit will abscise

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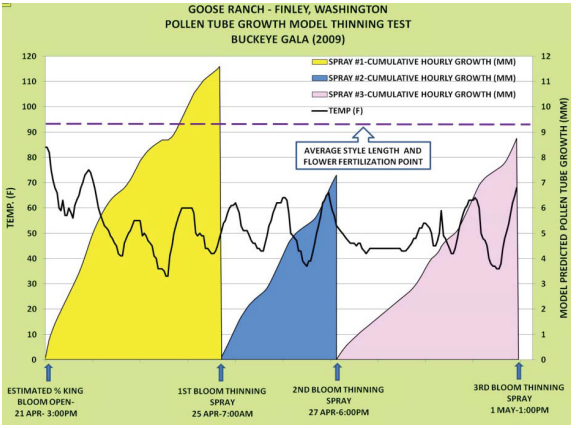
Fig. 1. Bloom is delayed by 8 days in misted flowers (left), compared to untreated control (right). Red Delicious, St. Joseph, MI, 2013.



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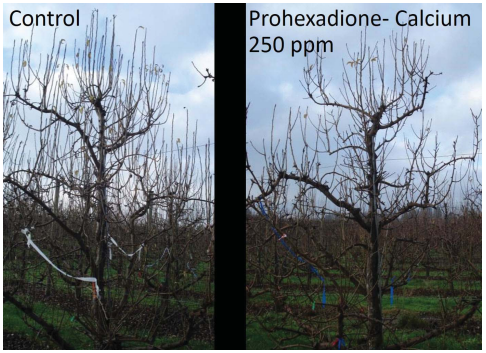

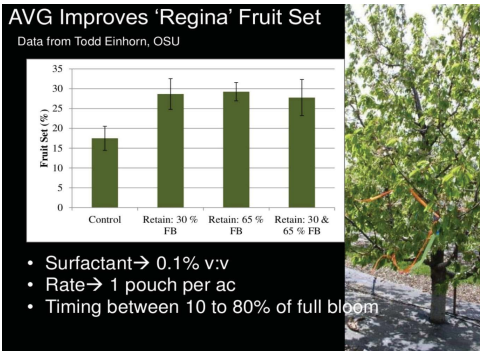

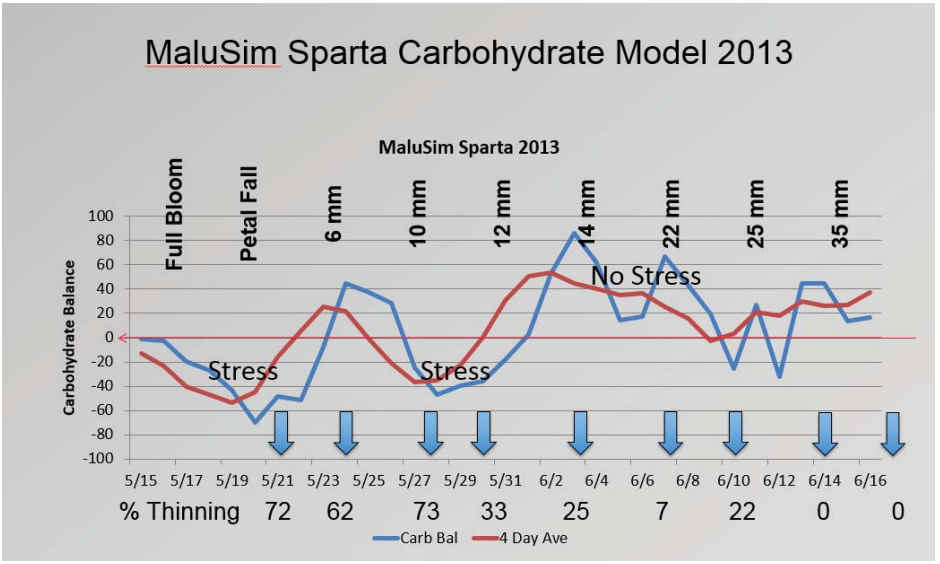

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