BEST MANAGEMENT PRACTICES TO MINIMIZE BITTER PIT IN HONEYCRISP

Penn State **Extension**

Best Management Practices

to Minimize Bitter Pit in Honeycrisp

Tara Baugher, Lynn Kime

Quick “Show of Hands” Survey on Best Management Practices for Honeycrisp:

Confident about management programs for Honeycrisp?
Continue to be frustrated by various management options tried for Honeycrisp??
Find Honeycrisp fruit quality is beginning to improve, but you are still learning how best to manage this high value, but grower-unfriendly cultivar???

It Takes a Team!

Grower Cooperators
Ben and Joe Lerew
Bill Lory
Mark Rice
Dave Slaybaugh
Chris Baugher
Dave and John Wenk
Jim Lott, Dave Benner
Lee Showalter

- Commercial Producers
- Commercial Packers/Storage

Experts (Special thanks to Rice Fruit Company, El Vista, Hess Bros.)

- ***Chris Watkins, Cornell University– conducting parallel field studies along with storage trials***
- ***Funding from the State Horticultural Association of PA Research Committee***

Penn State **Extension**

Focus on Bitter Pit

Investigations prior to start of project (2012) in 10 orchard blocks – bitter pit incidence ranged from 1 to 65%

2nd Year of Project – Preliminary Findings on:

- Fruit tissue sampling to assess bitter pit potential (more useful tool than leaf analysis)
- Optimum peel nutrient levels and ratios
- Relationships to terminal shoot growth
- Optimum crop load and interactions with peel nutrient levels
- Importance of harvesting fruit at optimum maturity both to minimize bitter pit and to improve consumer acceptance
- Importance of developing management programs specific to each orchard situation
- Spreadsheet calculations for decision-making on individual orchard blocks (Lynn Kime)

Fruit Tissue Sampling to Assess Bitter Pit Potential

Fruit segregation prior to storage—Ostensen, 2012

- Sampling fruit flesh tissue 3 weeks prior to harvest to assess bitter pit potential
- 2012 - Sampled fruit peel from the same apples, and it was better correlated to bitter pit
- 2013—further improved results by sampling peel 3 cm from calyx

Good News for Growers: *new procedure almost as easy as collecting leaf samples and results are more useful!*

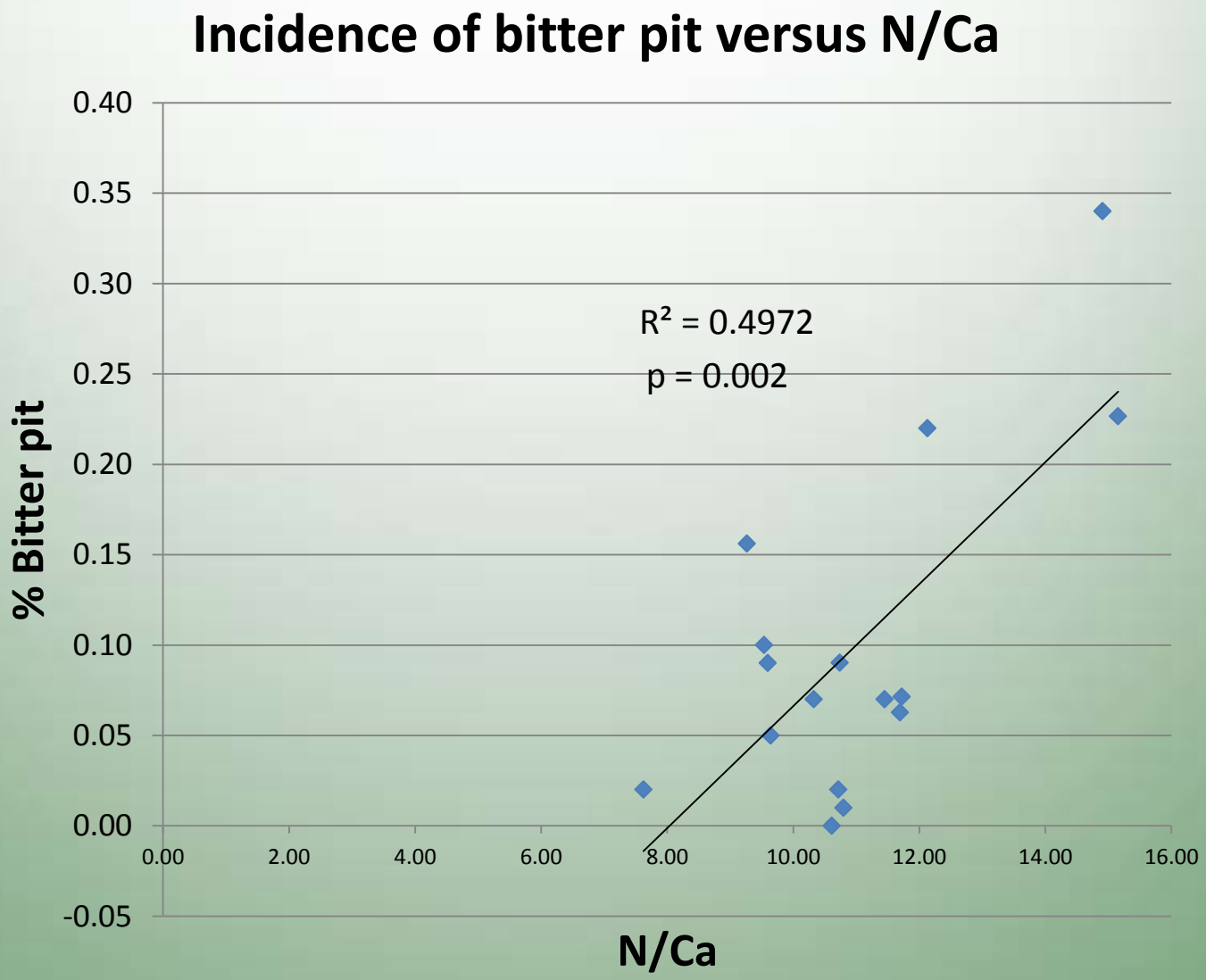
Relationship of bitter pit to peel nutrient levels and various cultural factors (2014)

Variable	r^2	*P*
Peel nutrient levels		
N %	0.086	0.0317
P %	0.357	0.0000
K %	0.249	0.0001
Ca %	0.227	0.0003
Mg %	0.009	0.5059
Mn ppm	0.004	0.6641
Fe ppm	0.014	0.3934
Cu ppm	0.113	0.0129
Peel nutrient ratios		
Mg/Ca	0.240	0.0002
N/Ca	**0.325**	**0.0000**
K/Ca	0.225	0.0003
(Mg+K)/Ca	0.227	0.0003
Accumulated Ratio*	0.265	0.0001
Cultural factors		
shoot length (cm)	0.298	0.0000
Crop Load**	0.233	0.0002

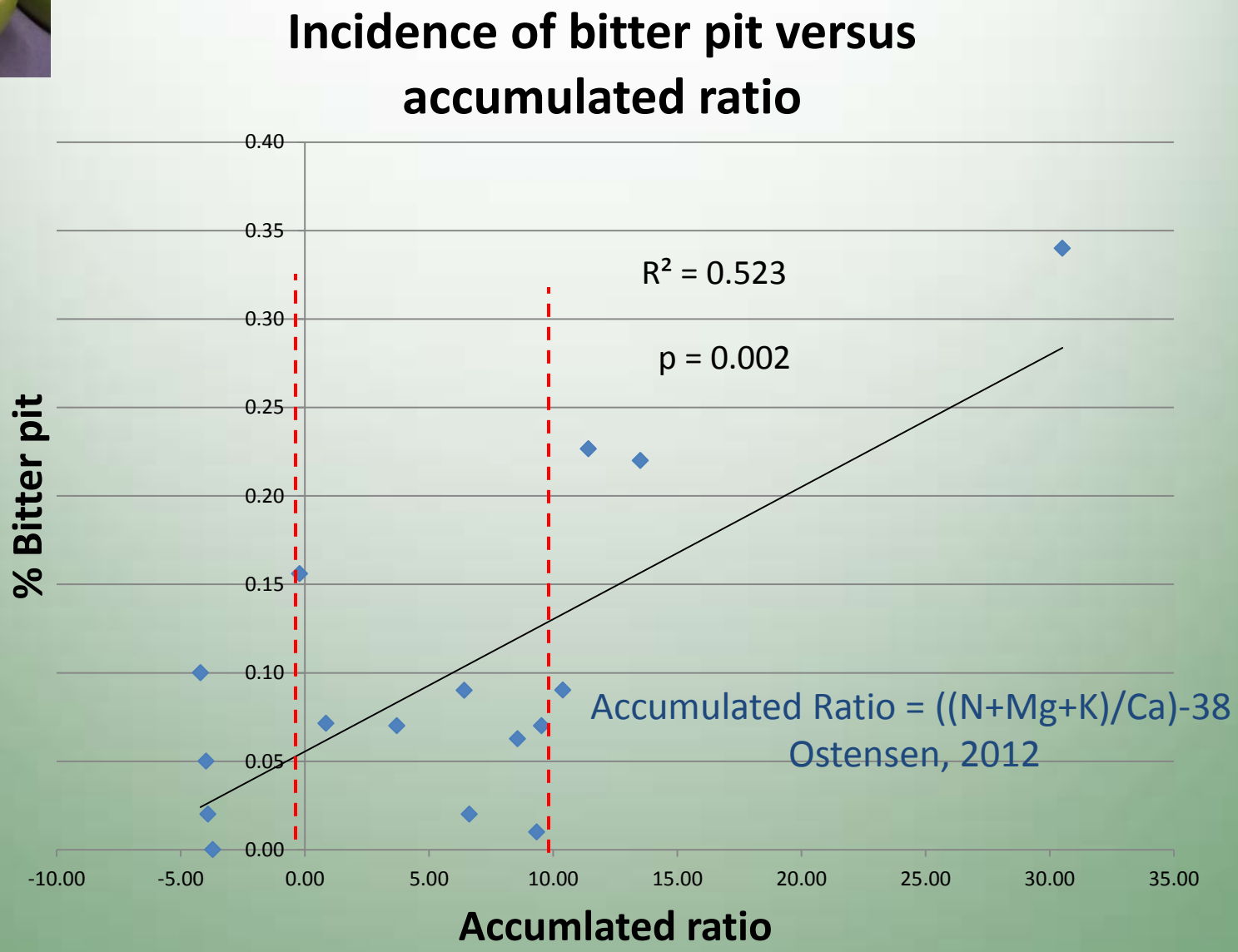
*Accumulated Ratio = ((N+Mg+K)/Ca)-38 (Hansen, 2012)

**crop load=apples per unit trunk cross-sectional area

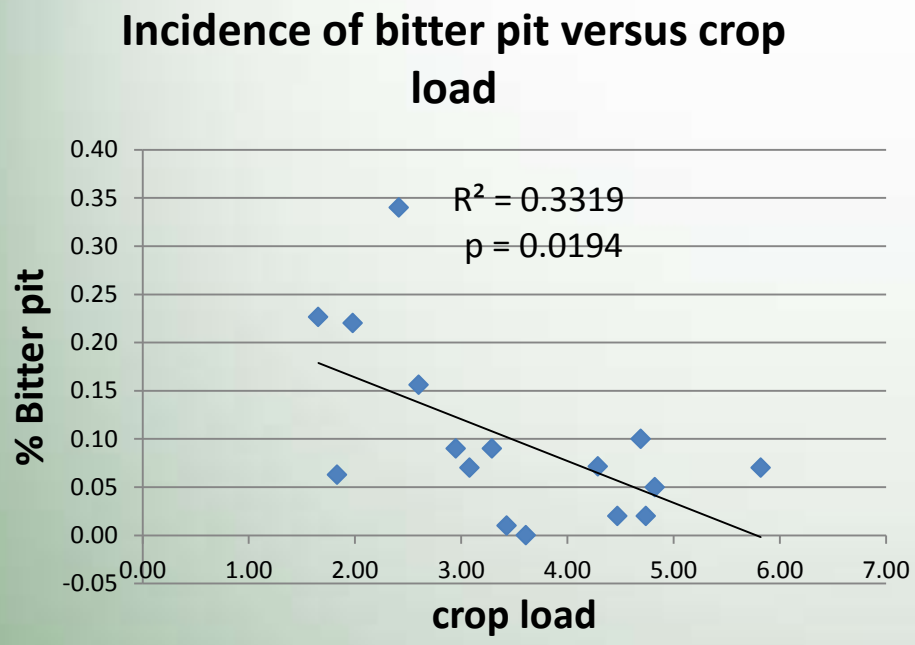
Peel Nutrient Relationships

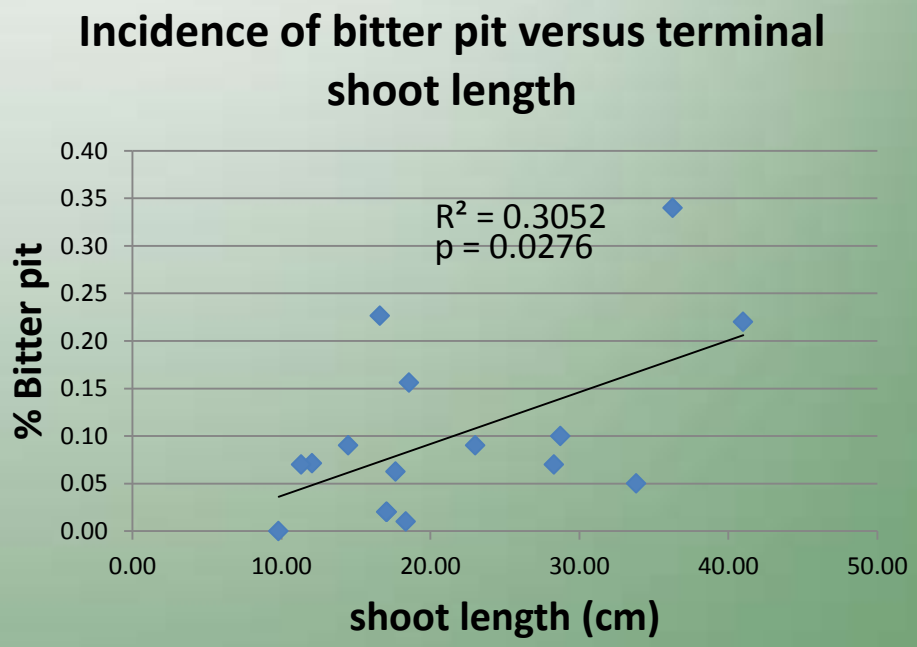


Peel Nutrient Relationships



Cultural Factors





N, K, Ca and Crop Load

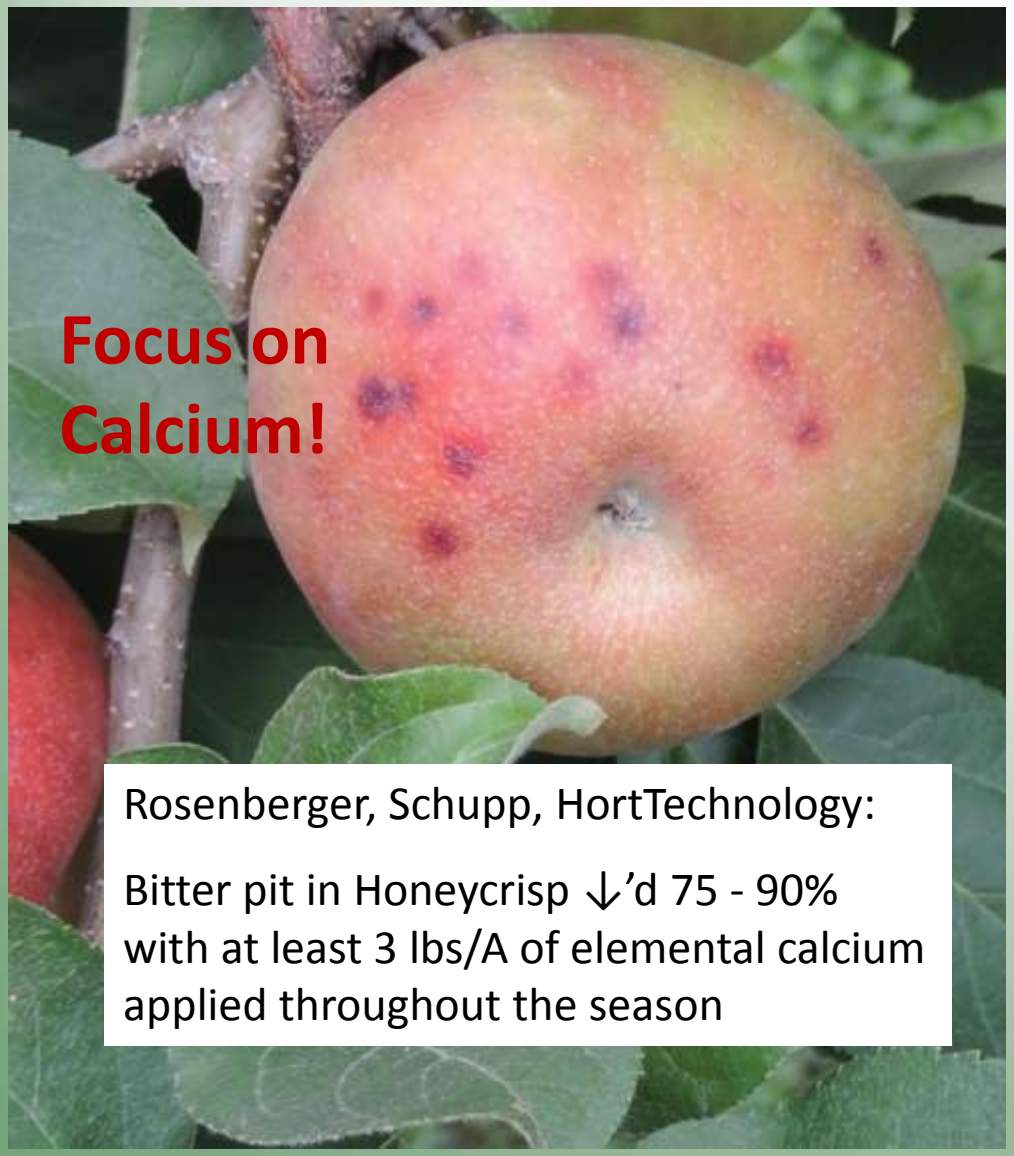
Low cropped trees:

reducing N important

Low, medium, high crop loads:

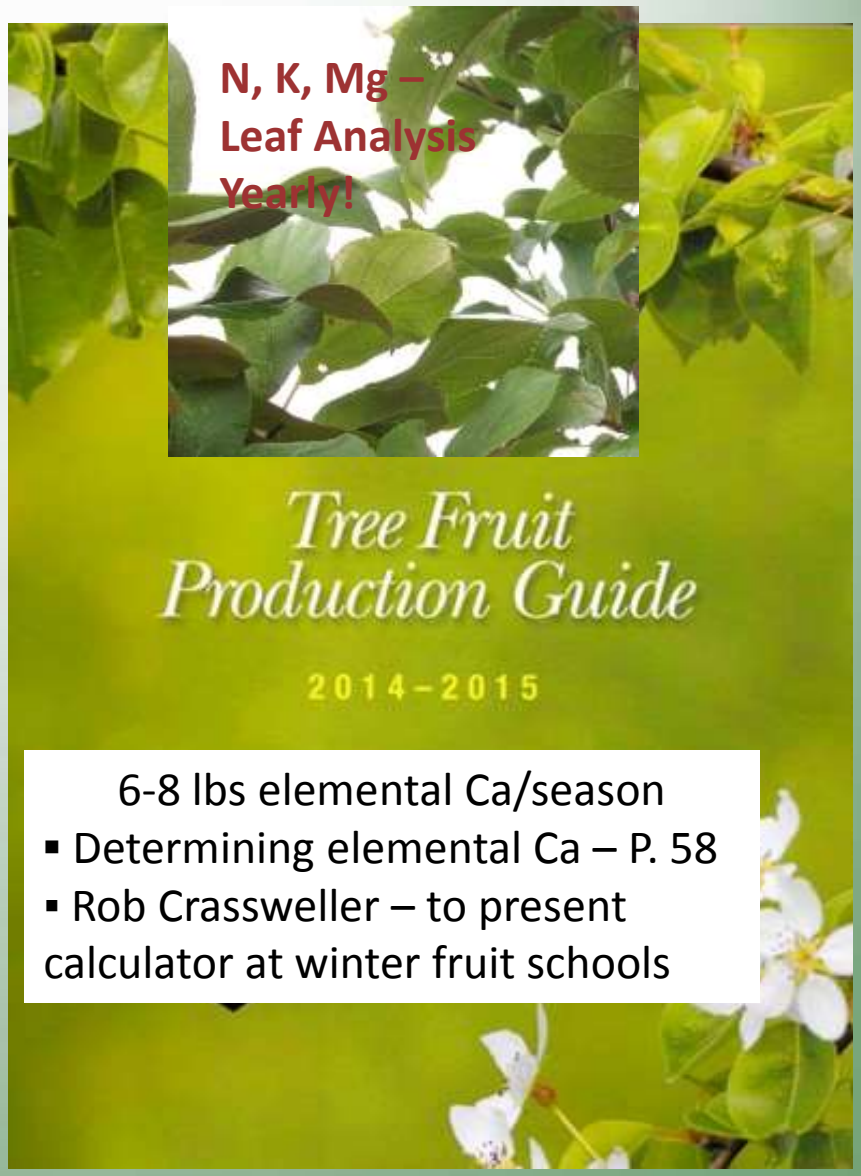
Ca and K important

Nutrient Management Recommendations



Rosenberger, Schupp, HortTechnology:

Bitter pit in Honeycrisp ↓'d 75 - 90% with at least 3 lbs/A of elemental calcium applied throughout the season



6-8 lbs elemental Ca/season

- Determining elemental Ca – P. 58
- Rob Crassweller – to present calculator at winter fruit schools

Rosenberger, Schupp, *HortTechnology*

Treatment	Ca (lb/A/yr)	% Bitter Pit
Control	--	27 c
Dow flake CaCl	6.8	3 a
405	3 a	2 a
Stopit	2.9	4 a
Nortrace 10%	3.5	6 a
Citraplex	2.6	10 ab
N. Norplex	1.8	18 b

Crop Load Management

5-6 fruit/cm^2 TCSA optimum

Harvesting Fruit at Optimum Maturity to Prevent Bitter Pit

2013 – DA meter (tool to measure "peel maturity" based on chlorophyll) and starch; variable results

2014 – Visual segregation of fruit based on background color

Findings following storage:

-Bitter pit was 60% higher on fruit harvested a little too green (or in 3 vs 5 pickings)

Note: Soft scald and soggy breakdown higher on overly-mature fruit; fortunate to be collaborating with Chris Watkins with on-going storage trials on PA fruit

Harvesting Honeycrisp at Optimum Maturity also Increases Consumer Acceptance

Harvest maturity (based on ground color)	Color	Taste
Slightly immature	2.8 c	2.3 b
Optimum maturity	2.0 b	1.9 a
Slightly over-mature	1.2 a	1.8 a

Ranking scale: 1-3, with 1 being most preferred

N=100

Importance of Developing Block-Specific Management Programs

Orchard	Bitter pit history	2014 Crop load	2014 Bitter pit
Block A - Low	0-5%	Moderate	6.3 ab
Block B - Low	0-5%	Moderate	0.0 c
Block C - Moderate	10-15%	Low	22.7 a
Block D - Moderate	10-15%	High	9.1 bc
Block E - High	50-60%	High	15.7 ab
Block F - High	50-60%	High	7.2 bc

Penn State **Extension**

Summary

New tool for assessing how to adjust nutritional levels to control bitter pit/to assess bitter pit potential

Better understand:

- Interactions of crop load with fruit nutrient levels and importance of using best tools for thinning
- Importance of harvesting fruit at optimal stage of maturity based on fruit background color
- Importance of developing management programs specific to each orchard situation

Continue to work with Cornell on storage concerns

Continue work on fruit nutrient levels and harvest maturity

Thank You

- **Grant Support** – State Horticultural Association of Pennsylvania Research Committee
- **Technical Support** – Tom Jarvinen, Tom Kon, Edwin Winzeler, Melanie Schupp, Ryan Hilton, Catherine Lara
- **Grower and Packer Cooperators**—Ben and Joe Lerew, Mark Rice, Dave Slaybaugh, Chris Baugher, Dave and John Wenk, Jim Lott, Dave Benner, Bill Lory, Lee Showalter, Rice Fruit Company, El Vista Orchards

Lynn Kime—Another tool:

As a grower, how do you decide what practices will be economical on a block by block basis?