

# Bitter Pit in 'Honeycrisp' – Causes and Mitigation



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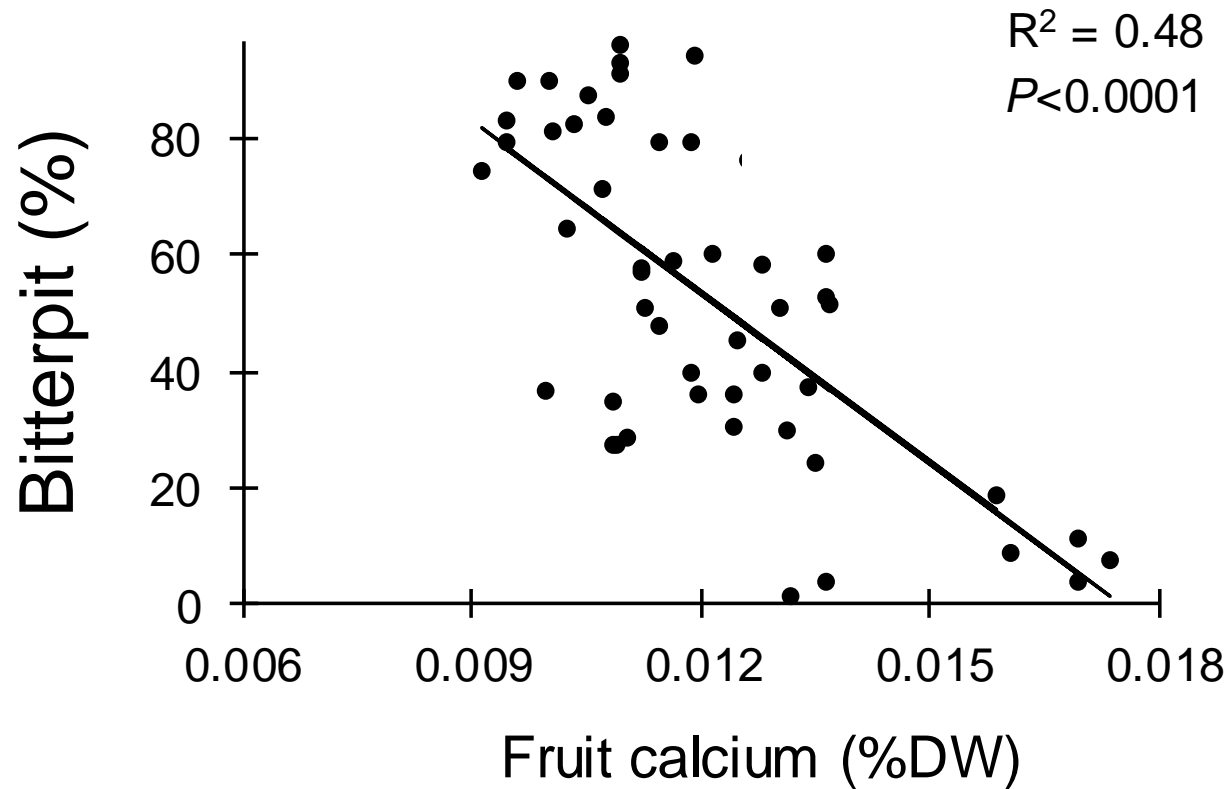
**Cornell University**



# Bitter Pit



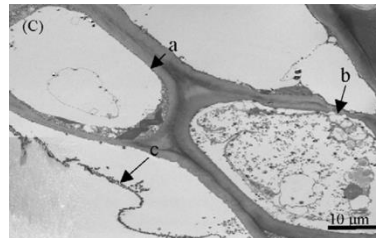
# Honeycrisp Bitterpit in Relation to Fruit Ca



# Bitterpit Susceptibility



Cell plamamembrane Ca level



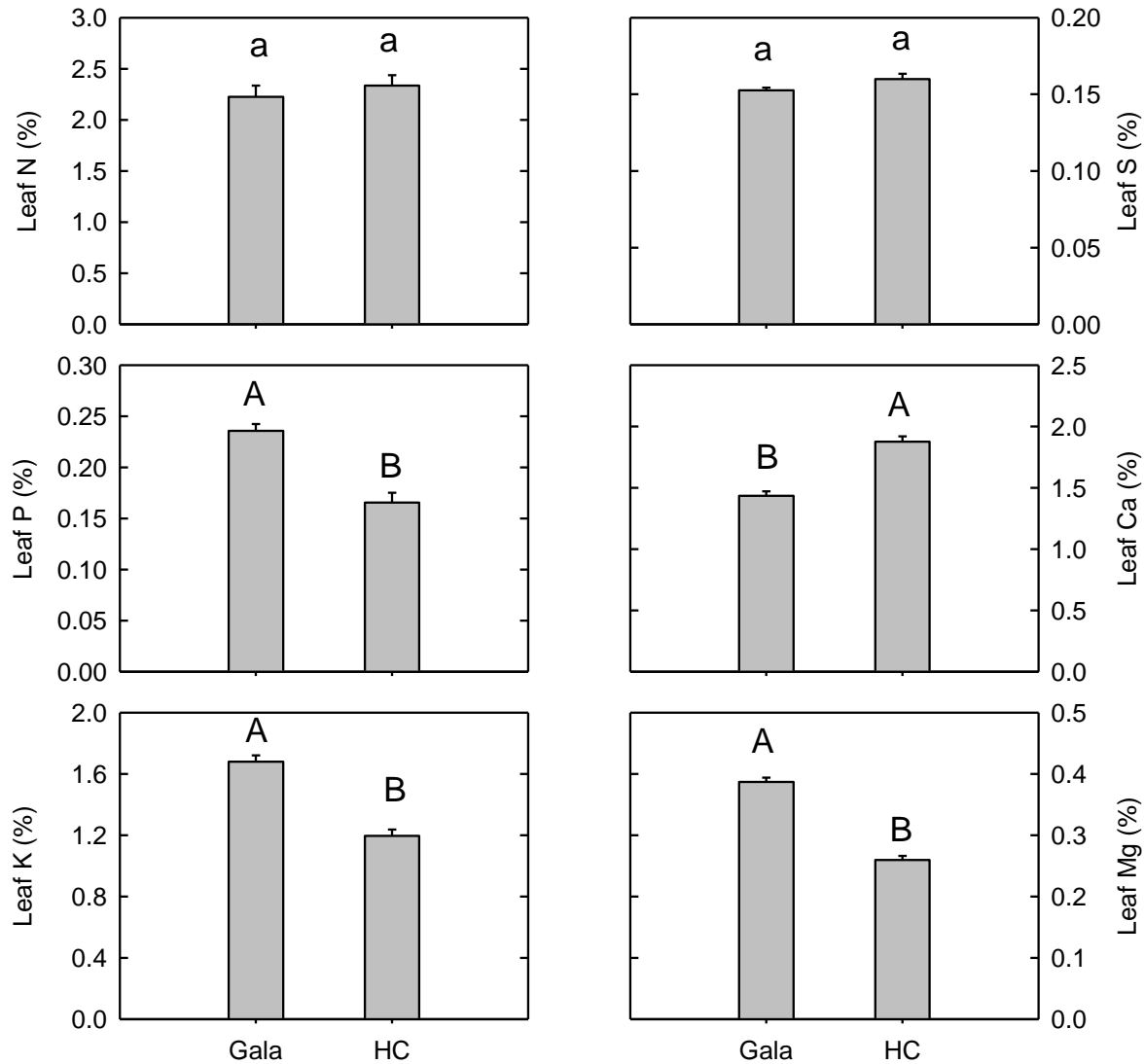
**Cellular partitioning in fruit**

Fruit Ca level & its balance with other nutrients

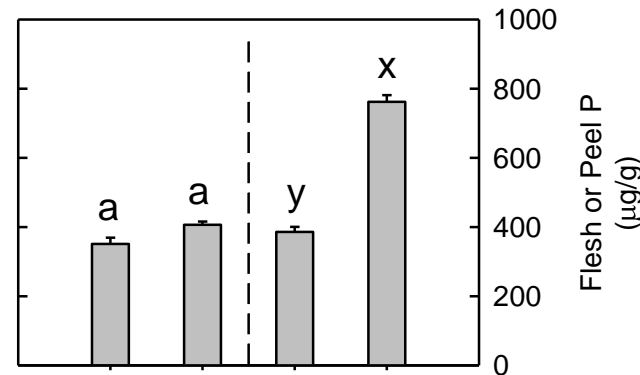
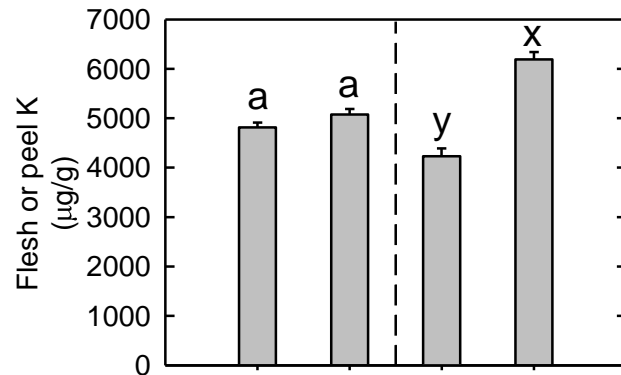
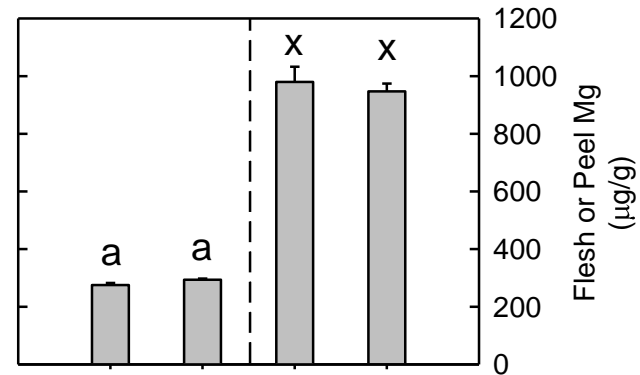
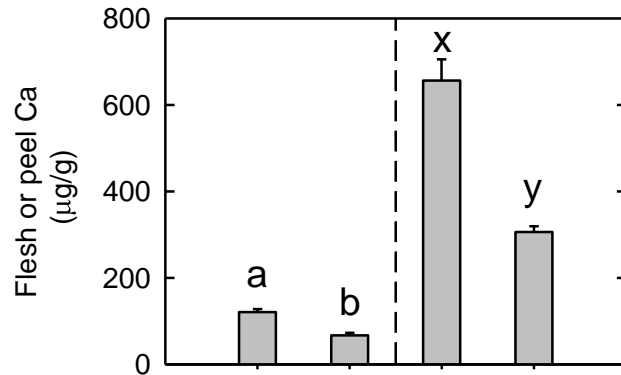
**Partitioning btw leaves & fruit**

Root uptake of Ca and other nutrients

# Leaf Nutrient Levels in Gala and Honeycrisp



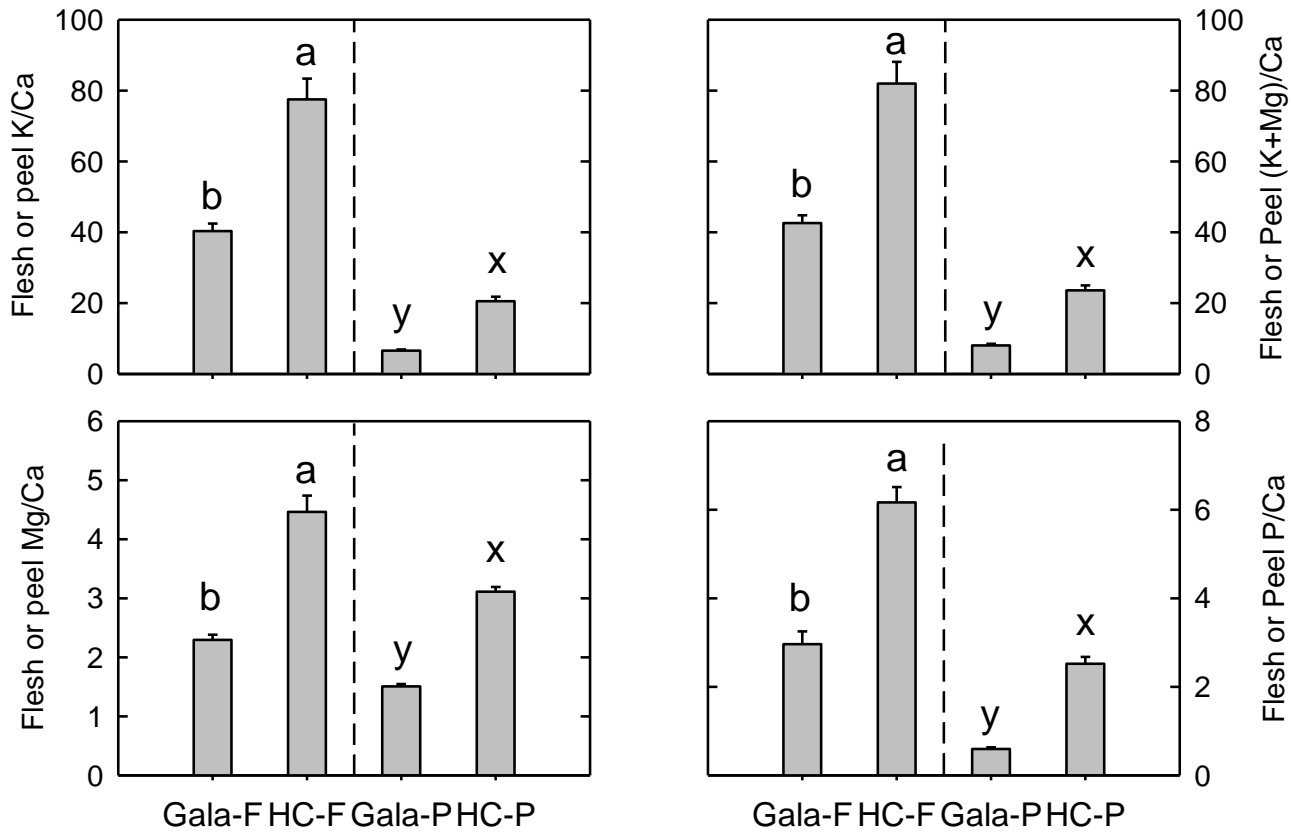
# Fruit Nutrient Levels in Gala and Honeycrisp



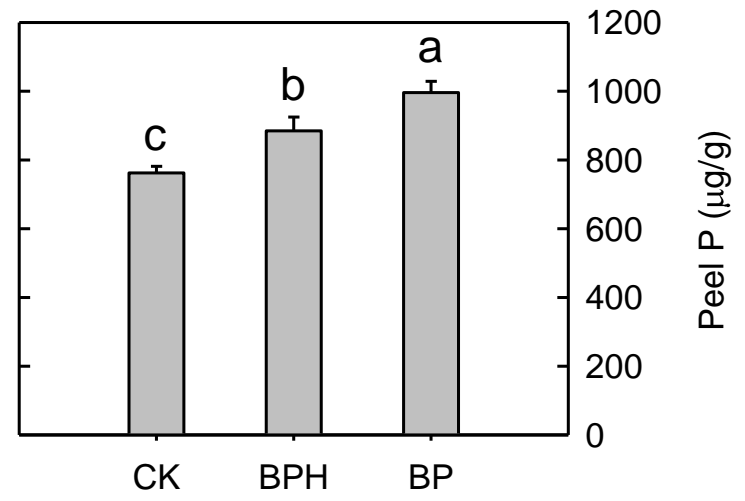
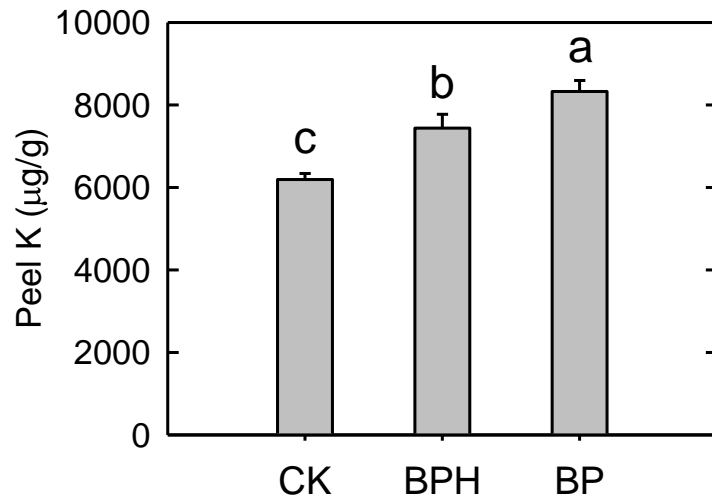
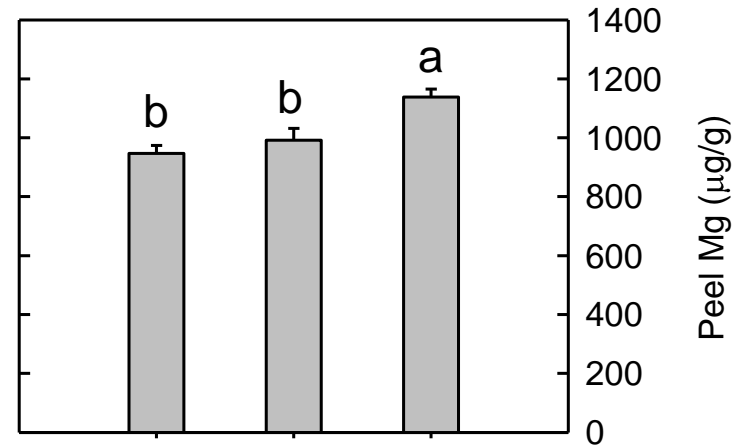
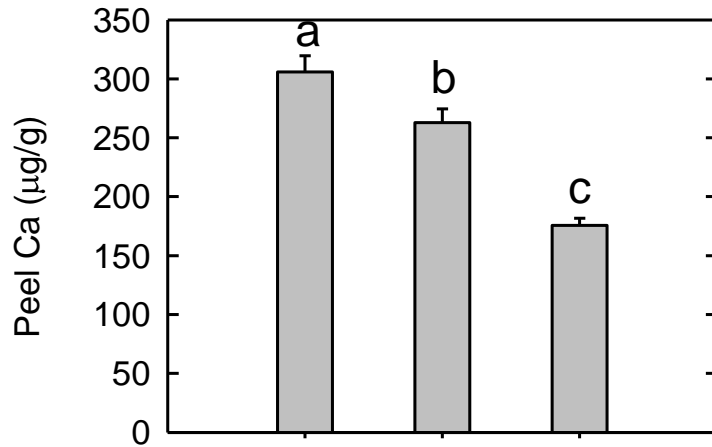
Gala-F HC-F Gala-P HC-P

Gala-F HC-F Gala-P HC-P

# Fruit Nutrient Ratios in Gala and Honeycrisp

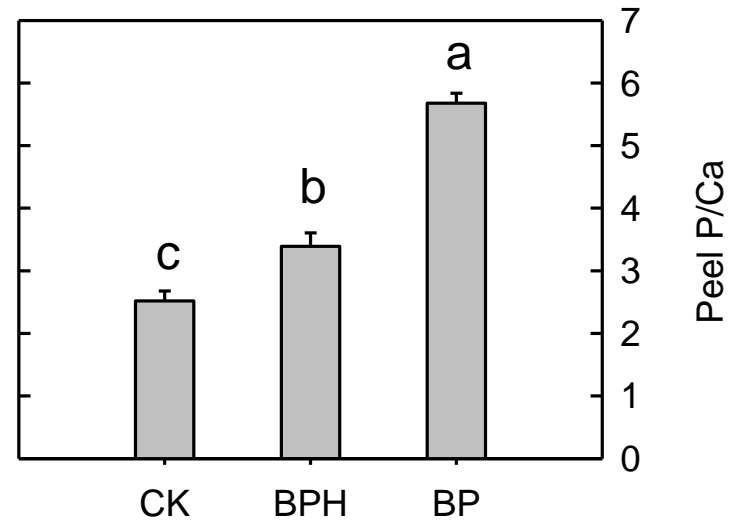
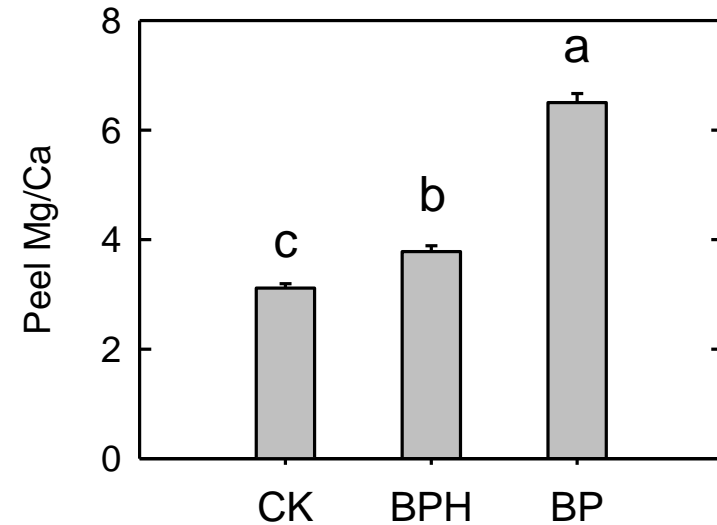
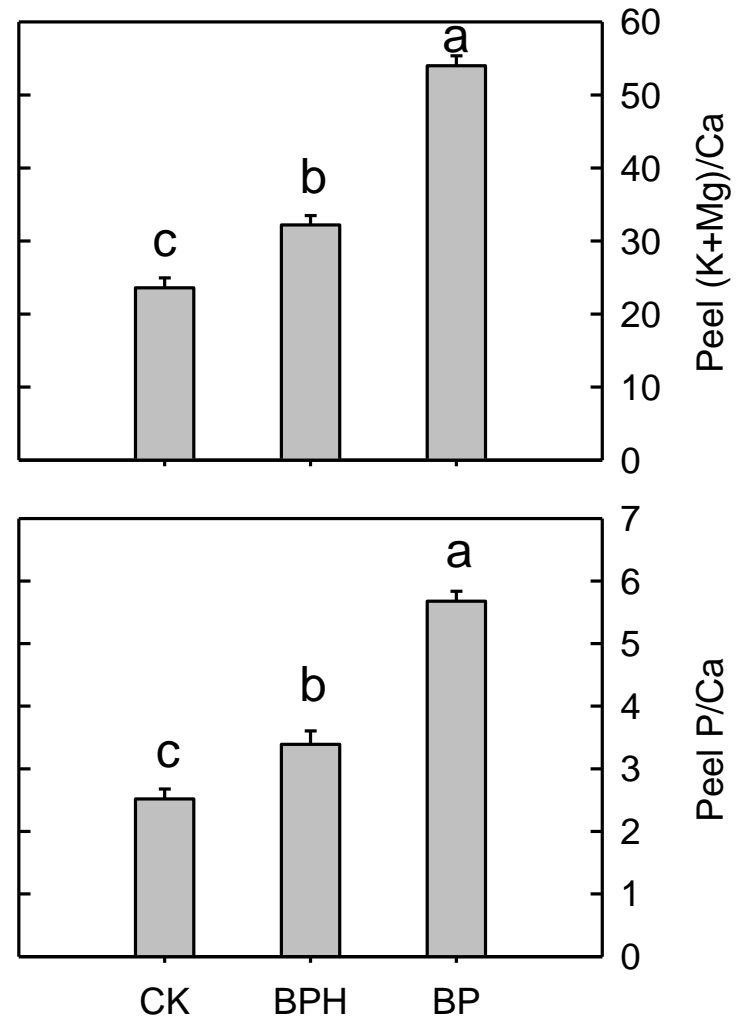
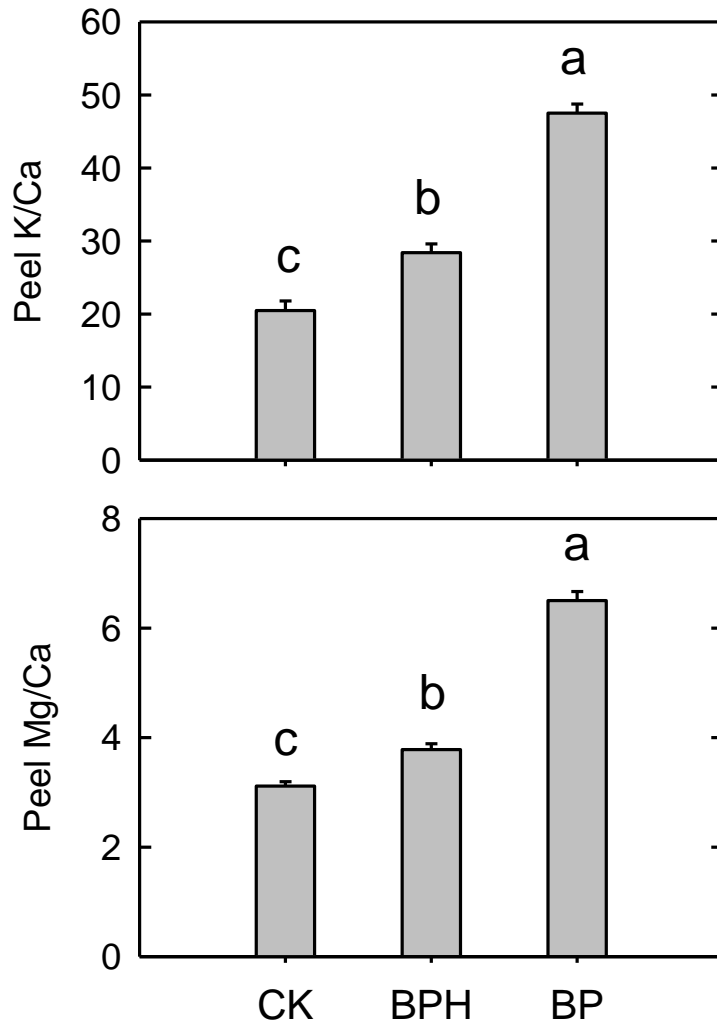


# Peel Nutrient Levels in Honeycrisp fruit





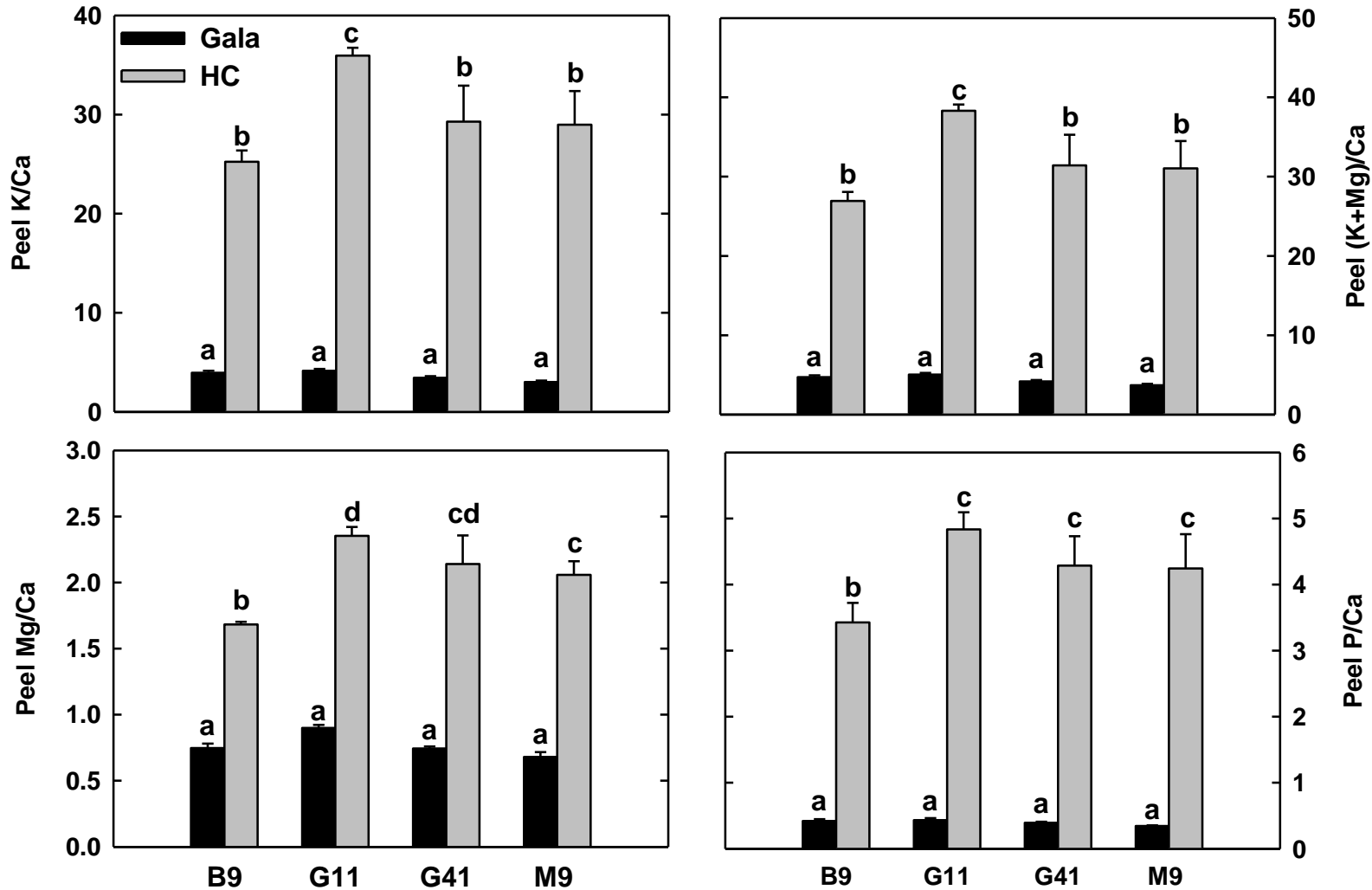
# Peel Nutrient Ratios in Honeycrisp fruit



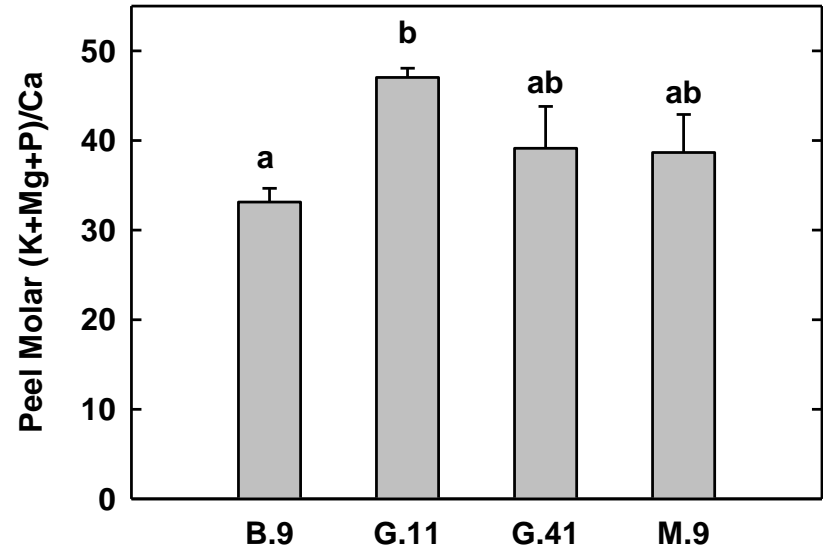
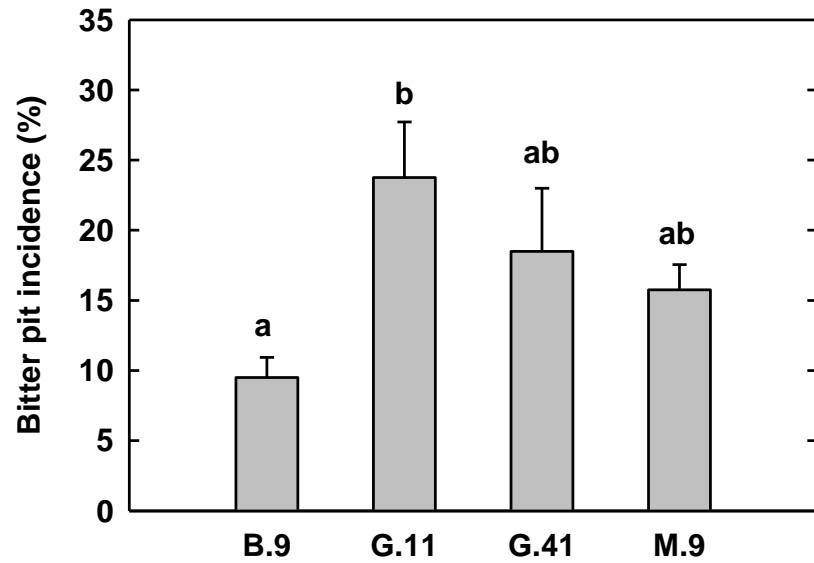
# Conclusions

- **Less Ca is partitioned to fruit in ‘Honeycrip’ than in ‘Gala’**
- **Imbalances of Ca with K, Mg and P are closely associated with bitterpit**

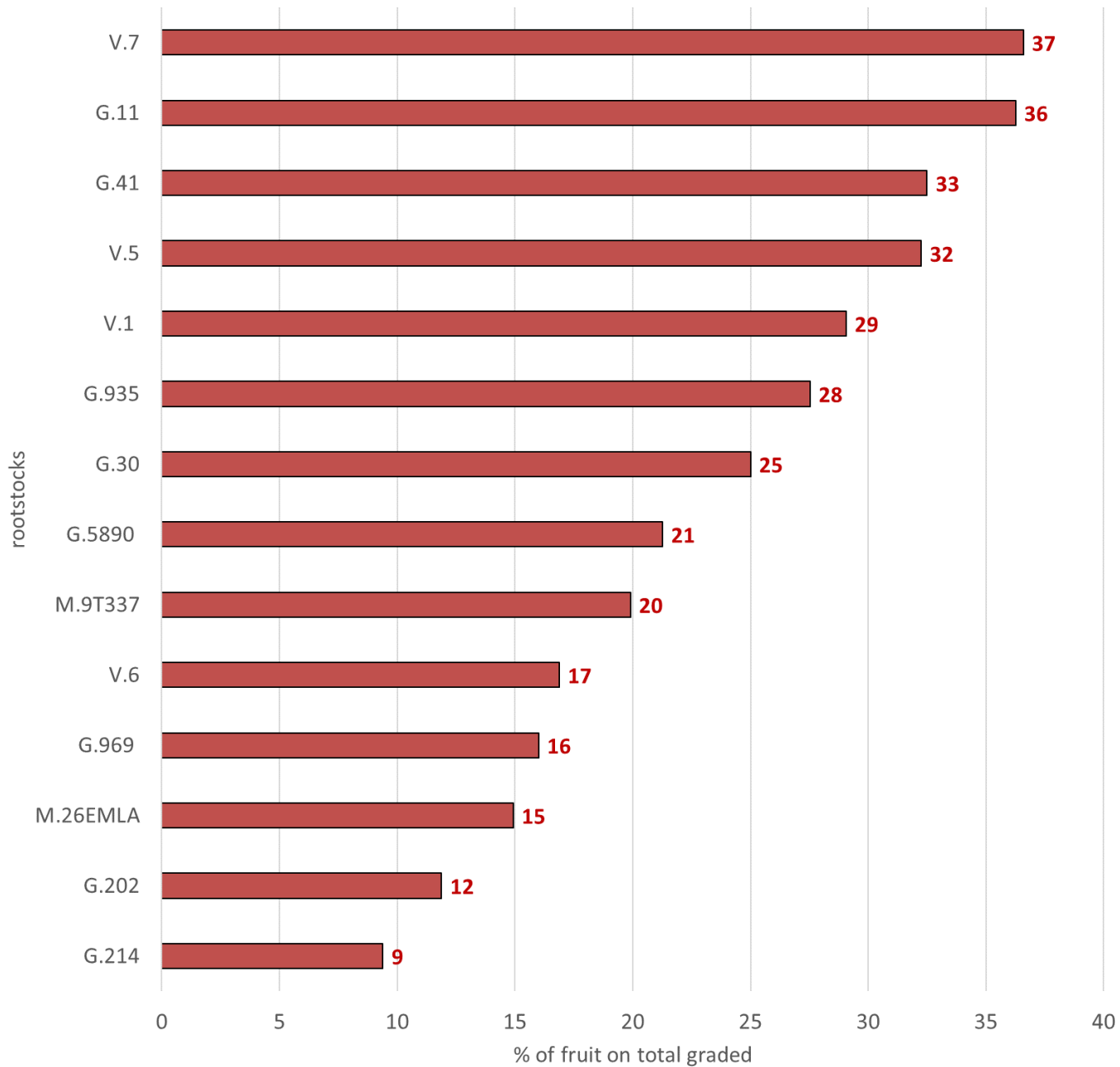
# Rootstock effects on peel nutrient ratios in Honeycrisp & Gala



# Rootstock Effects on Bitter Pit Incidence of Honeycrisp



### Incidence (%) of BITTER PIT by rootstock



■ Bitter Pit

From Stefano Musacchi of WSU

# Bitter Pit in Relation to Cropload in Honeycrisp



Courtesy of Dr. Jim Schupp

# Cropload Effects on Fruit Nutrients and Bitterpit

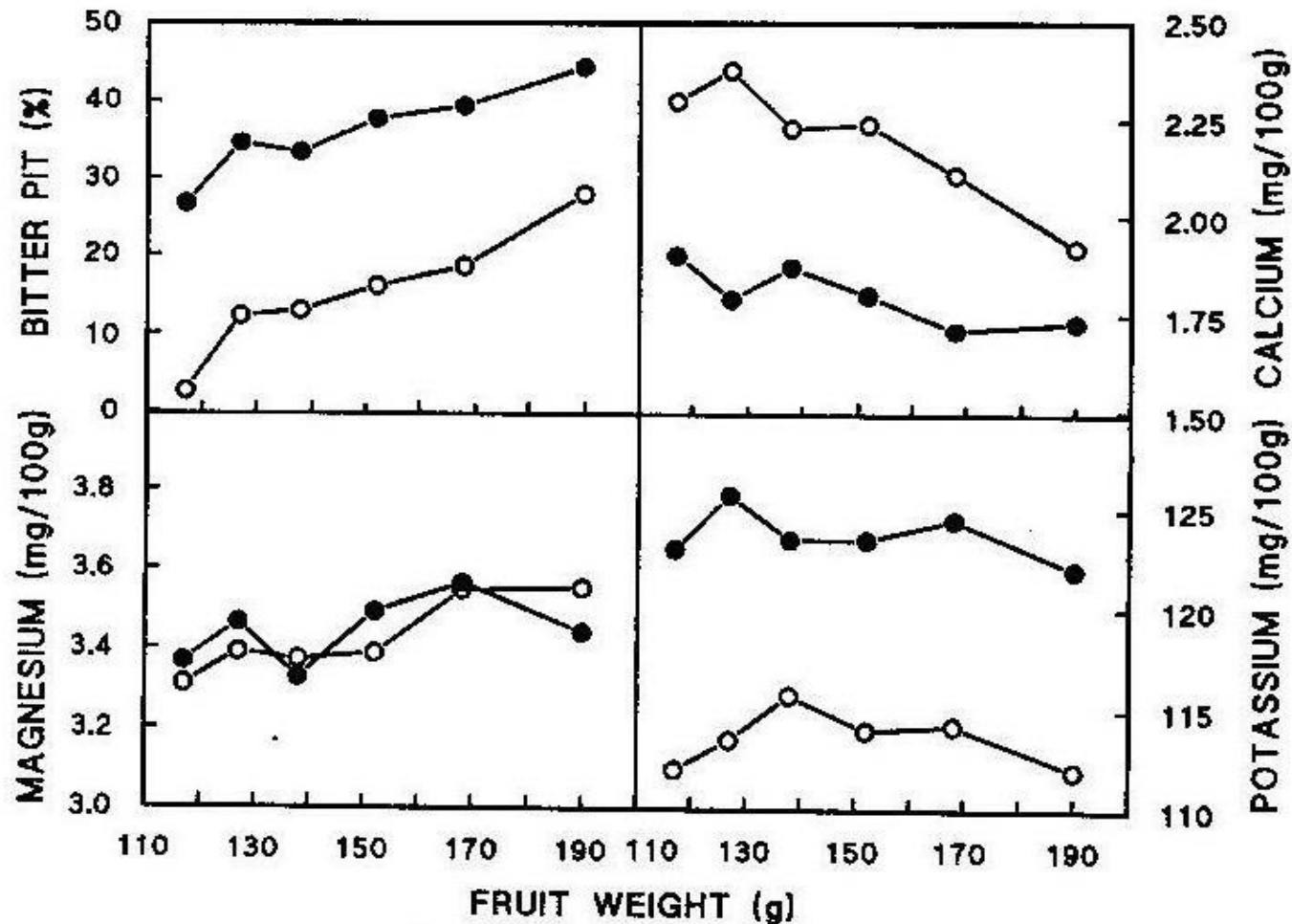


Fig. 1. Bitter pit incidence and Ca, Mg, and K concentrations of fruit from heavy-(○) and light-(●) cropping trees. Data are the means from four orchards for each fruit weight. SEDs and *P* values for the mean data are given in Table 1.

# Management Strategies

- **Adjust soil pH to ensure adequate Ca supply in soil**
- **Promote and maintain root growth and Ca uptake (B, Zn, water availability)**
- **Control tree vigor to mitigate competition with fruit for Ca.**
- **Avoid low cropload situation**
- **Strictly control K (N, Mg and P) to balance fruit Ca with K.**

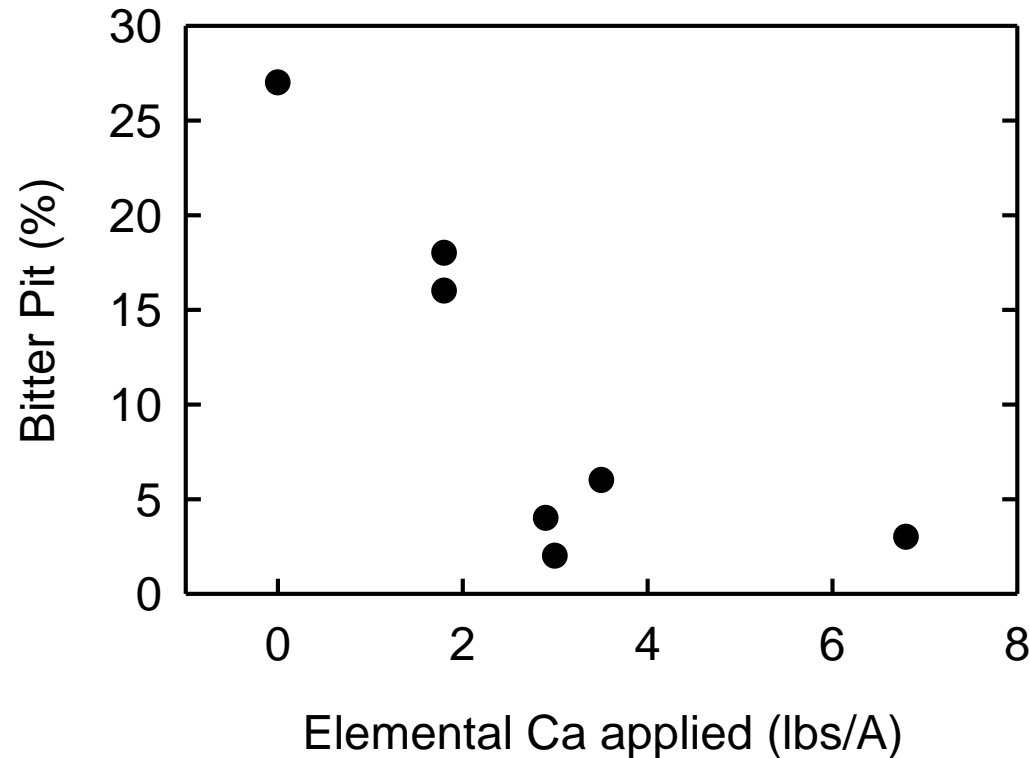


# Calcium Sprays

- 4 sprays of 1.5 to 2 lbs of  $\text{CaCl}_2$  (78%) or its equivalent per 100 gallons (dilute basis) at 10 to 14 day intervals beginning 7 to 10 days after petal fall.
- 2 sprays of 3 to 4 lbs per 100 gallons at 2 week intervals starting from mid-season.

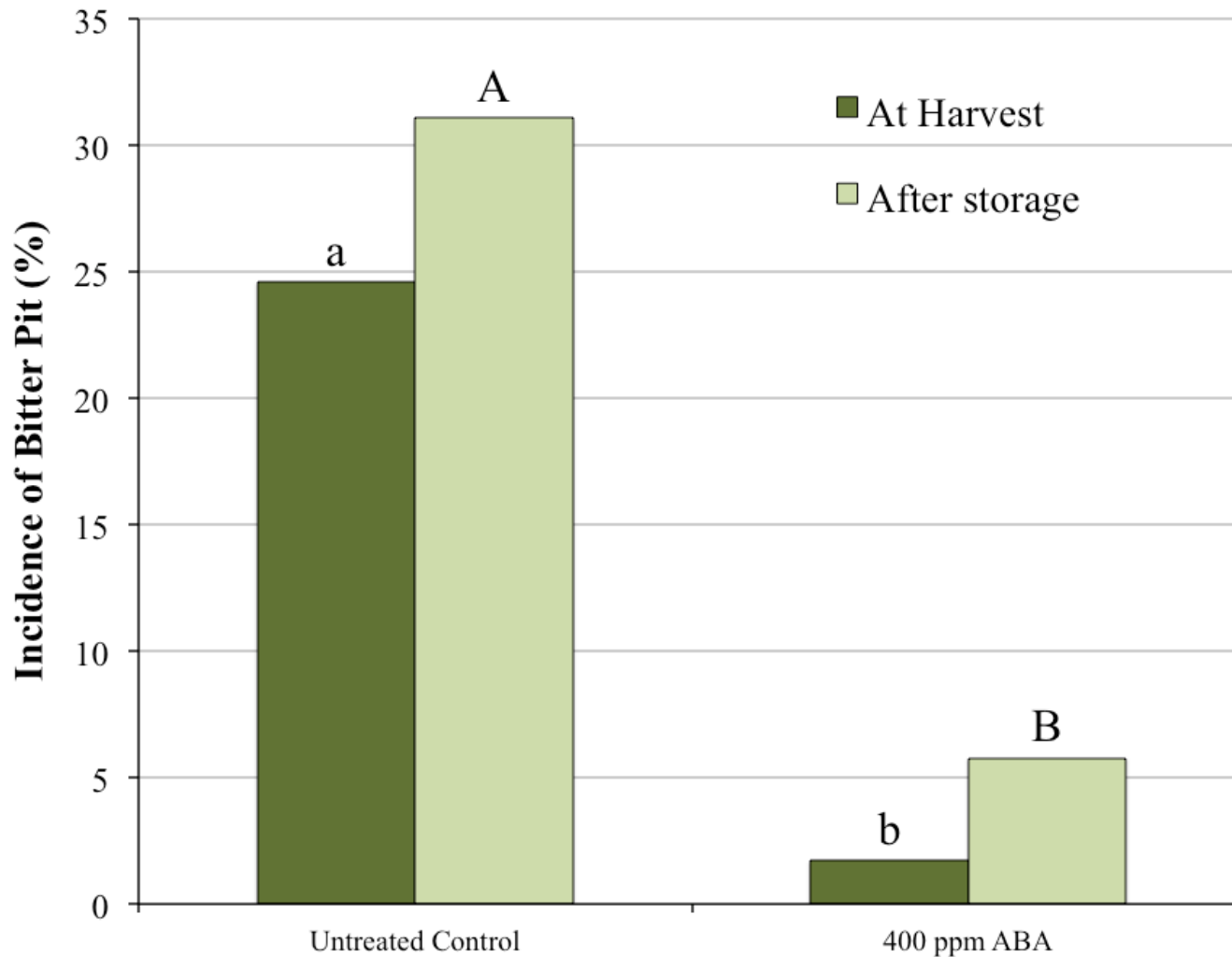
**This program provides 3.4-4.5 lbs of actual Ca per acre**

# Bitterpit Occurrence vs. Amount of Ca Applied



Rosenberger et al, 2004

# Effects of ABA sprays on Bitter Pit in Honeycrisp



Poliana Francescato  
Geneva, NY - 2015

# Partitioning of a Water Soluble Dye, Acid Fuchsin

Untreated control



ABA (350 ppm)



Poliana Franciscatto

# Acknowledgments

- Terence Robinson, Poliana Francescato, Greg Lang, Phil Schwallier, Chris Watkins, Dave Rosenberger, Steve Hoying, Mario Miranda Sazo, Huaiyu Ma, Yongzhang Wang, Hufeng Li & Kaspar Kuehn
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