# Boosting Citrus Resilience: The Power of Silicon as a Beneficial Nutrient

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Quincy
August 21, 2025

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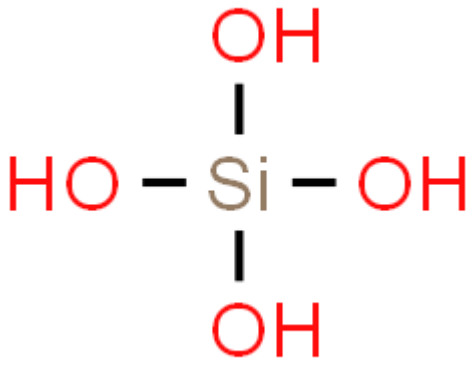
# Take home message

- Silicon beneficial nutrient for citrus
- Improves plant growth, productivity and fruit quality
- Makes plant more resilient to biotic and abiotic factors

# Silicon not Silicone

- **Silicon:**
- **Orthosilicic acid: $H_4SiO_4$**
  - Form absorbed by plants
- Silica, $SiO_2$, Quartz amorphous glass
  - Form deposited into plant tissues

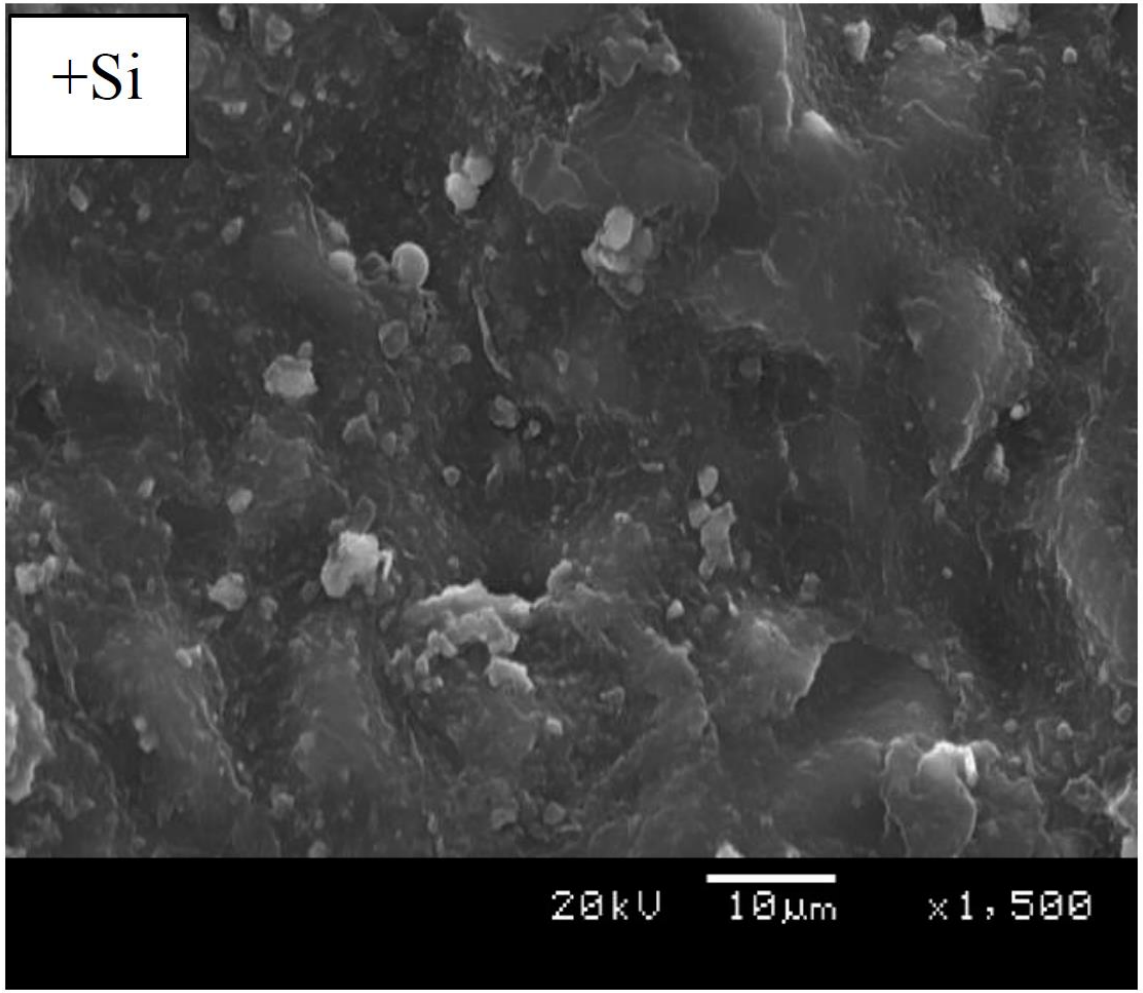



- **Silicone:**
- Polymer of Si, C, H, and O
- Rubber-like consistency
- Commonly used in cookware, sealant, adhesive, lubricant

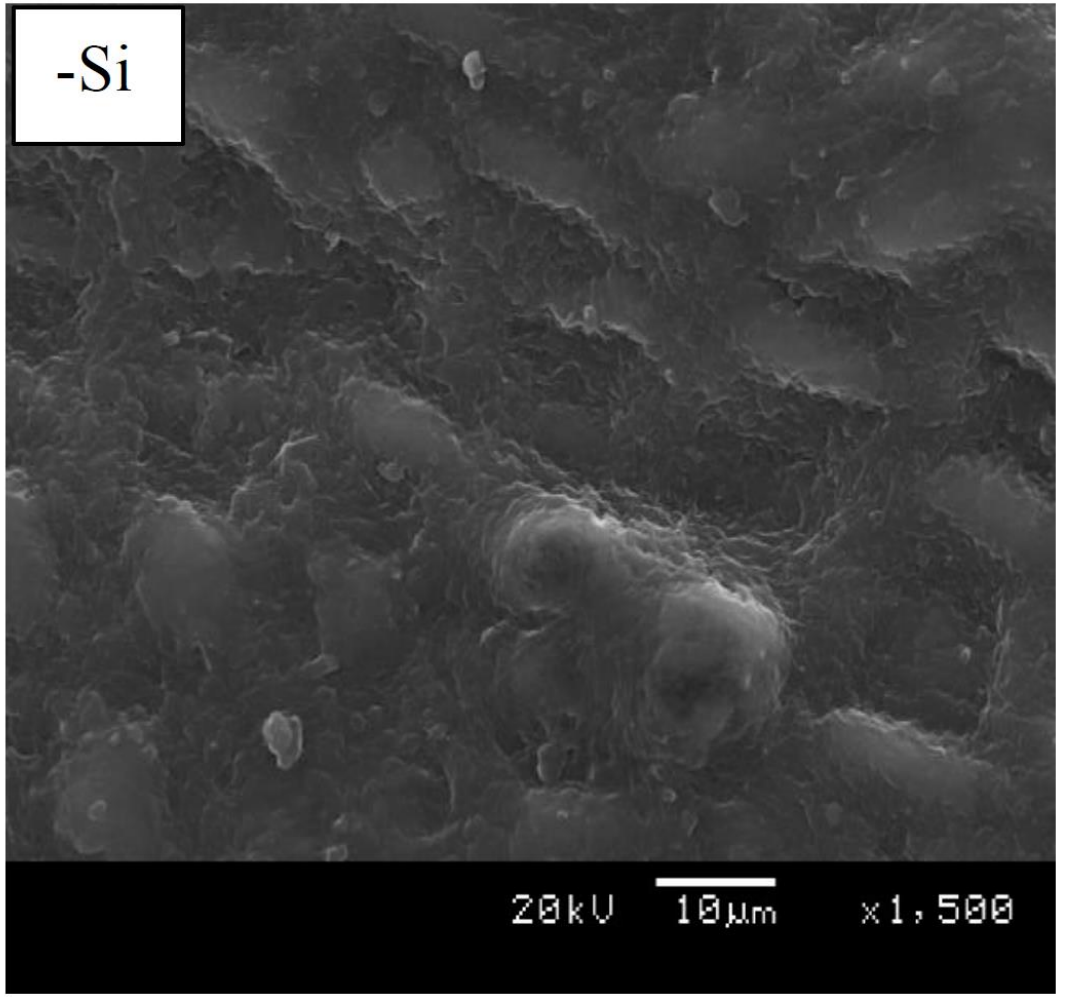
# Is Si beneficial or essential???

- In 2012, Si was categorized as a plant "beneficial substance" by *Association of American Plant Food Control Officials (AAPFCO)*
- Prior to AAPFCO approval, all Si products were listed on fertilizer labels as "non-plant food ingredient"
- Si products are also approved by Organic Materials Review Institute (OMRI) for use in organic production

# Physical barrier prevents plant pathogens and herbivores




Silicon treated citrus leaf surface




Control

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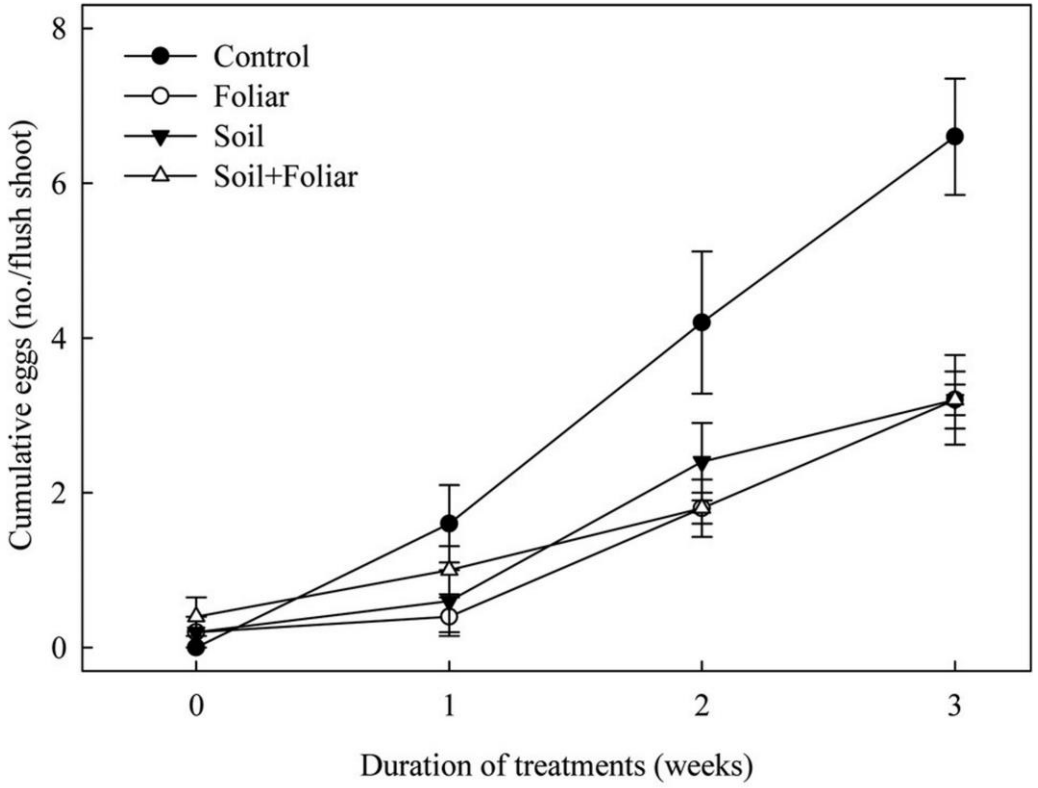
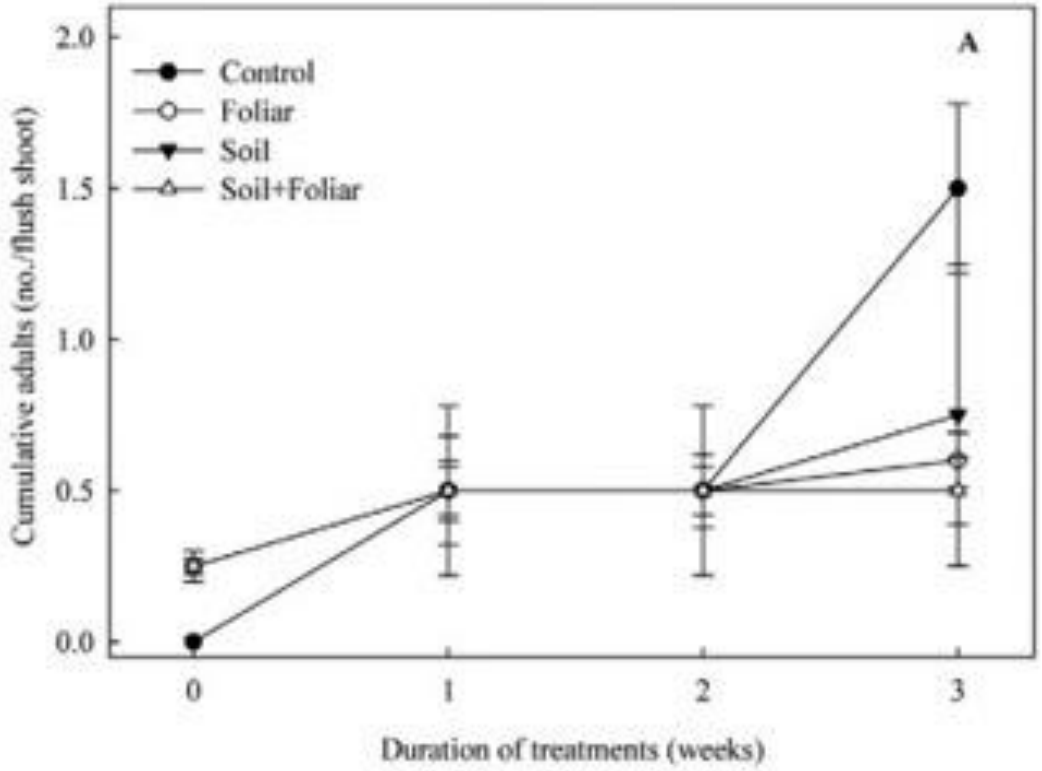
# Silicon for Disease Control in Fruit Crops

| Disease | Pathogen | Reference |
|---|---|---|
| **Brown Spot** | *Alternaria alternata* | Asanzi et al. (2015) |
| **Green mold** | *Penicillium digitatum* | Liu et al. (2010) |
| **Green mold** | *P. digitatum* | Mkhize et al.(2012) |
| **Root rot disease** | *Cylindrocladium spathiphylli* | Vermeire et al.(2011) |
| **Fusarium wilt** | *Fusarium oxysporum f. sp. cubense* | Fortunato et al. 2012 |
| **Powdery mildew** | *Uncinula necator* | Bowen et al. (1992) |

# Silicon reduced ACP papulation in Tahiti Lime




Silicon application reduced the ACP egg laying capacity and adult papulation

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# Si Application Methods for Citrus

- **Soil**
  - Dissolved in water to make solution and then apply to soil through Micro-Sprinkler, or drip
- **Foliar**
  - Liquid blends
- **Rate**
  - 150-200 ppm beneficial for citrus

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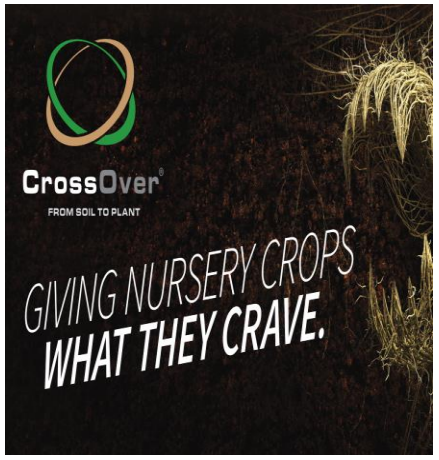
# Commercially Available Si Products

AgrowSil®







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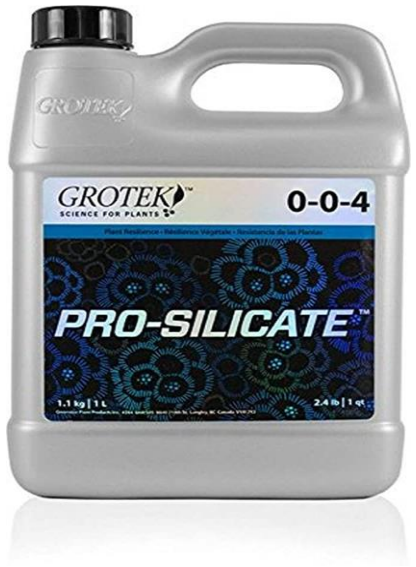
# Commercially Available Si Products





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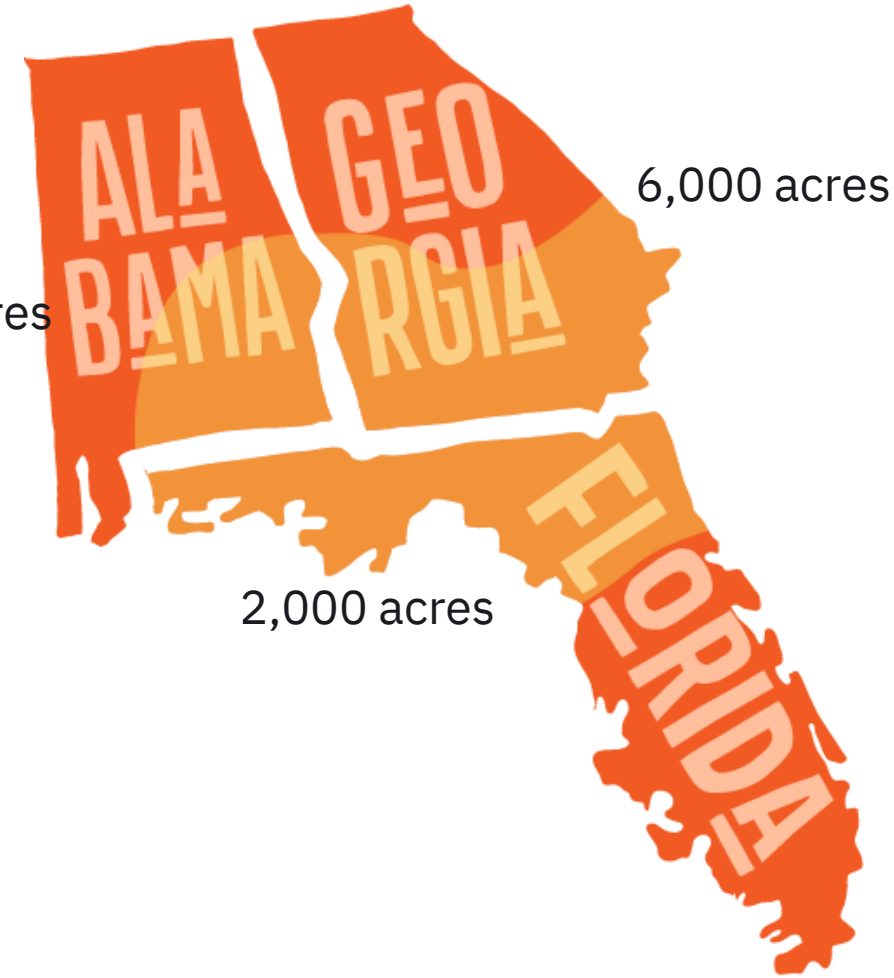
# Cold Hardy Citrus Industry in North Florida

800-1000 acres




6,000 acres

2,000 acres

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# Freeze is one of the main threat to citrus in North FL

Snowfall in January 22, 2025

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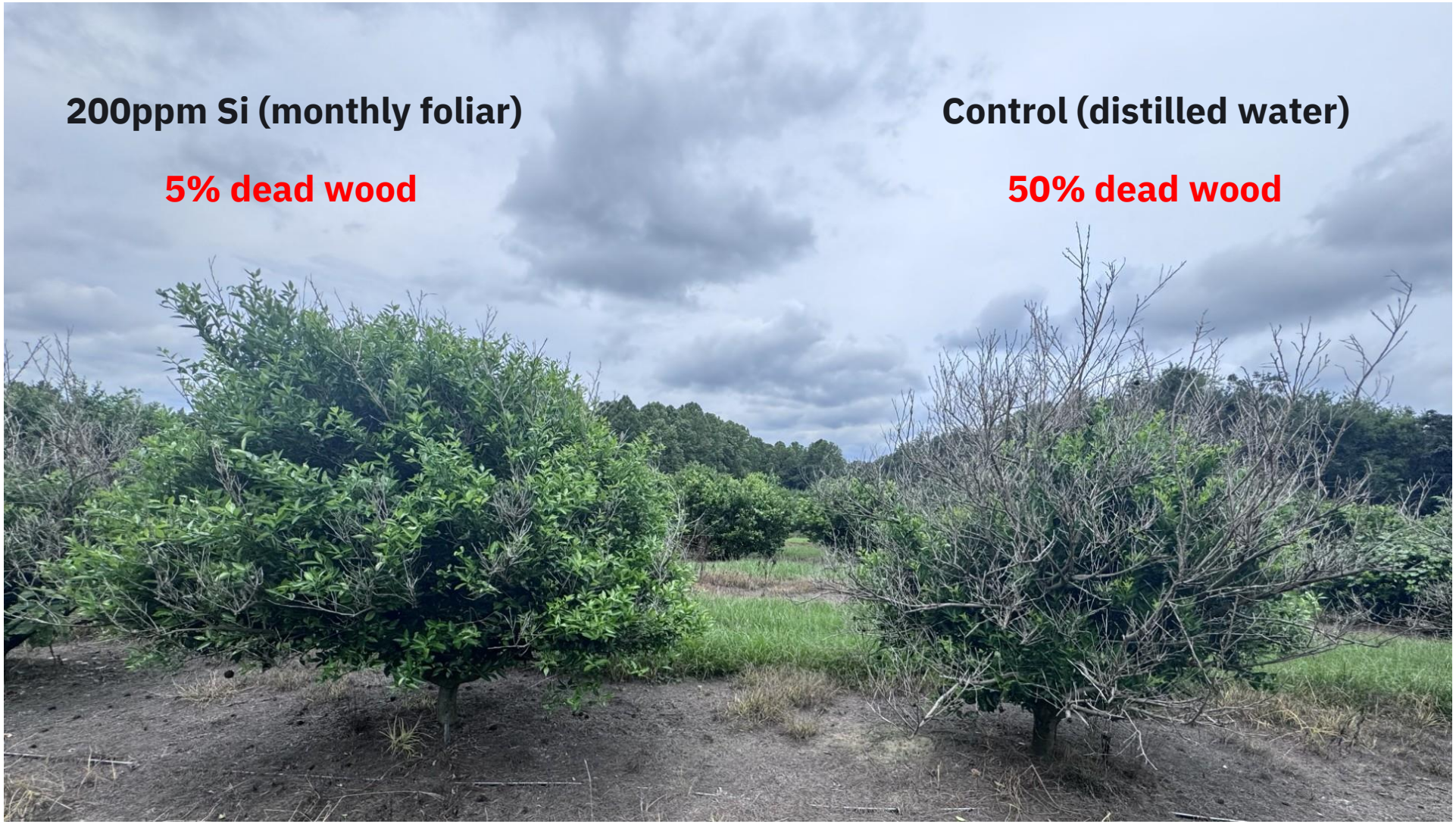
# Silicon improved cold hardiness in citrus




4 months after snowfall

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# Silicon improved cold hardiness in citrus

200ppm Si (monthly foliar)

Control (distilled water)

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# Silicon improved tree canopy


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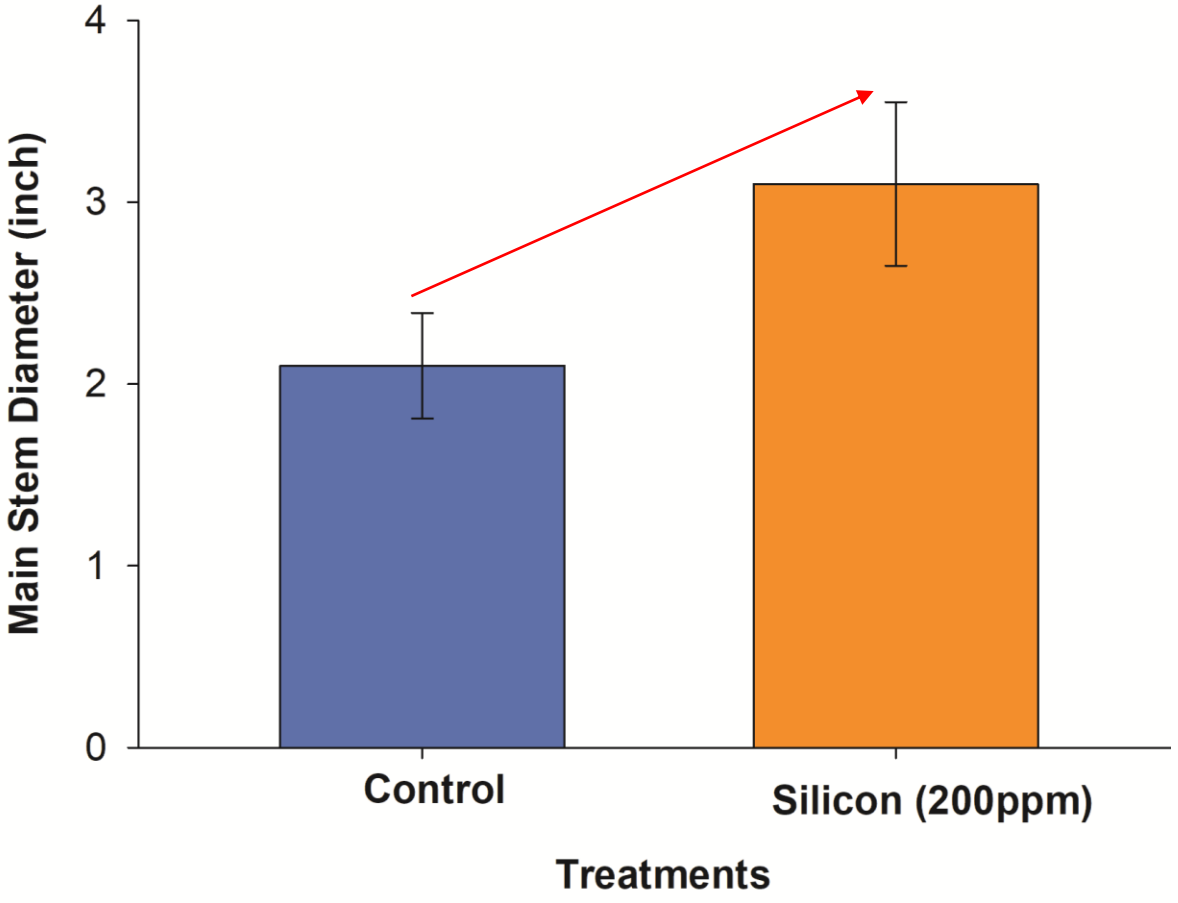
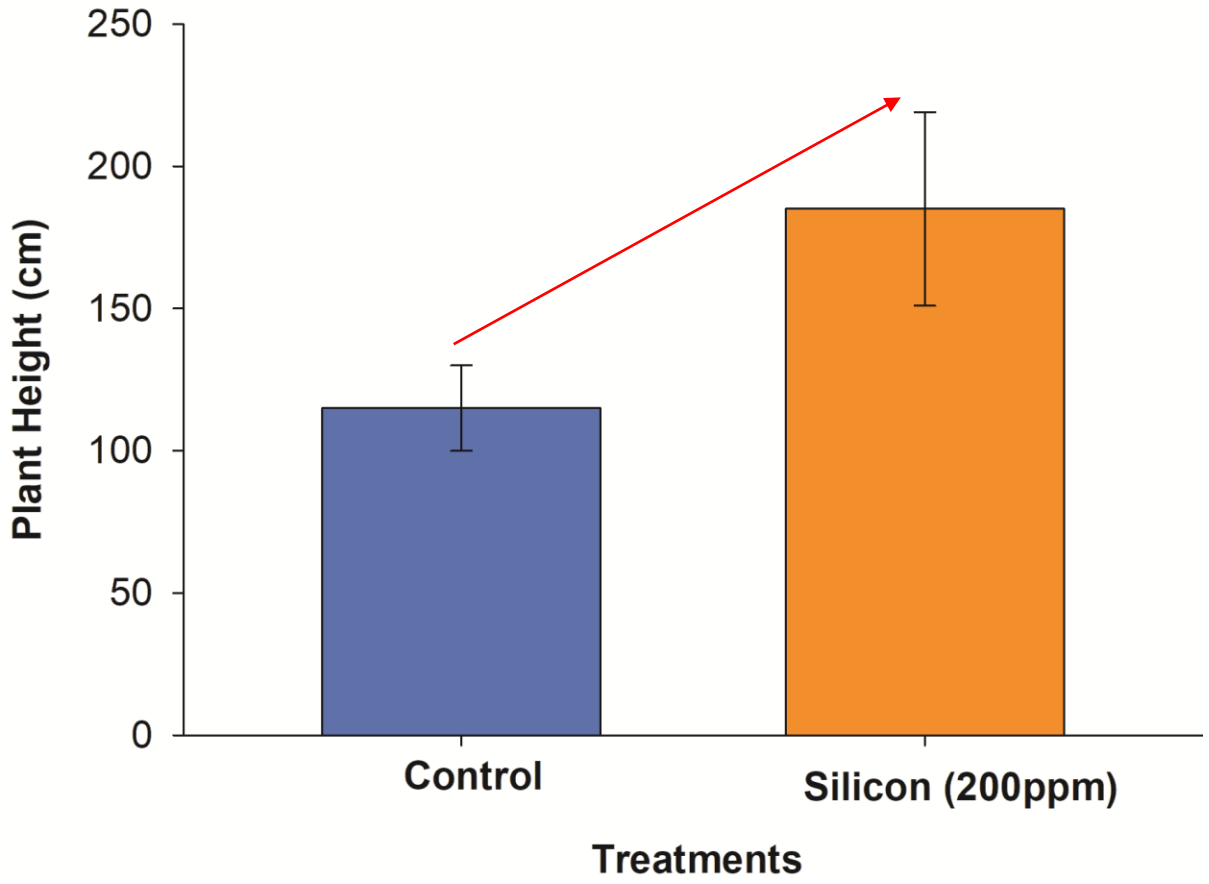
# Silicon enhanced stem diameter and plant height

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**Silicon enhanced stem diameter by 50% and plant height by 63%**

# Silicon improved fruit quality attributes

- TSS
- Firmness
- Fruit color
- Fruit diameter
- Fruit weight
- Juice %
- Respiration
- Fruit weight loss
- Total phenol and flavonoids
- Fruit freeze tolerance

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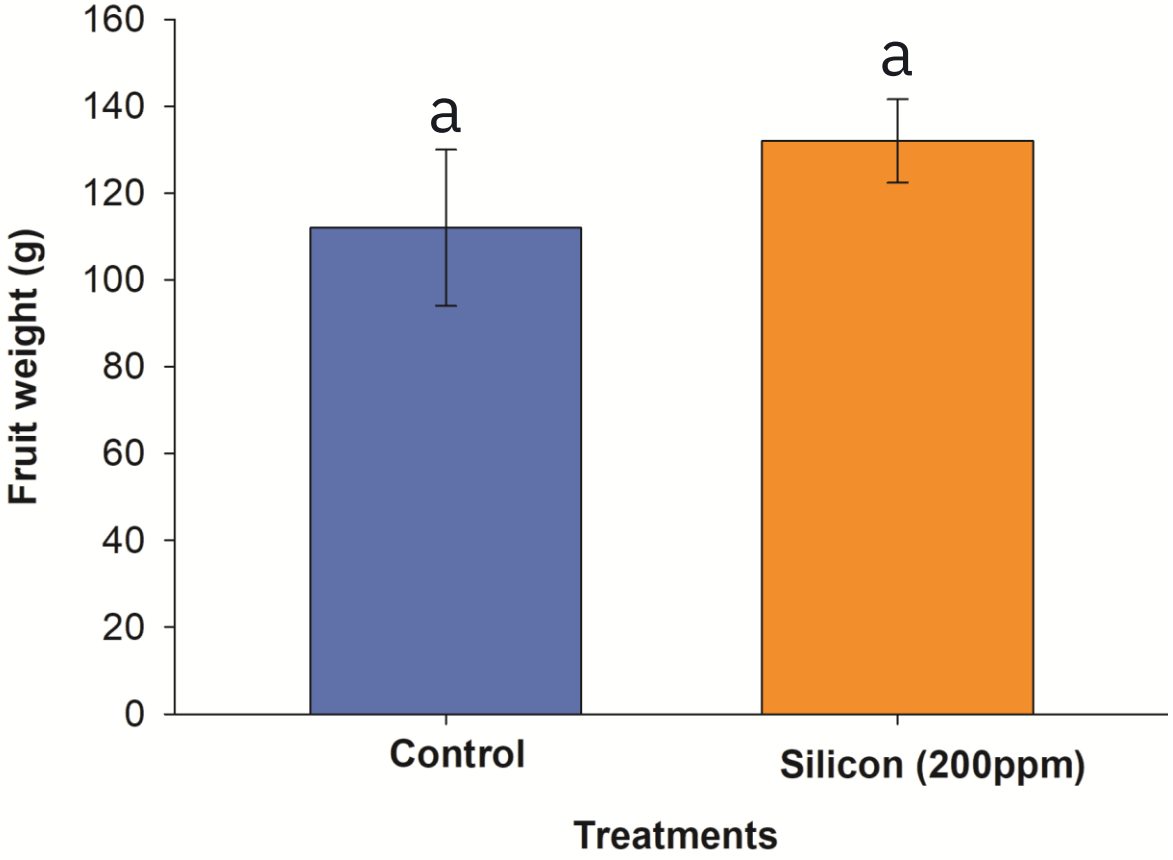
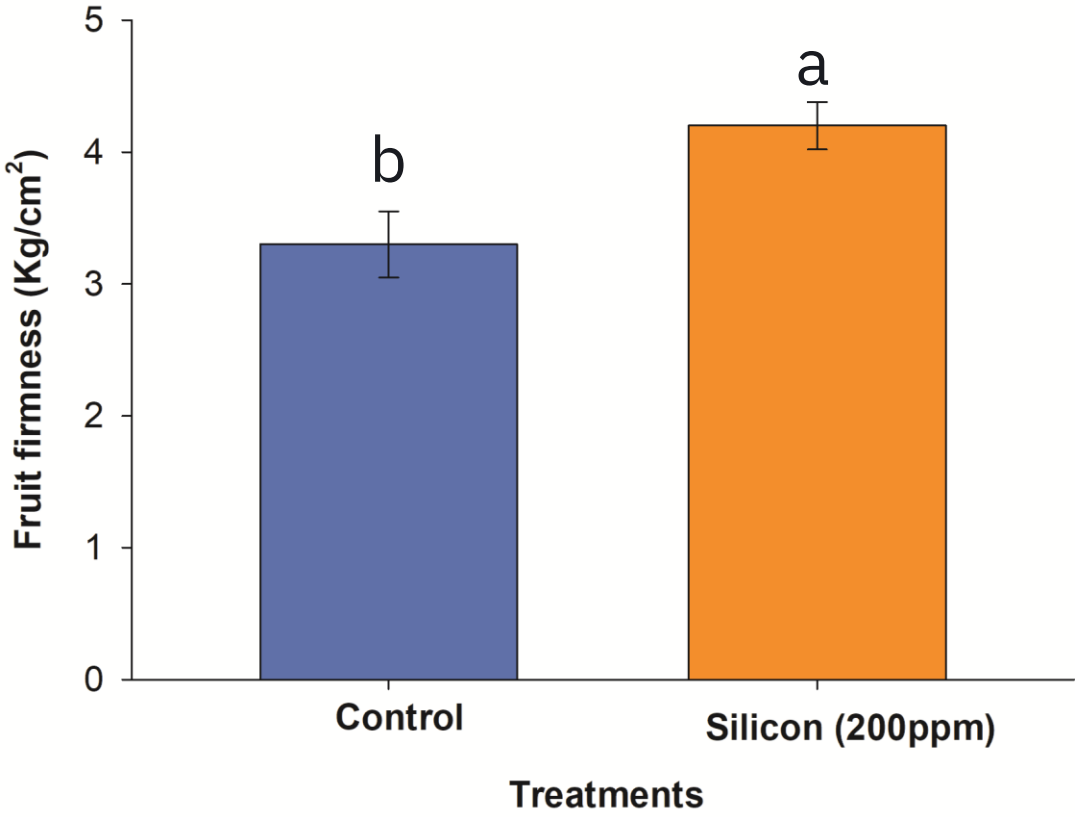
# Silicon improved fruit fruit weight and firmness




**Silicon improved fruit firmness by 35%**

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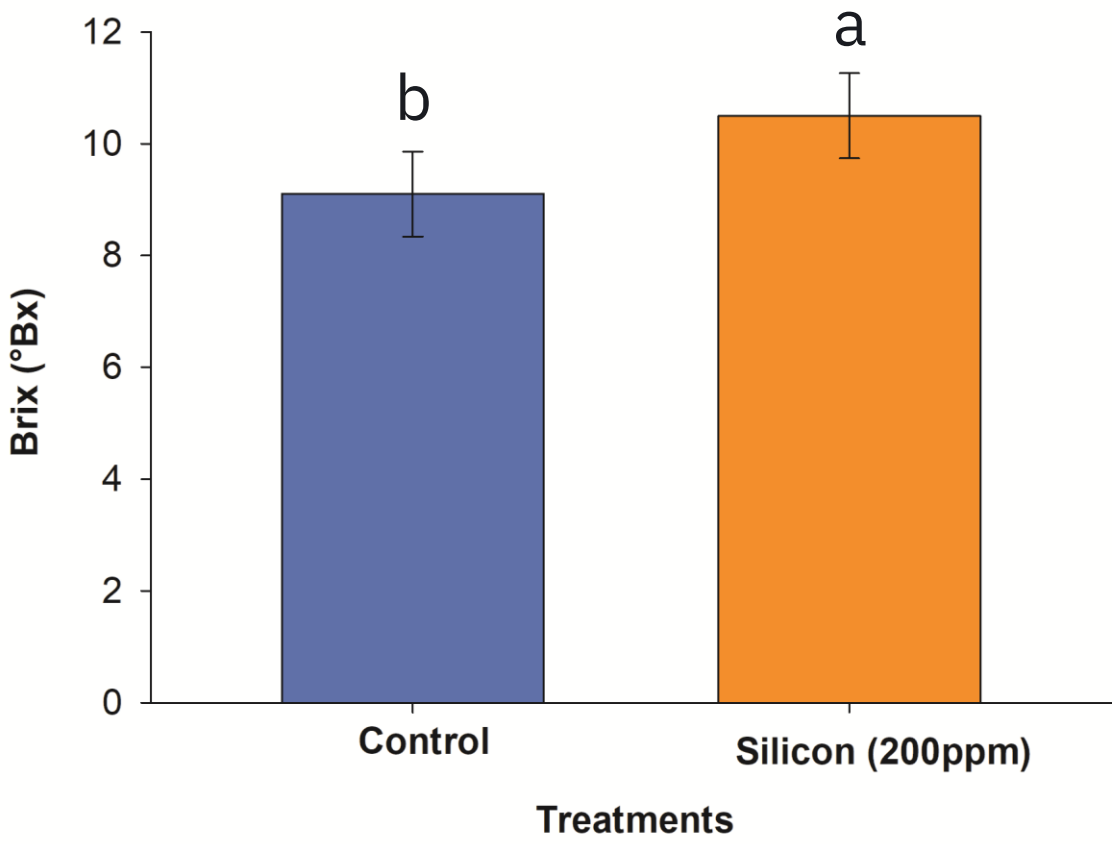
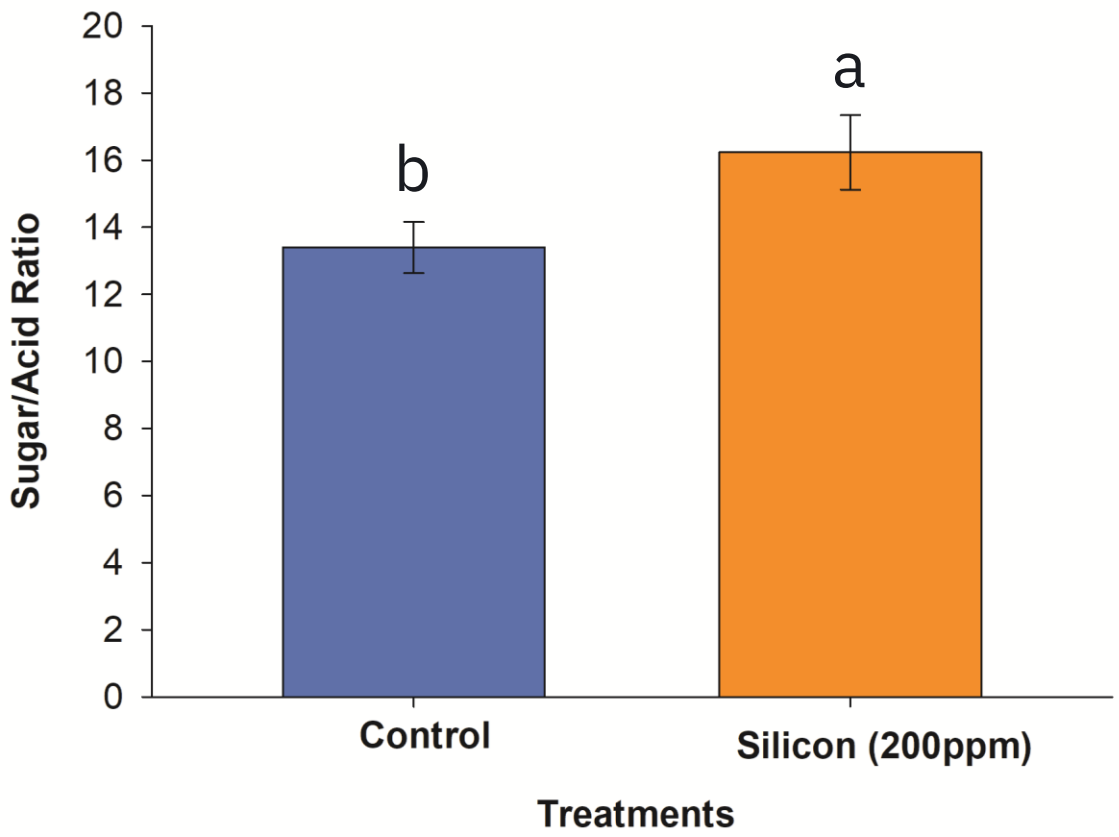
# Silicon improved brix and sugar/acid ratio

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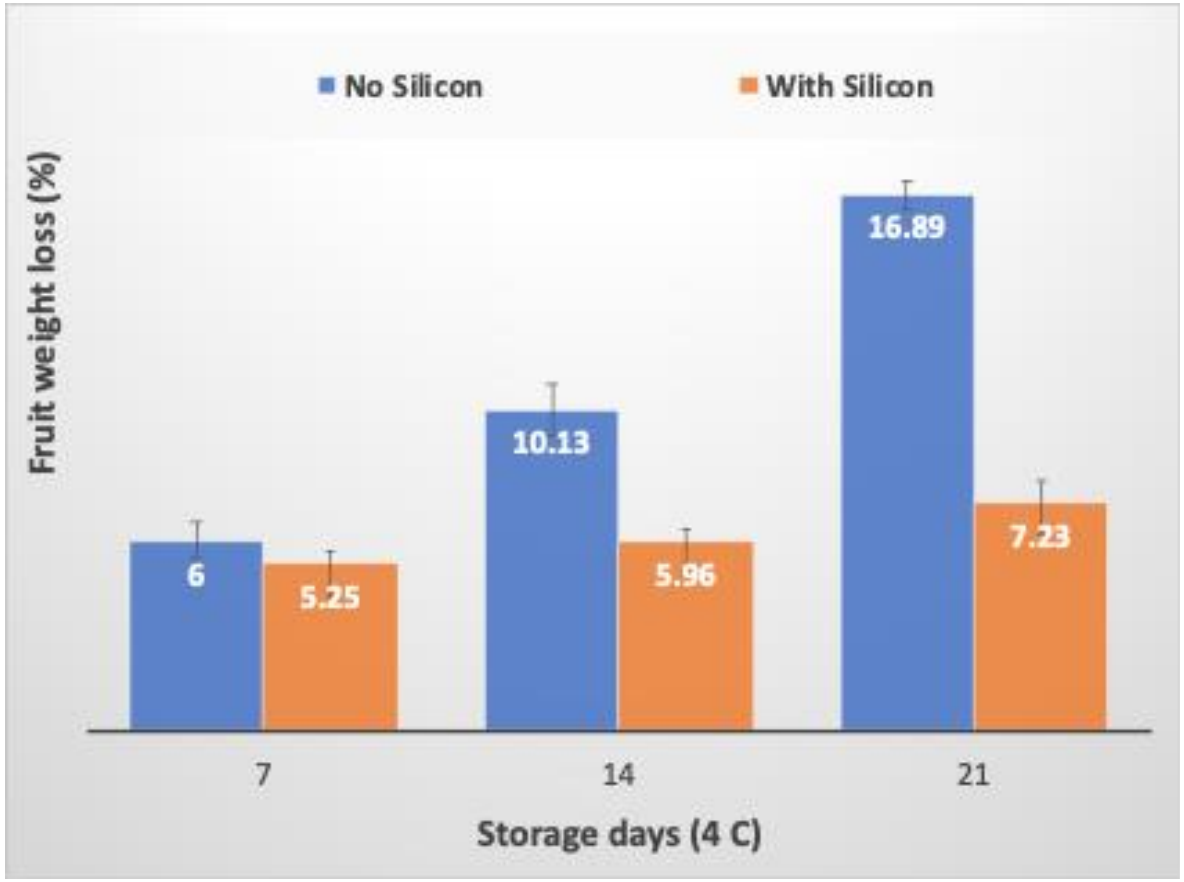
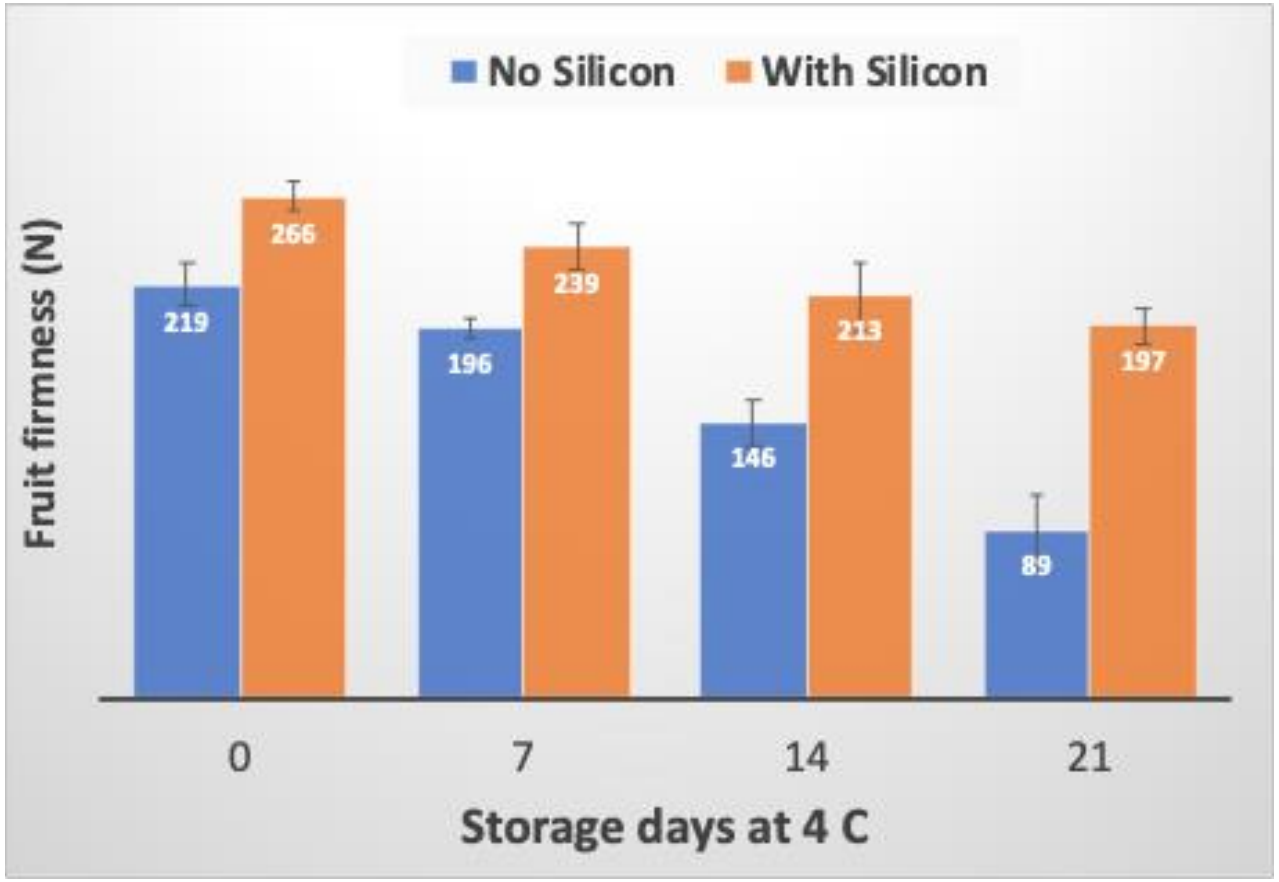
**Silicon improved Brix and sugar/acid by 11% and 23%**

# Silicon improved fruit shelf-life under storage

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# Silicon improved fruit peel color in Tango

Control (distilled water)

200ppm Si (monthly foliar)

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# Silicon improved fruit freeze tolerance

Control

Silicon treated (200ppm)

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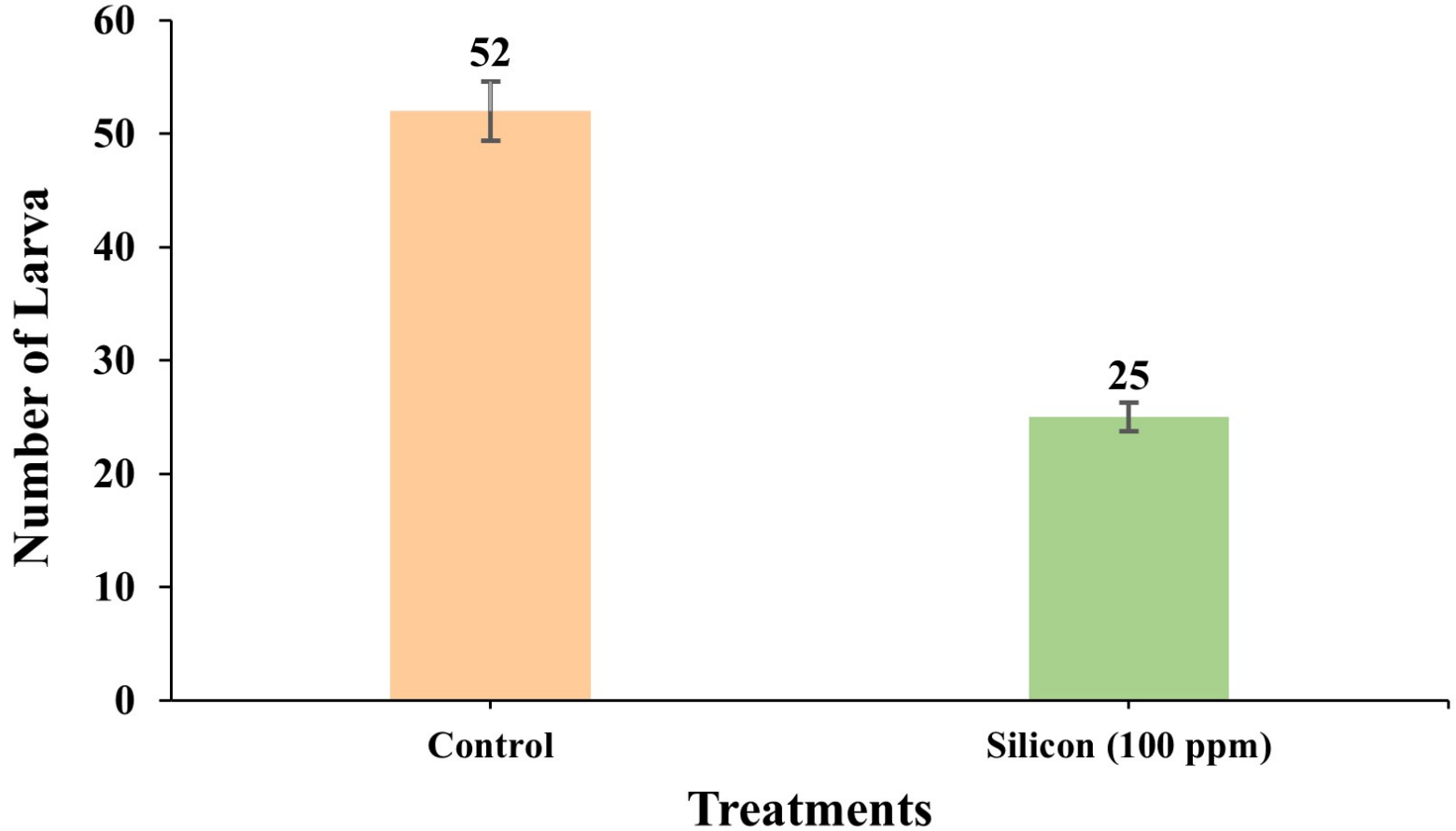
# Silicon reduced leafminer attack




Silicon reduce leafminer attack by 51%

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# Silicon in HLB-affected trees is in progress……

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# Conclusion

- Mono-silicic acid is the most plant available form of silicon
- Silicon improved fruit weight, firmness, quality and shelf-life
- Silicon made plants more resilient to freezing tempertuers
- Silicon reduced the leafminer and ACP papulation
- Foliar application of silicon 150ppm and 200ppm is beneficial for young and mature citrus trees

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# THANK YOU

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# 2025 COLD HARDY CITRUS FIELD DAY & WORKSHOP

## NFREC, Quincy

WEDNESDAY
**October**
**1**

**8:30 am - 3:00 pm EST.**
**UF/IFAS North Florida**
**Research & Education Center**
**155 Research Rd.**
**Quincy, FL 32351**

An Equal Opportunity Institution.

You don't want to miss the opportunity to hear about and tour the citrus research trials going on at NFREC! Experts have been planned to speak on varieties, production system, freeze protection, fabric mulch, marketing strategies, demonstrations, and taste samplings. Networking with vendors is always a win win! Space is limited, register at the link below or for more information contact Lisa Strange at 850-838-3508, lstrange@ufl.edu.
CEUs will be available

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