# Product Testing and Pesticide Research

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*College of Agriculture and Environmental Science*

## Outline

- Example Research Presentation
  - Silicate fertilizers and their effects on Leafminer

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- Introduction to experimental design for product testing at your facility
- What to look for in efficacy data figures

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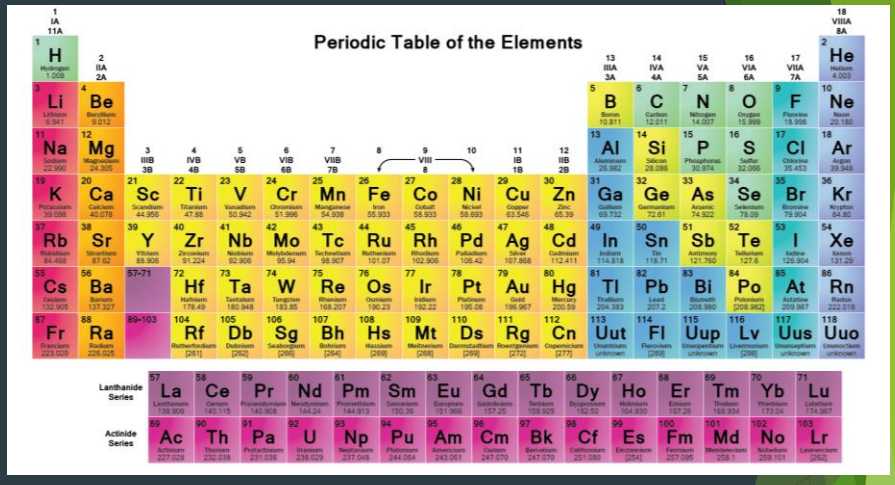
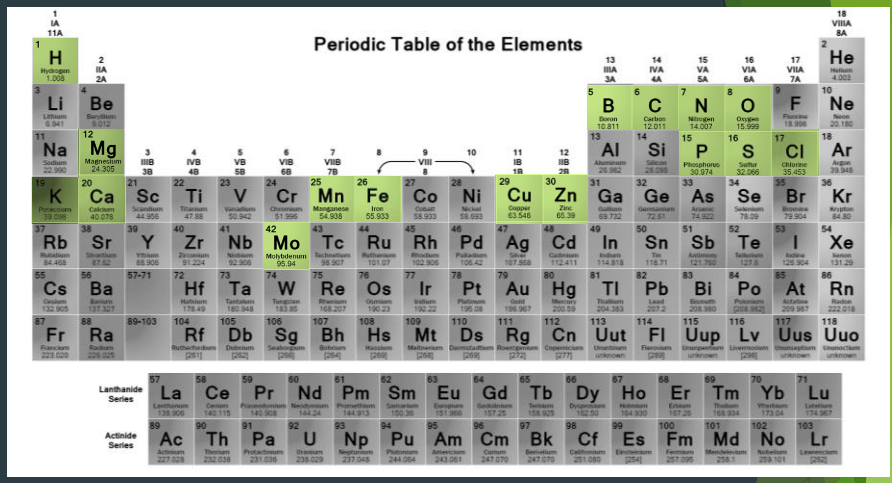
- Mainspring efficacy testing example

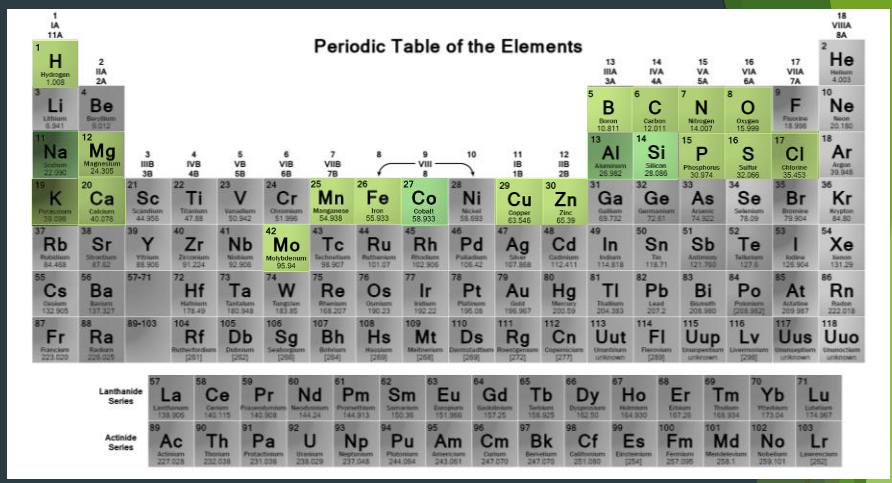
# Silicate Fertilizers and Their Effects on Leafminer






## Plant Essential Nutrients






## Plant Essential Nutrients + Plant Beneficial Nutrients

## Silicon Accumulation

- Variable accumulation among plant species
- Passive and active transport

## Silicon Effects

- Improved disease resistance
- Improved response to drought stress
- Salt stress resistance
- Increased structural stability
- Negative effects on pest populations

*(Dantoff et al. 2001)*

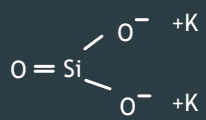


## Silicate Fertilizers

- Silicon sources:
  - Rice hull ash
  - Fly ash
  - Calcium Silicate ($Ca_2SiO_4$)
  - Sodium Silicate ($Na_2SiO_3$)
  - Potassium Silicate ($K_2SiO_3$)

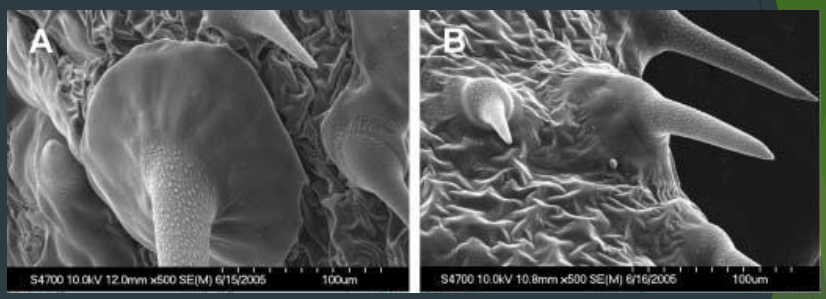
# Silicate Fertilizers

- Silicon sources:
  - Potassium Silicate ($K_2SiO_3$)
    - Liquid formulation
    - Water soluble
    - Commercially available
    - High pH









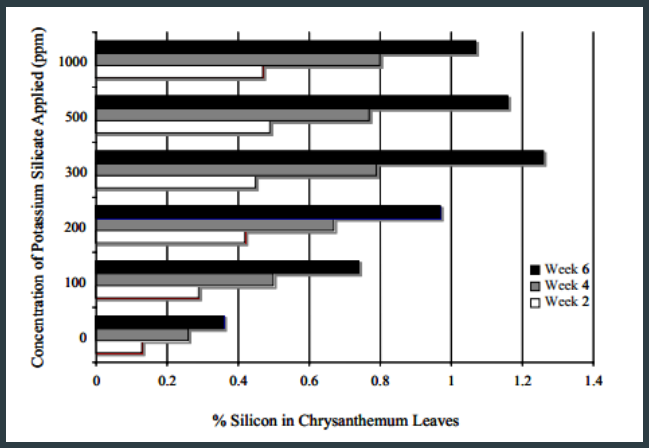

Scanning electron micrographs of verbena trichomes with (left) and without (right) Si treatment (Frantz et al. 2008)

# Introduction

Chrysanthemum



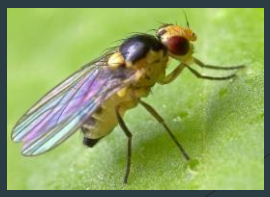
# Introduction




Residual accumulation of silicon in chrysanthemum leaves over time under different application rates. (Parrella et al. 2007)

# *Liriomyza trifolii*
## Serpentine leafminer

- Diptera: Agromyzidae
- Large host range
- Significant crop loss
- Damage to flowers (adult) and leaves (larva)





# Questions

Is leafminer mining activity affected under silicon treatment?

Does silicon supplementation affect plant growth characteristics?

# Methods

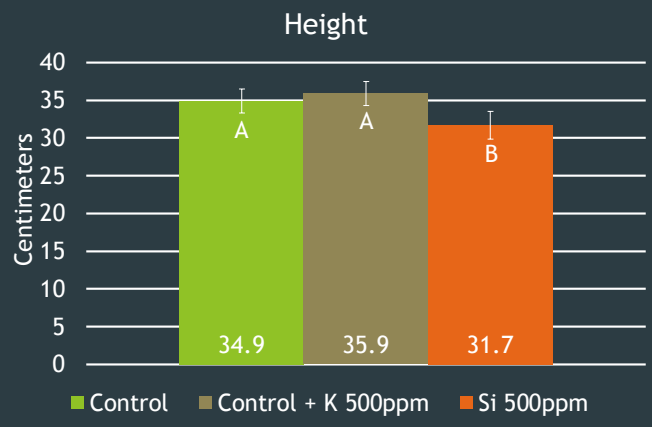
- Chrysanthemums grown under three different treatments:
  - (1) 500ppm potassium silicate
  - (2) Untreated control + equivalent potassium
  - (3) Untreated control
- 16 replicates
- Completely Randomized Design



# Methods

- Natural populations of LM were present in greenhouse on other crops.
- Plant height and leafminer damage were measured 47 days after planting.
- Statistics: The assumptions of ANOVA were met for height data and by Log10+1 transformation of mining data. Data analyzed using ANOVA and Tukey HSD for mean separation. (JMP Pro 11)

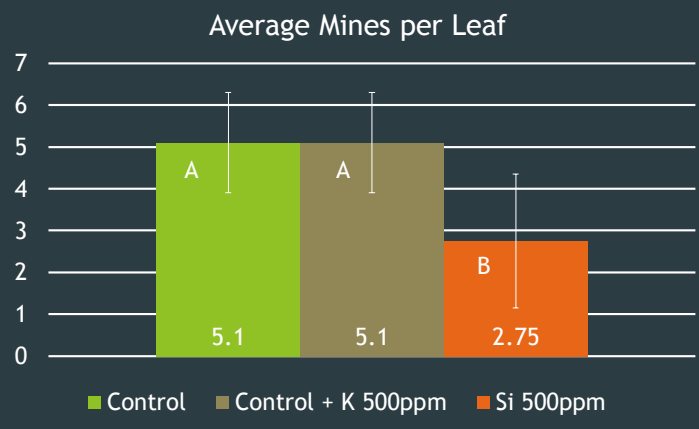
# Results




df= 43, F=5.4, p=0.0085



# Results




df= 43, F=4.05, p=0.025

# Discussion and Other Findings

- Reduction in mining very promising
- High silicon rate (500ppm) may not be feasible in production setting
  - *Field studies have shown a 300ppm rate is feasible*
- Choice studies have shown reduced oviposition on silicon treated plants
- Future Work:
  - Lab assays looking for differences that leafminer are using to make choice

# Experimental Design Intro



## Methods

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Experimental Design Intro

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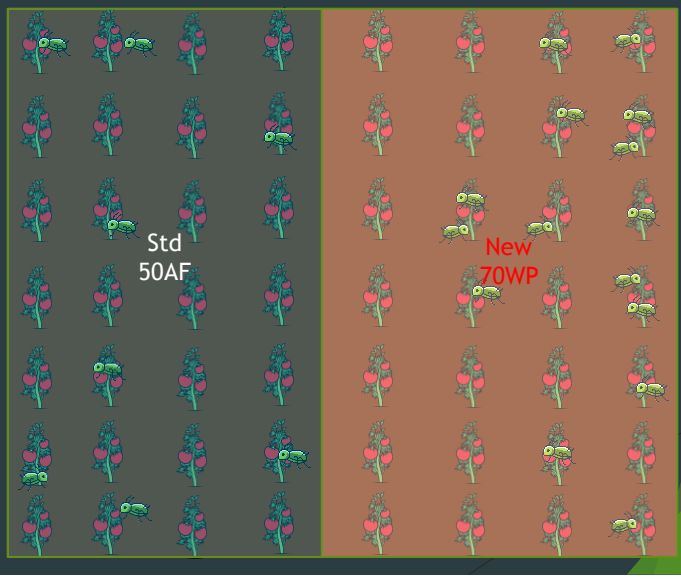
## Experimental Design Important Points

- **Controls/ Untreated Checks**
- **Replication**
- **Randomization**
- **Consistent sampling**
- **Statistics**

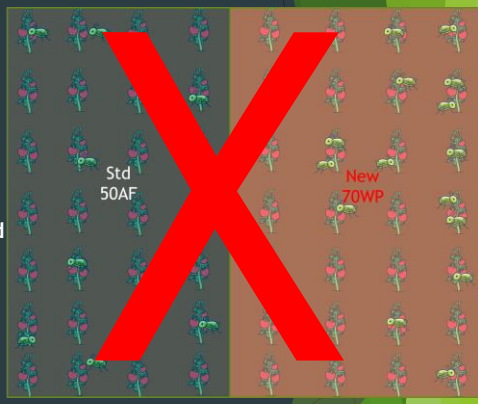
## Experimental Design Important Points

## Experimental Design Important Points



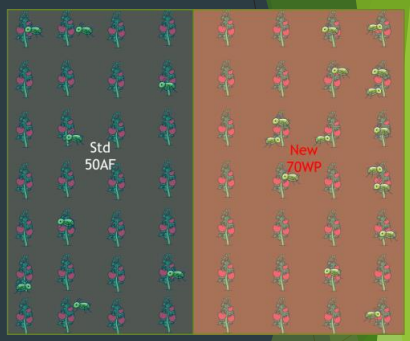
## Experimental Design Important Points

- What If:
  - Aphid are not equally distributed in the field
  - The weather changes before you can count and most the aphid die
  - The neighbor sprays for aphid and you get drift onto part of your field
  - There is a systemic pesticide residue in the soil in part of the field from the last crop
  - You have whiteflies move into the field at the end of the week after the crop next door gets plowed under and you need to spray



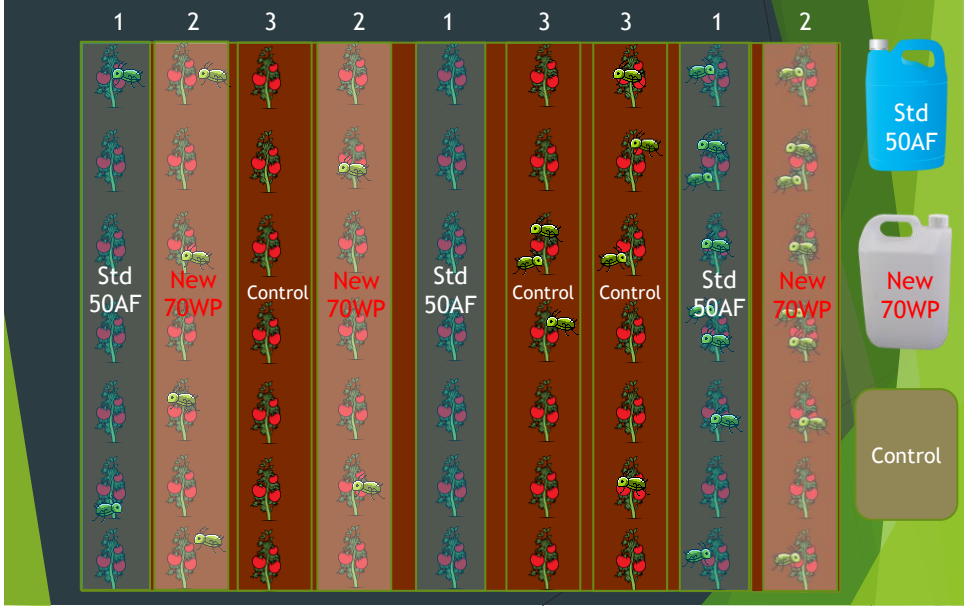

## Experimental Design Important Points

- How do we solve this:
  - Controls/ Untreated Checks
  - Replication
  - Randomization



## Experimental Design Important Points

Random # 1-3 for 9 rows

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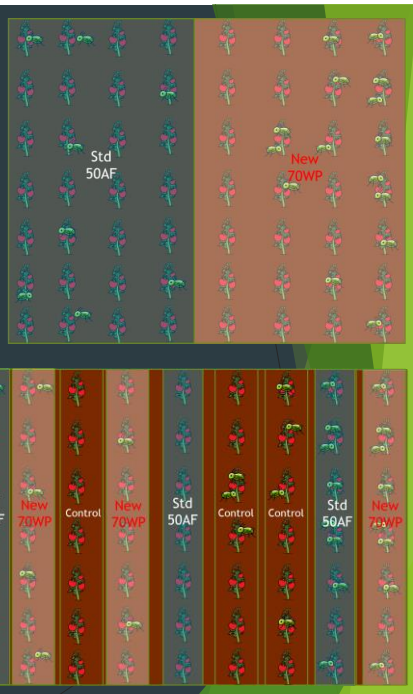

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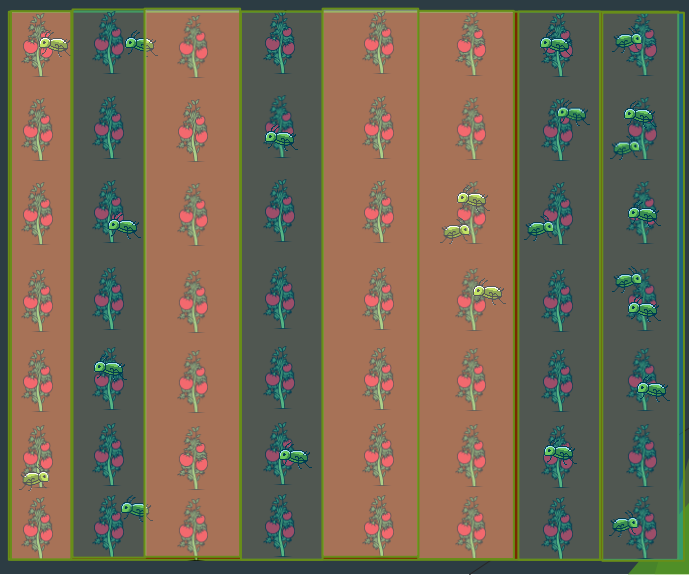




## Experimental Design Important Points

- ✓ Controls/ Untreated Checks
- ✓ Replication
- ✓ Randomization
- ✓ Consistent sampling
- Statistics

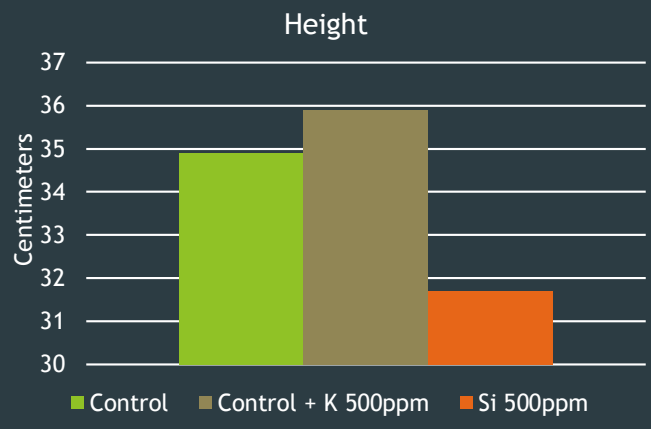
# Experimental Design Important Points

- **Statistics**
  - *t*-test - used for comparing two groups
    - Ex: Control to treatment
  - Analysis of Variance (ANOVA) - used to compare three or more groups
    - Ex: Control vs. Std 50AF vs. New 70WP

# Efficacy Data Figures

What to look for…..

# Critical Reading of Figures



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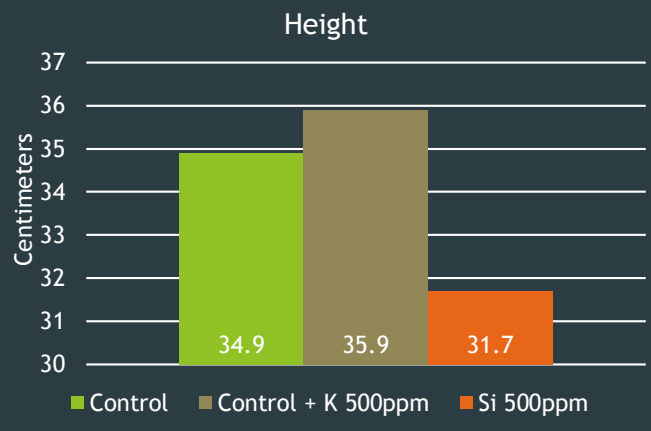




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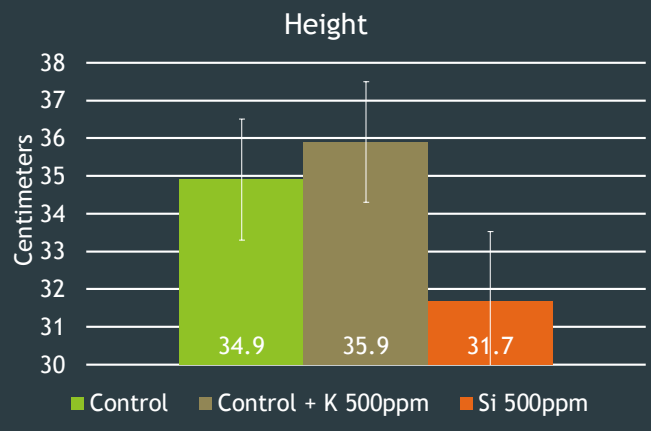


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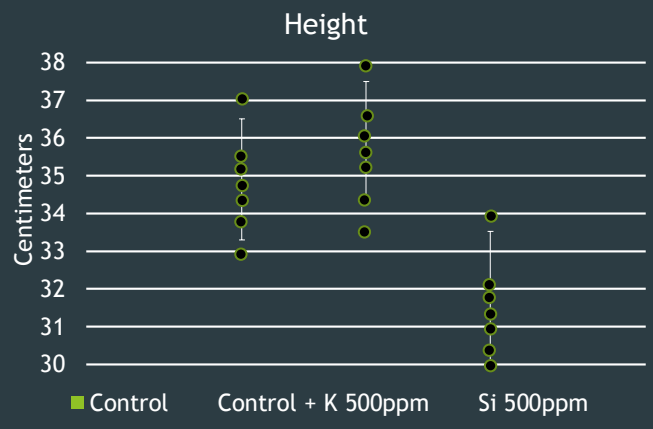


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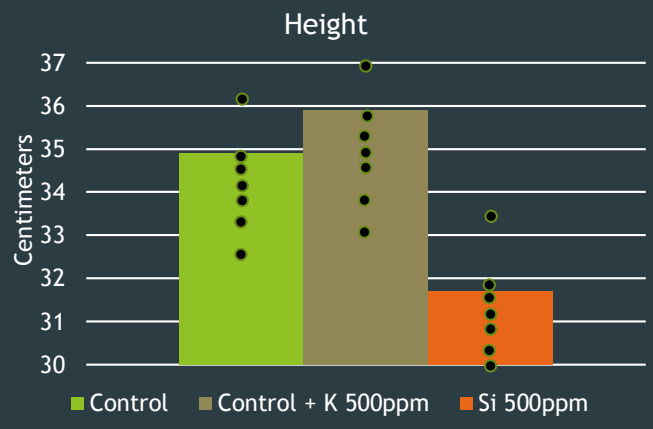


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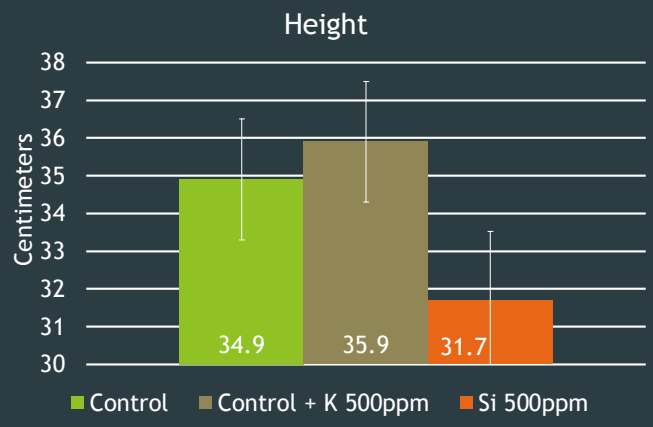


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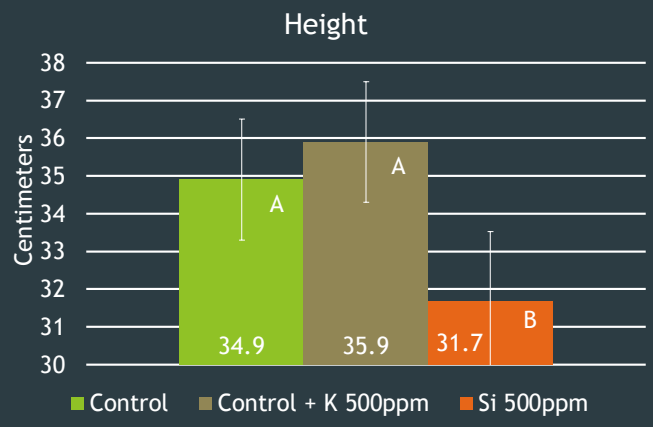


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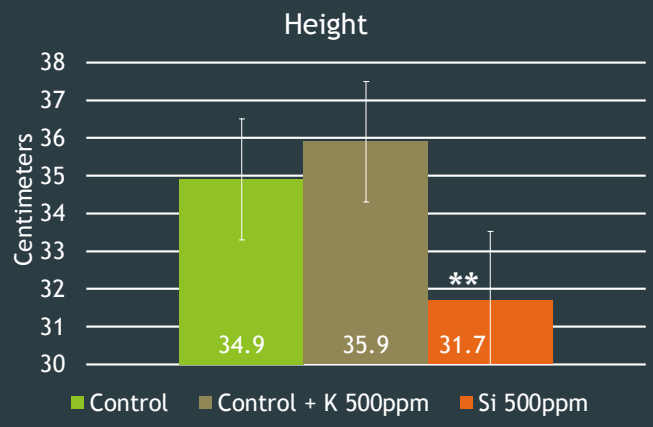


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*Introduction* *Questions* *Methods* **Results** *Discussion* *Conclusion*

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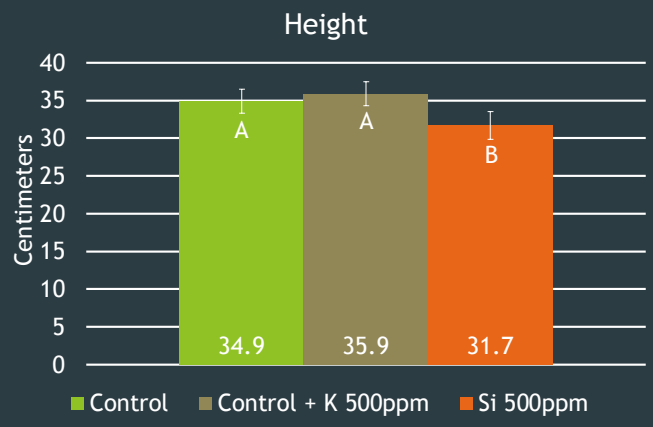


df= 43, F=5.4, **p=0.0085**

*Introduction* *Questions* *Methods* **Results** *Discussion* *Conclusion*

# Critical Reading of Figures

df= 43, F=5.4, **p=0.0085**

- Want p to be less then 0.05
  - This means 95% confidence
  - If p<0.10 then 90% confidence
    - 95% is 1 in 20,  90% is 1 in 10
- α (alpha) can also be used to indicate confidence.
  - Ex: α =0.05 is the same as p<0.05

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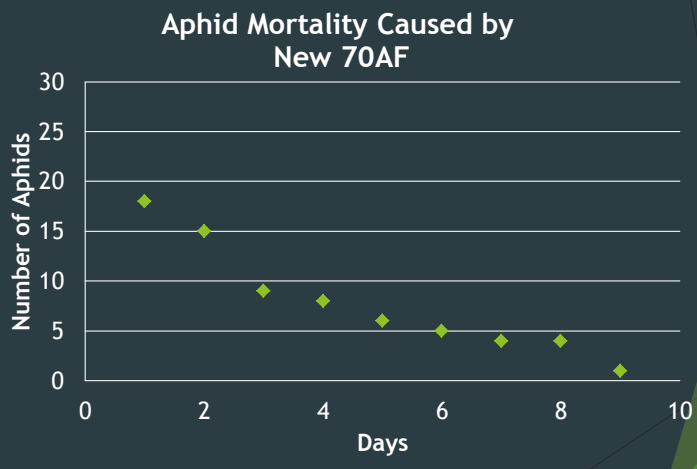

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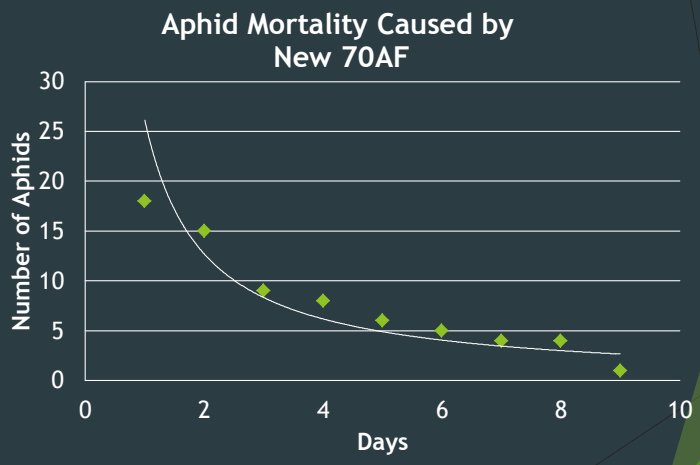


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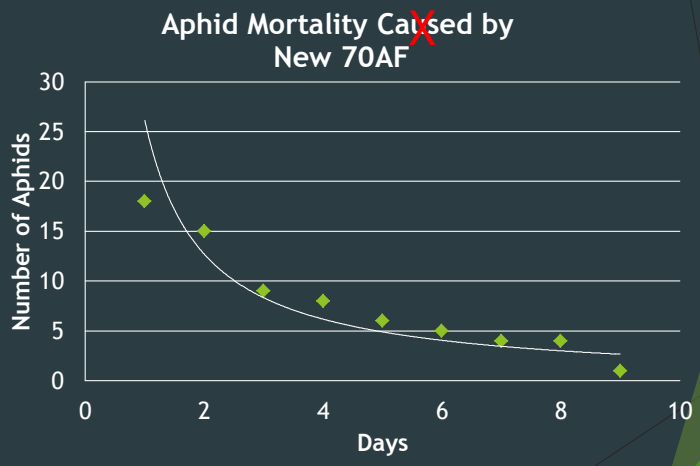


Correlation does <u>not</u> equal Causation

# Critical Reading of Figures

- Main Points
  - Error Bars are Important
  - Look for p-values smaller then 0.05
    - This means the study has significant differences
  - Markers indicating difference are a bare minimum (ex: ABCD, * ** ***)
  - Correlation does **not** equal Causation

# Mainspring Efficacy Against Leafminer in Gerbera

Treatments

- Mainspring Drench
- Mainspring 12oz
- Mainspring 6oz
- Avid
- Trigard
- NoFoamB Control
- Water Control

syngenta

Mainspring

## Mainspring Efficacy Against Leafminer in Gerbera

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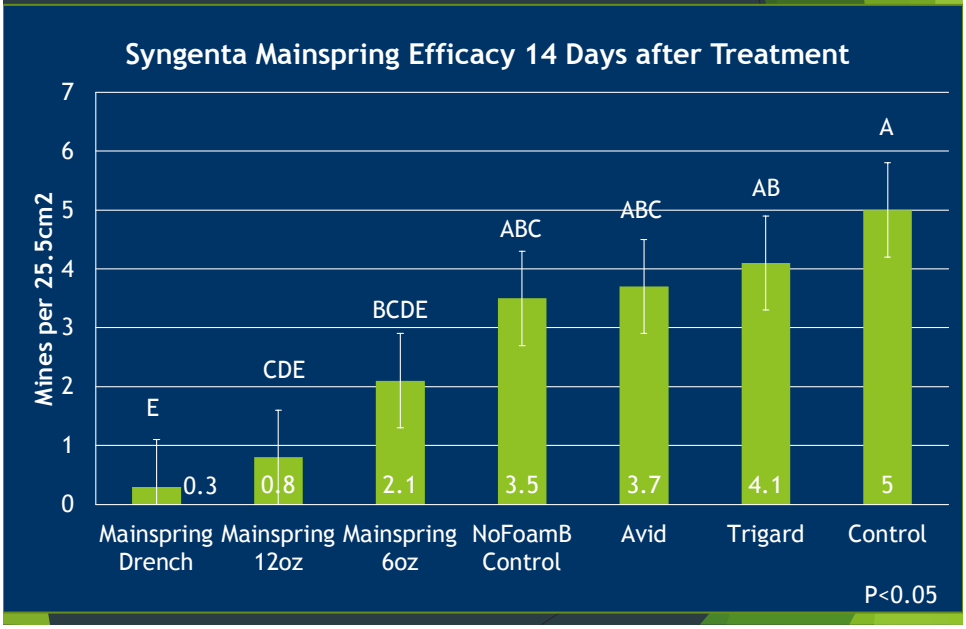

# Thank you

- Dr. Michael Parrella
- Bob Starnes
- Chris Durand
- Machiko Murdock


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