

Product Testing and Pesticide Research

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Outline

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

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

- ▶ Mainspring efficacy testing example

Silicate Fertilizers and Their Effects on Leafminer

Periodic Table of the Elements

1 1A 11A																	18 VIIIA 8A																								
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37 Rb Rubidium 85.468	38 Sr Strontium 87.62	39 Y Yttrium 88.906	40 Zr Zirconium 91.224	41 Nb Niobium 92.906	42 Mo Molybdenum 95.94	43 Tc Technetium 98.906	44 Ru Ruthenium 101.07	45 Rh Rhodium 102.906	46 Pd Palladium 106.42	47 Ag Silver 107.868	48 Cd Cadmium 112.411	49 In Indium 114.818	50 Sn Tin 118.71	51 Sb Antimony 121.760	52 Te Tellurium 127.6	53 I Iodine 126.905	54 Xe Xenon 131.29	55 Cs Cesium 132.905	56 Ba Barium 137.327	57-71 Lanthanide Series	72 Hf Hafnium 178.49	73 Ta Tantalum 180.948	74 W Tungsten 183.85	75 Re Rhenium 186.207	76 Os Osmium 190.23	77 Ir Iridium 192.22	78 Pt Platinum 195.08	79 Au Gold 196.967	80 Hg Mercury 200.59	81 Tl Thallium 204.383	82 Pb Lead 207.2	83 Bi Bismuth 208.980	84 Po Polonium [209]	85 At Astatine [210]	86 Rn Radon [222]						
87 Fr Francium [223]	88 Ra Radium [226]	89-103 Actinide Series	104 Rf Rutherfordium [261]	105 Db Dubnium [262]	106 Sg Seaborgium [266]	107 Bh Bohrium [264]	108 Hs Hassium [265]	109 Mt Meitnerium [268]	110 Ds Darmstadtium [271]	111 Rg Roentgenium [272]	112 Cn Copernicium [285]	113 Nh Nihonium [284]	114 Fl Flerovium [289]	115 Uup Ununpentium [288]	116 Lv Livermorium [293]	117 Uus Ununseptium [294]	118 Uuo Ununoctium [294]	119 Uue Ununennium [295]	120 Uub Unbinilium [293]	121 Ubu Unbiunium [294]	122 Ubu Unbibium [294]	123 Ubu Unbibium [294]	124 Ubu Unbibium [294]	125 Ubu Unbibium [294]	126 Ubu Unbibium [294]	127 Ubu Unbibium [294]	128 Ubu Unbibium [294]	129 Ubu Unbibium [294]	130 Ubu Unbibium [294]	131 Ubu Unbibium [294]	132 Ubu Unbibium [294]	133 Ubu Unbibium [294]	134 Ubu Unbibium [294]	135 Ubu Unbibium [294]	136 Ubu Unbibium [294]	137 Ubu Unbibium [294]	138 Ubu Unbibium [294]				

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37 Rb Rubidium 85.468	38 Sr Strontium 87.62	39 Y Yttrium 88.906	40 Zr Zirconium 91.224	41 Nb Niobium 92.906	42 Mo Molybdenum 95.94	43 Tc Technetium 98.906	44 Ru Ruthenium 101.07	45 Rh Rhodium 102.905	46 Pd Palladium 106.42	47 Ag Silver 107.868	48 Cd Cadmium 112.411	49 In Indium 114.818	50 Sn Tin 118.71	51 Sb Antimony 121.757	52 Te Tellurium 127.6	53 I Iodine 126.905	54 Xe Xenon 131.29	55 Cs Cesium 132.905	56 Ba Barium 137.327	57-71 Lanthanide Series	72 Hf Hafnium 178.49	73 Ta Tantalum 180.948	74 W Tungsten 183.85	75 Re Rhenium 186.207	76 Os Osmium 190.23	77 Ir Iridium 192.22	78 Pt Platinum 195.08	79 Au Gold 196.967	80 Hg Mercury 200.59	81 Tl Thallium 204.383	82 Pb Lead 207.2	83 Bi Bismuth 208.980	84 Po Polonium (209)	85 At Astatine (210)	86 Rn Radon (222)
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Plant Essential Nutrients

Introduction Questions Methods Results Discussion Conclusion

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Plant Essential Nutrients + Plant Beneficial Nutrients

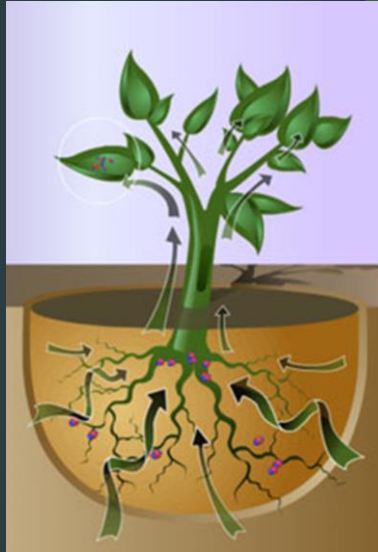
Introduction Questions Methods Results Discussion Conclusion

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)

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Silicate Fertilizers

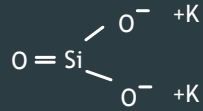
► Silicon sources:

- Rice hull ash
- Fly ash
- Calcium Silicate (Ca_2SiO_4)
- Sodium Silicate (Na_2SiO_3)
- Potassium Silicate (K_2SiO_3)

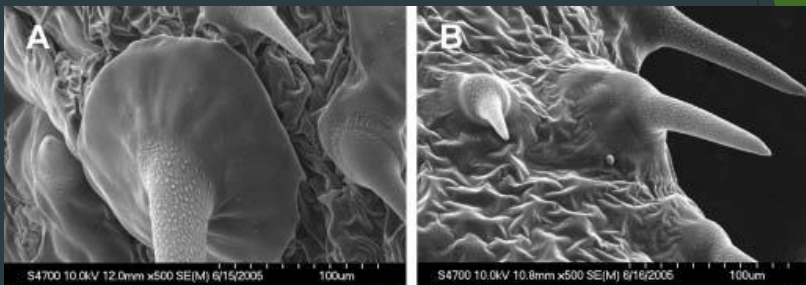
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Silicate Fertilizers

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



Introduction Questions Methods Results Discussion Conclusion



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

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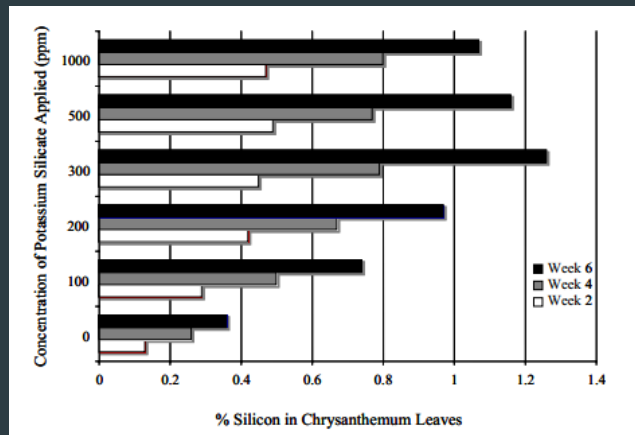
Introduction



Chrysanthemum

Introduction Questions Methods Results Discussion Conclusion

Introduction



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

Introduction Questions Methods Results Discussion Conclusion

Liriomyza trifolii

Serpentine leafminer



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



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Questions



Is leafminer mining activity affected under silicon treatment?



Does silicon supplementation affect plant growth characteristics?

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Methods

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



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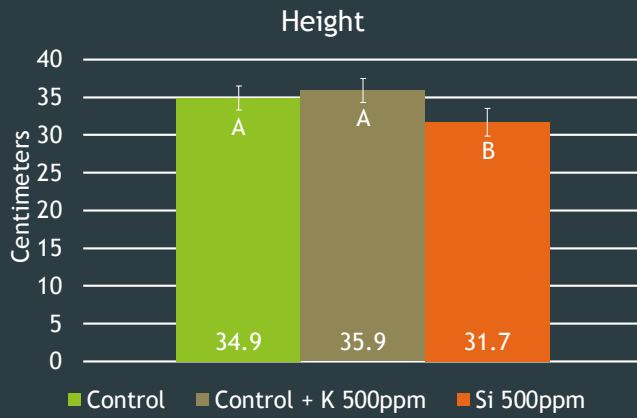
Methods

- ▶ 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)



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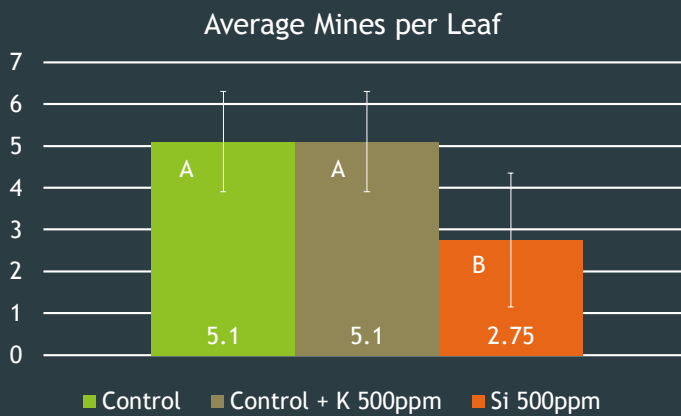
Results



df= 43, F=5.4, p=0.0085

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Results



df= 43, F=4.05, p=0.025

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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

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Experimental Design Intro

Experimental Design Intro

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Experimental Design Intro

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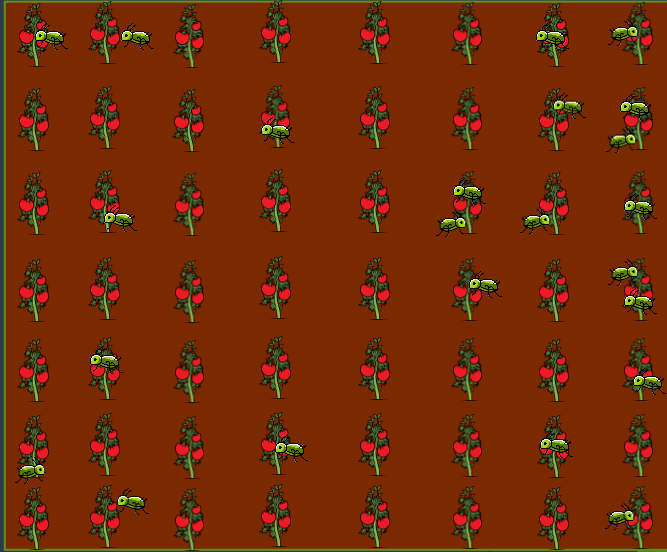


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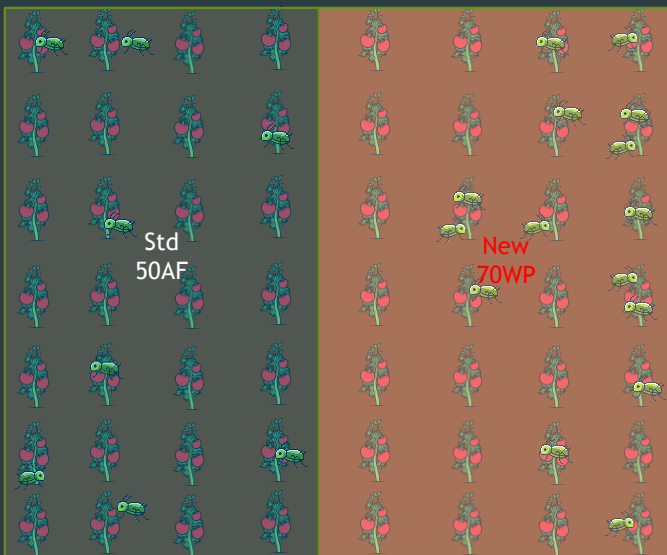
Experimental Design Important Points

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

Experimental Design Important Points



Experimental Design Important Points



Experimental Design Important Points

► What If:

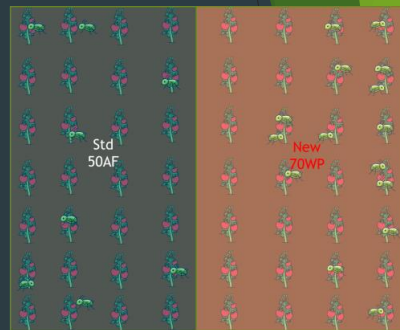
- Aphid are not equally distributed in the field
- The weather changes before you can count and most the aphid die
- The neighbor sprays for aphid and you get drift onto part of your field
- There is a systemic pesticide residue in the soil in part of the field from the last crop
- You have whiteflies 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

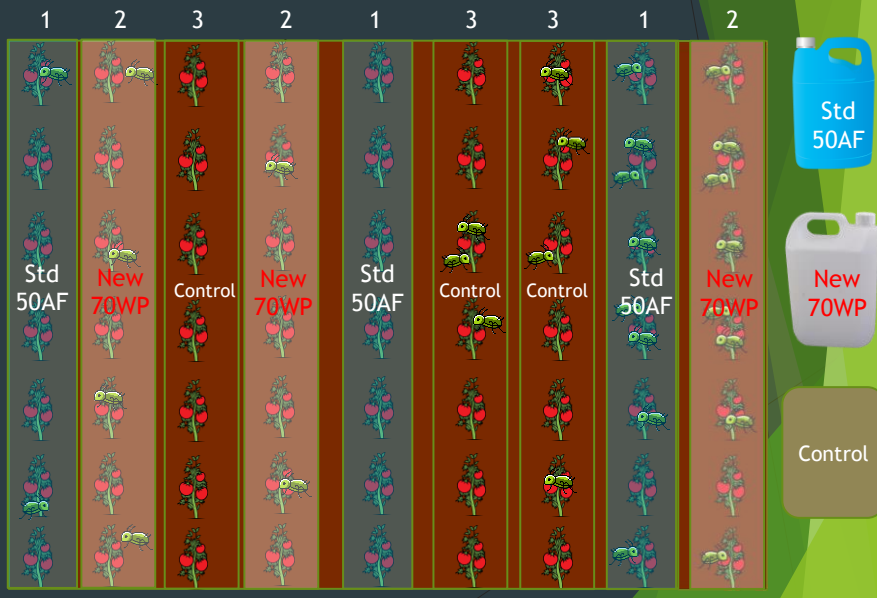
► How do we solve this:

- Controls/ Untreated Checks
- Replication
- Randomization



Experimental Design Important Points

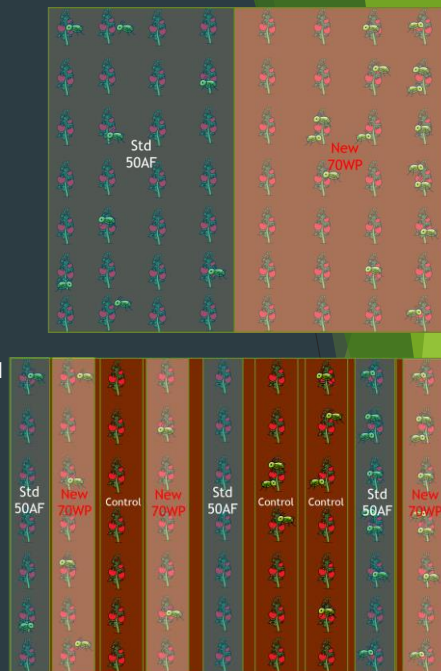
Random # 1-3 for 9 rows



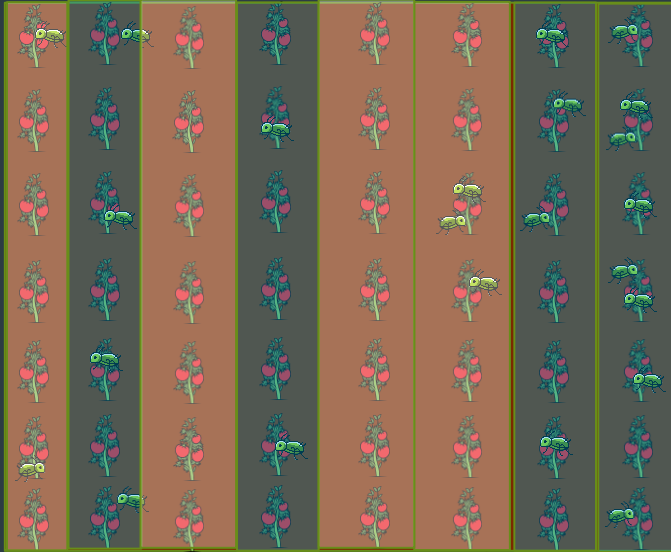
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Experimental Design Important Points







Experimental Design Important Points

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Experimental Design Important Points

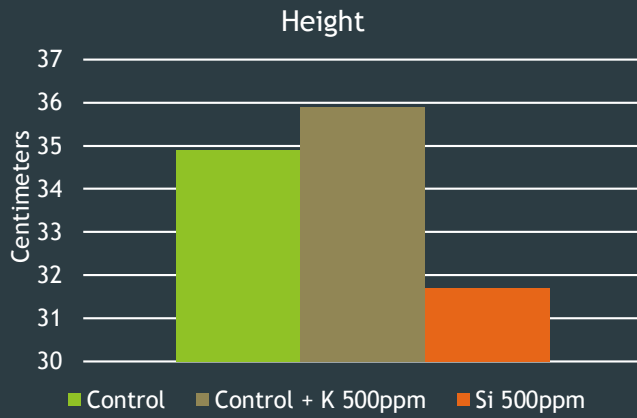
▶ Statistics

- ▶ 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

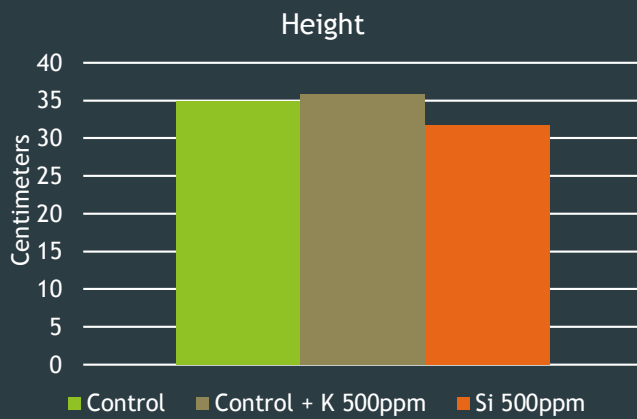
What to look for.....

Critical Reading of Figures



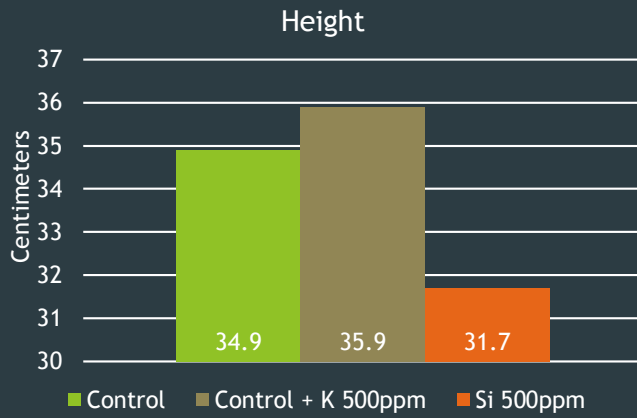
Introduction Questions Methods Results Discussion Conclusion

Critical Reading of Figures



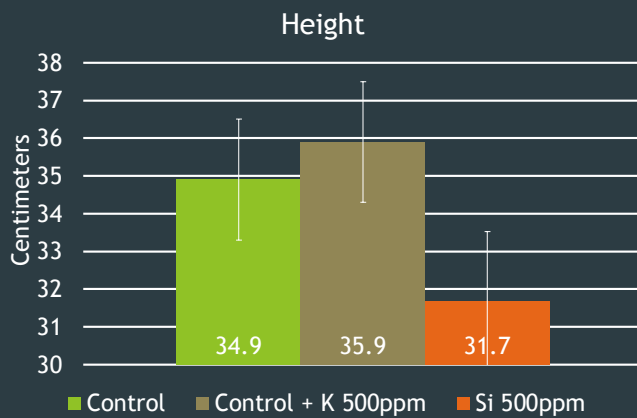
Introduction Questions Methods Results Discussion Conclusion

Critical Reading of Figures



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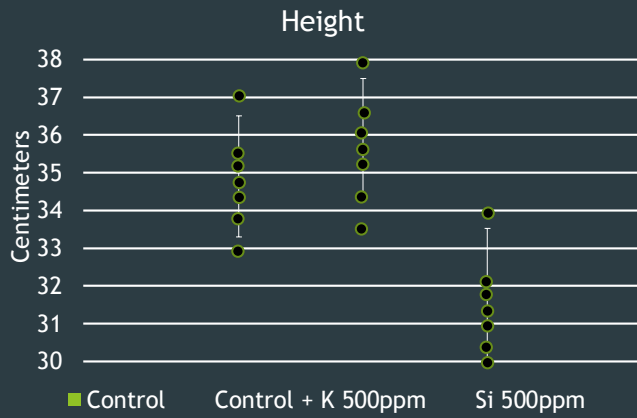
Critical Reading of Figures



df= 43, F=5.4, p=0.0085

Introduction Questions Methods Results Discussion Conclusion

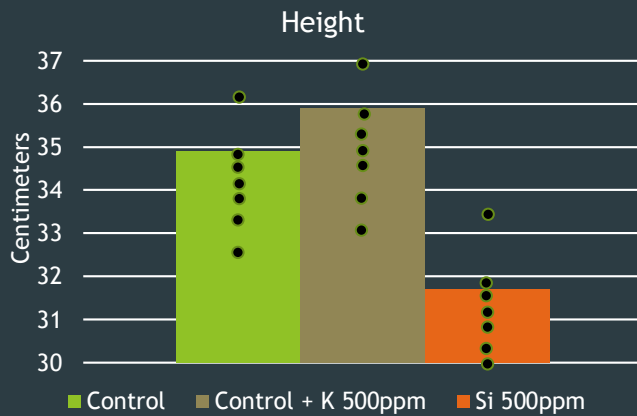
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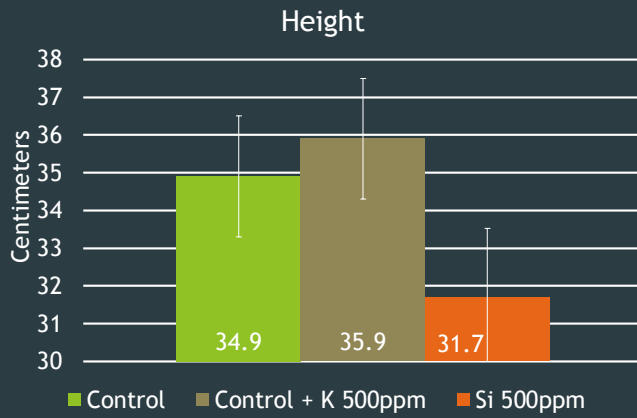
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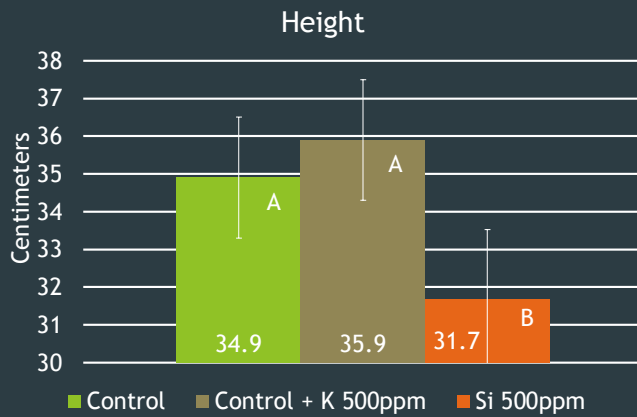
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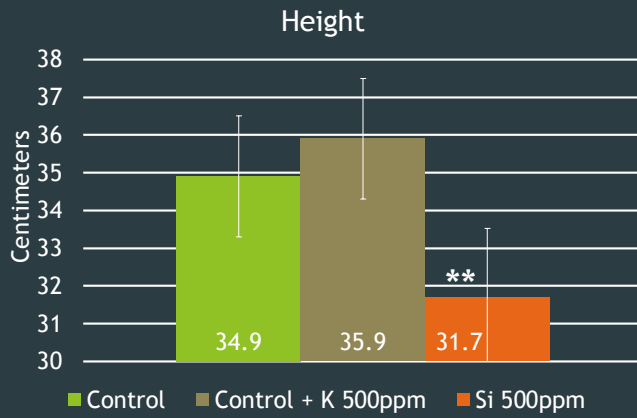
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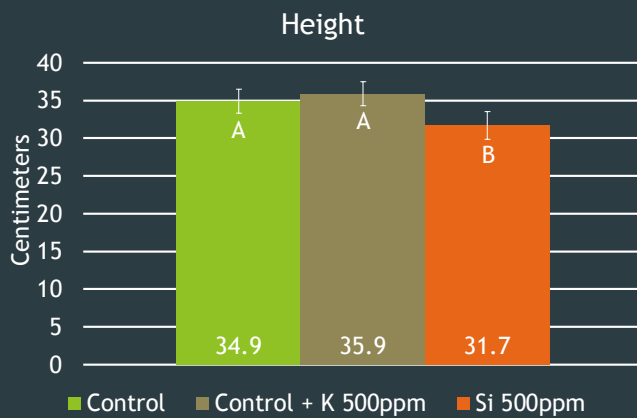
Critical Reading of Figures



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Introduction Questions Methods Results Discussion Conclusion

Critical Reading of Figures



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

Introduction Questions Methods Results Discussion Conclusion

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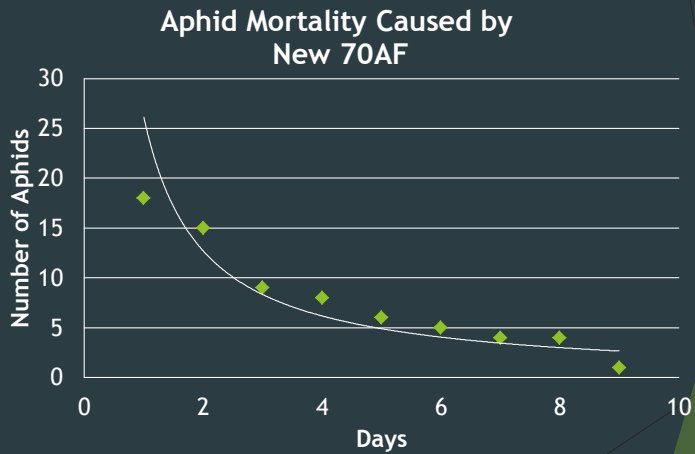
- ▶ Want p to be less than 0.05
 - ▶ This means 95% confidence
 - ▶ If $p < 0.10$ then 90% confidence
 - ▶ 95% is 1 in 20, 90% is 1 in 10
- ▶ α (alpha) can also be used to indicate confidence.
 - ▶ Ex: $\alpha = 0.05$ is the same as $p < 0.05$

Critical Reading of Figures

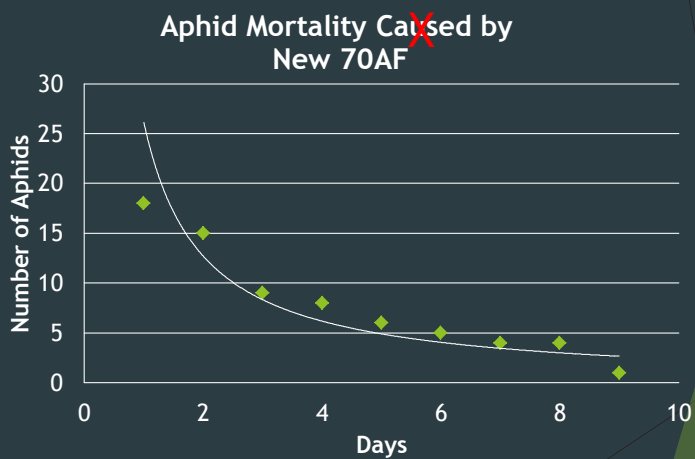
Aphid Mortality Caused by
New 70AF



Critical Reading of Figures



Critical Reading of Figures



Correlation does not equal Causation

Critical Reading of Figures

▶ Main Points

- ▶ Error Bars are Important
- ▶ Look for p-values smaller than 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

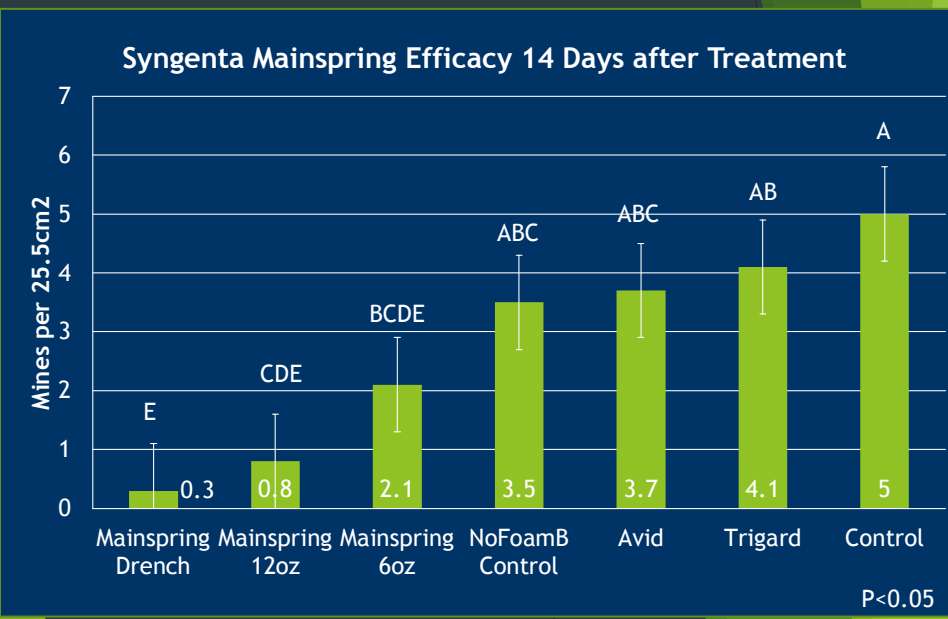
The logo for Syngenta Mainspring. It features the word "syngenta" in a blue, lowercase, sans-serif font with a small green leaf icon above the letter 'a'. Below it, the word "Mainspring" is written in a large, bold, black, sans-serif font.

syngenta
Mainspring

Mainspring Efficacy Against Leafminer in Gerbera



Mainspring Efficacy Against Leafminer in Gerbera



Thank you

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



UC Hanson Fund

