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### Combined Effects of Allelochemical and Pesticide Treatment on the Growth of Cucumber Plants

Samue Morgan

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# Combined Effects of Allelochemical and Pesticide Treatment on the Growth of Cucumber Plants

By Samuel Morgan



# Background:

Allelopathy: Biochemicals produced by one plant that inhibits the success of other plants in its vicinity.

Ferulic Acid: Ubiquitous phenolic acid; found in soils; damages P, K, and water uptake in cucumber roots.

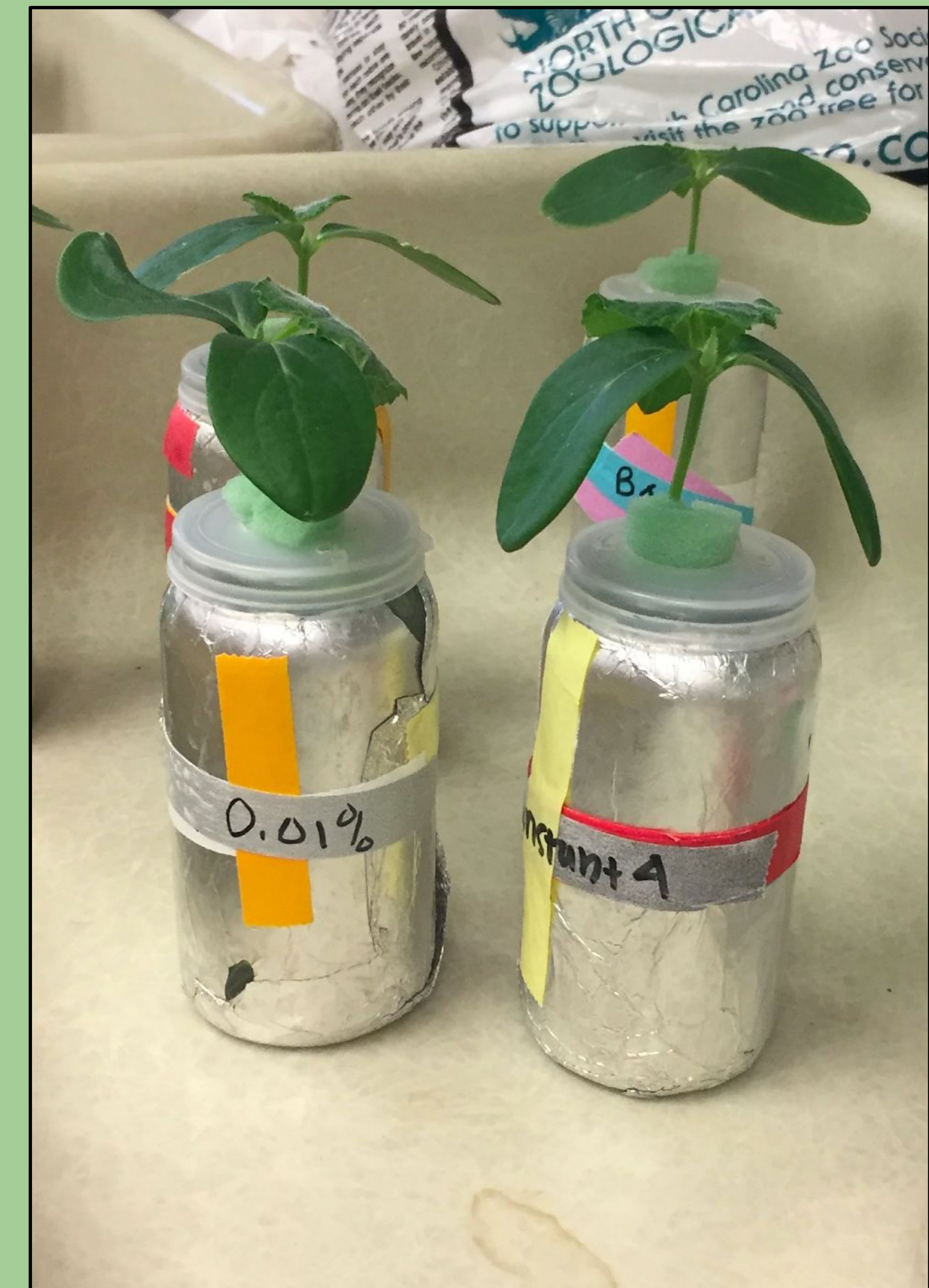
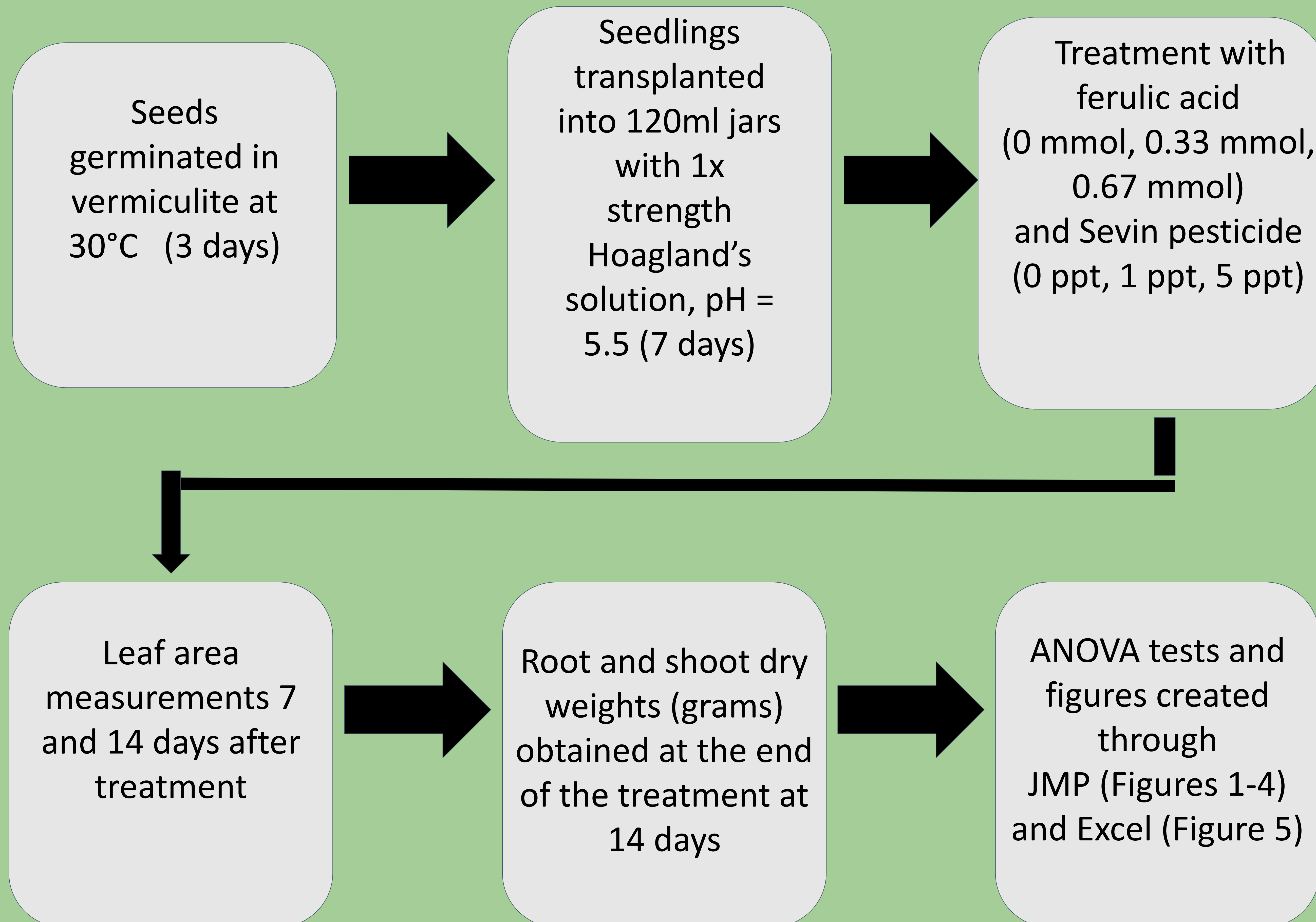
Zeta Cypermethrin: Insecticide with shorter application to harvest period than Carbaryl.

# Research Question:

Does the interaction of Ferulic Acid and Zeta Cypermethrin create a unique effect on cucumbers?



# Methods



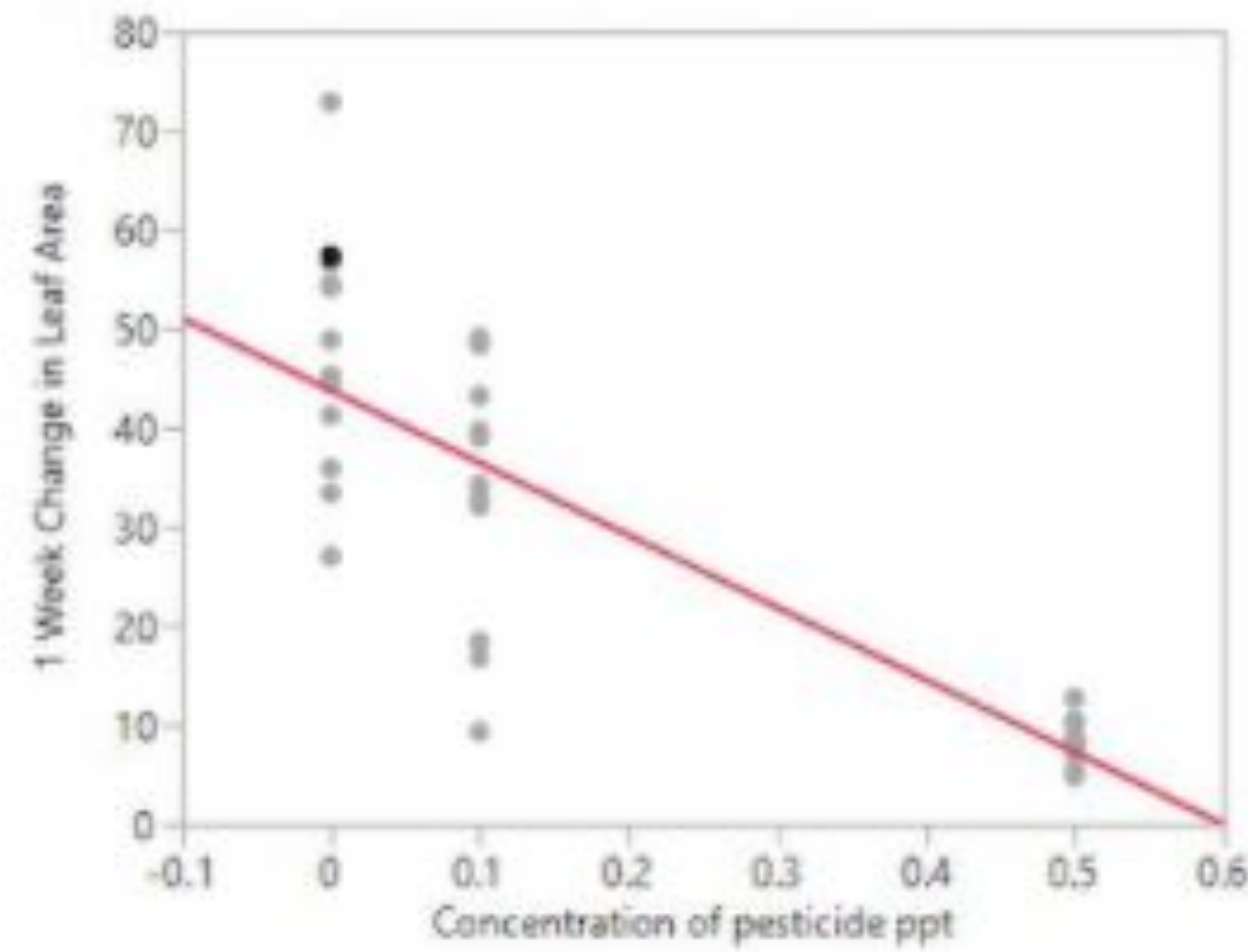
Cucumber plants placed in hydroponic Nutrient System

# Results

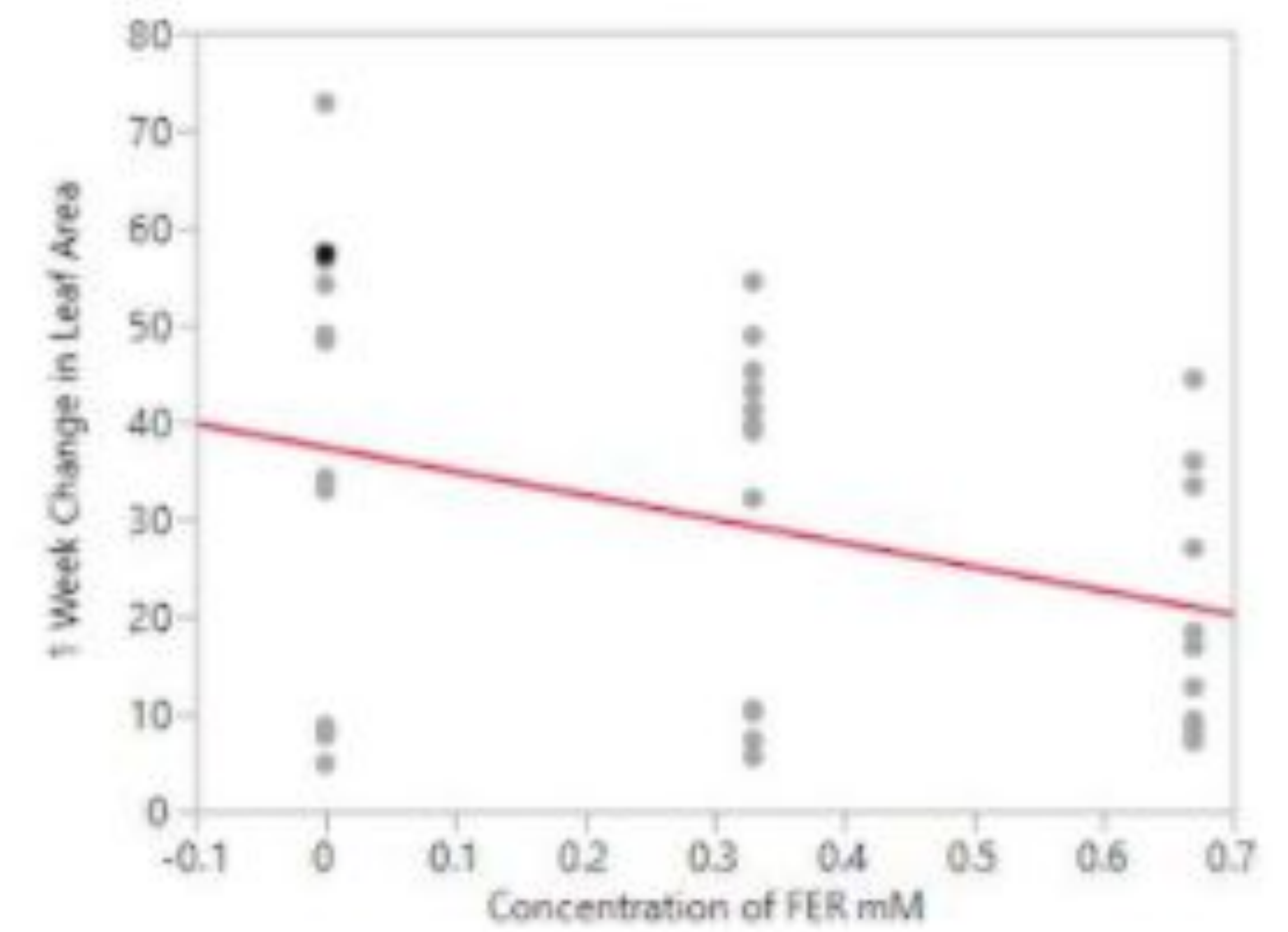
- Significant interactions of ferulic acid and pesticides found in root and shoot weights after two weeks.
- Pesticide was the dominant inhibitor of growth.
- Increased ferulic acid quantities were inhibitory throughout week 1, but stimulatory in week 2.

## Week 1 Growth (Figs. 1 & 2)

Pesticide Variable

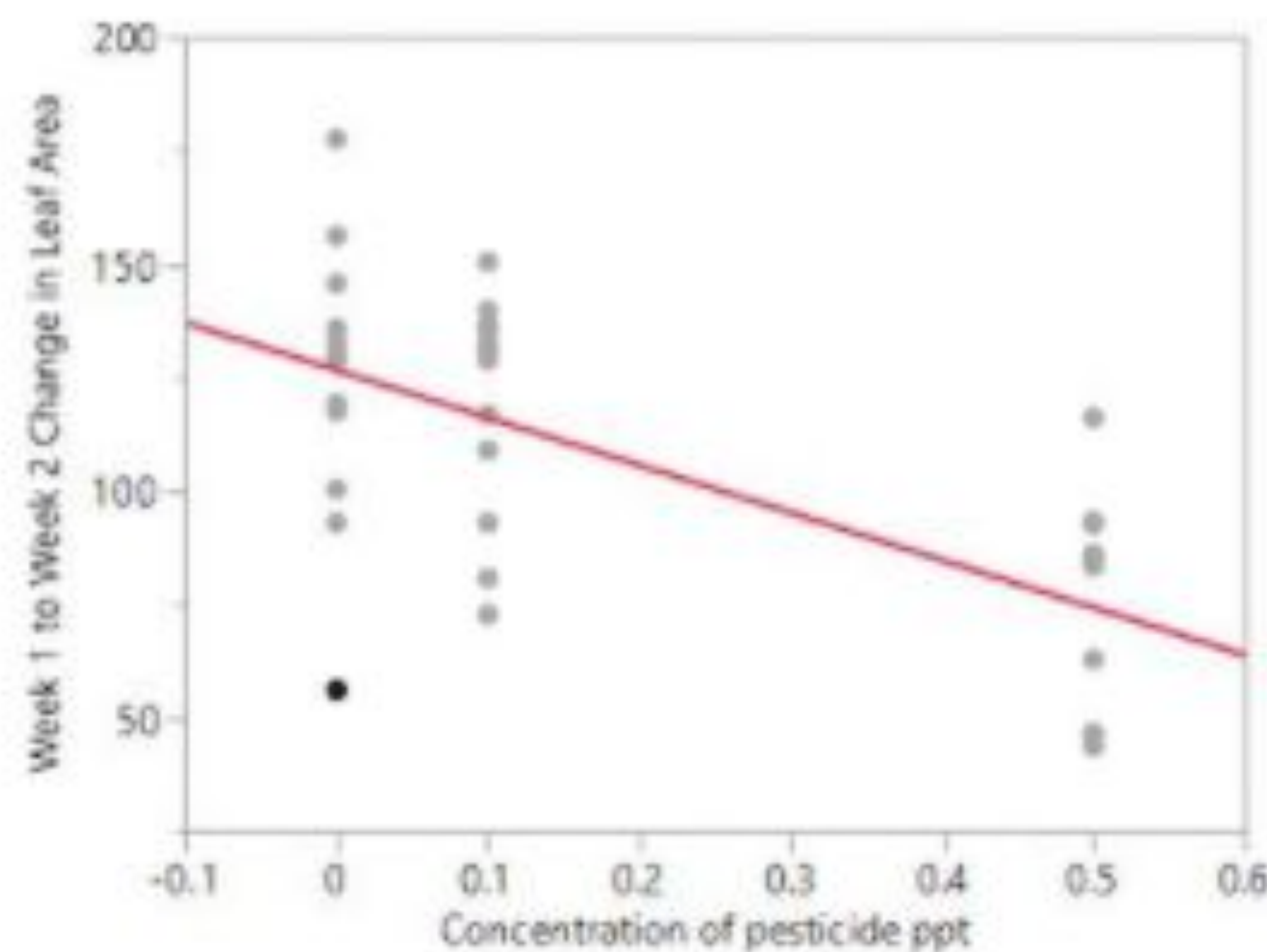


Ferulic Acid Variable

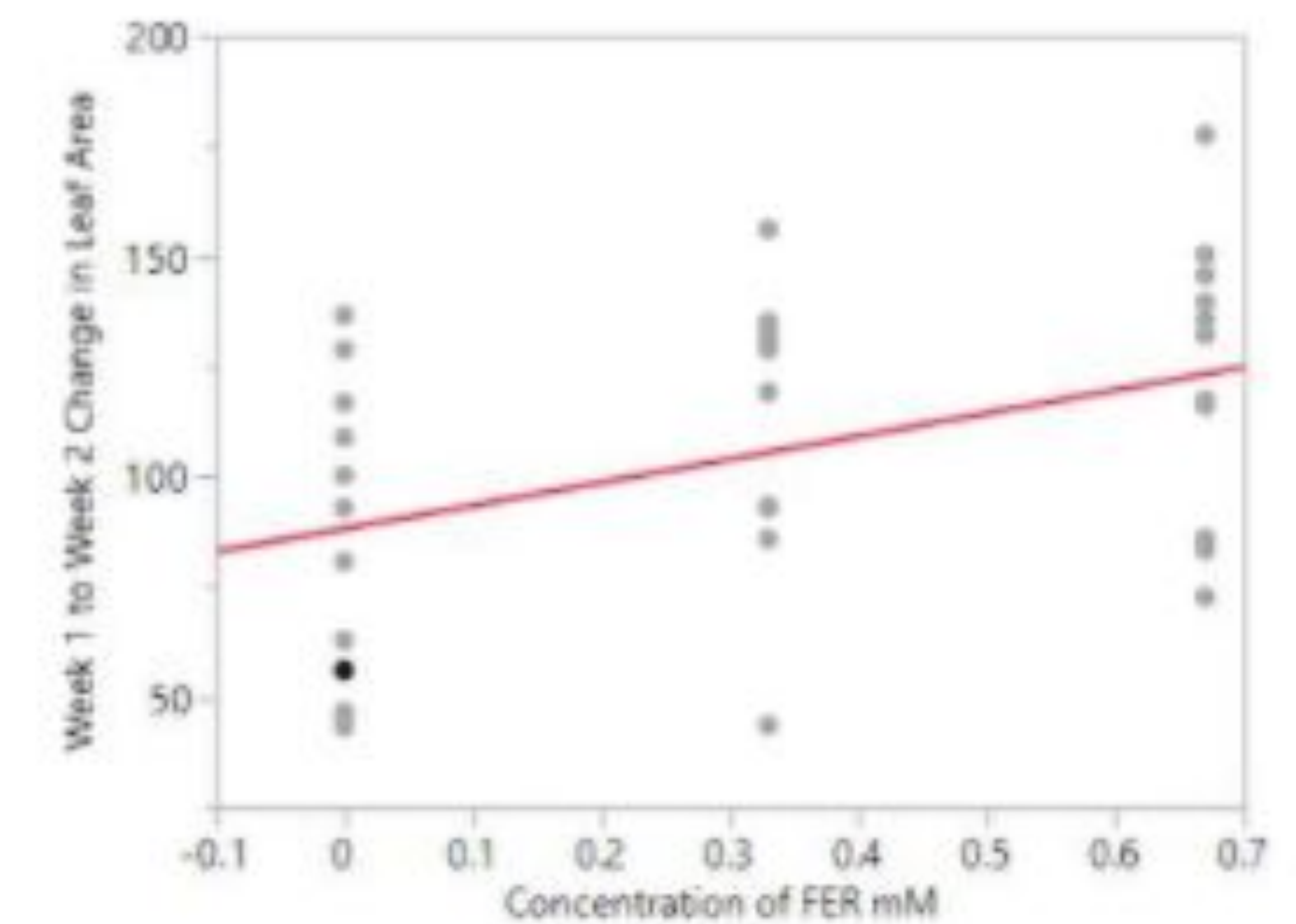


## Week 2 Growth (Figs. 3 & 4)

Pesticide Variable

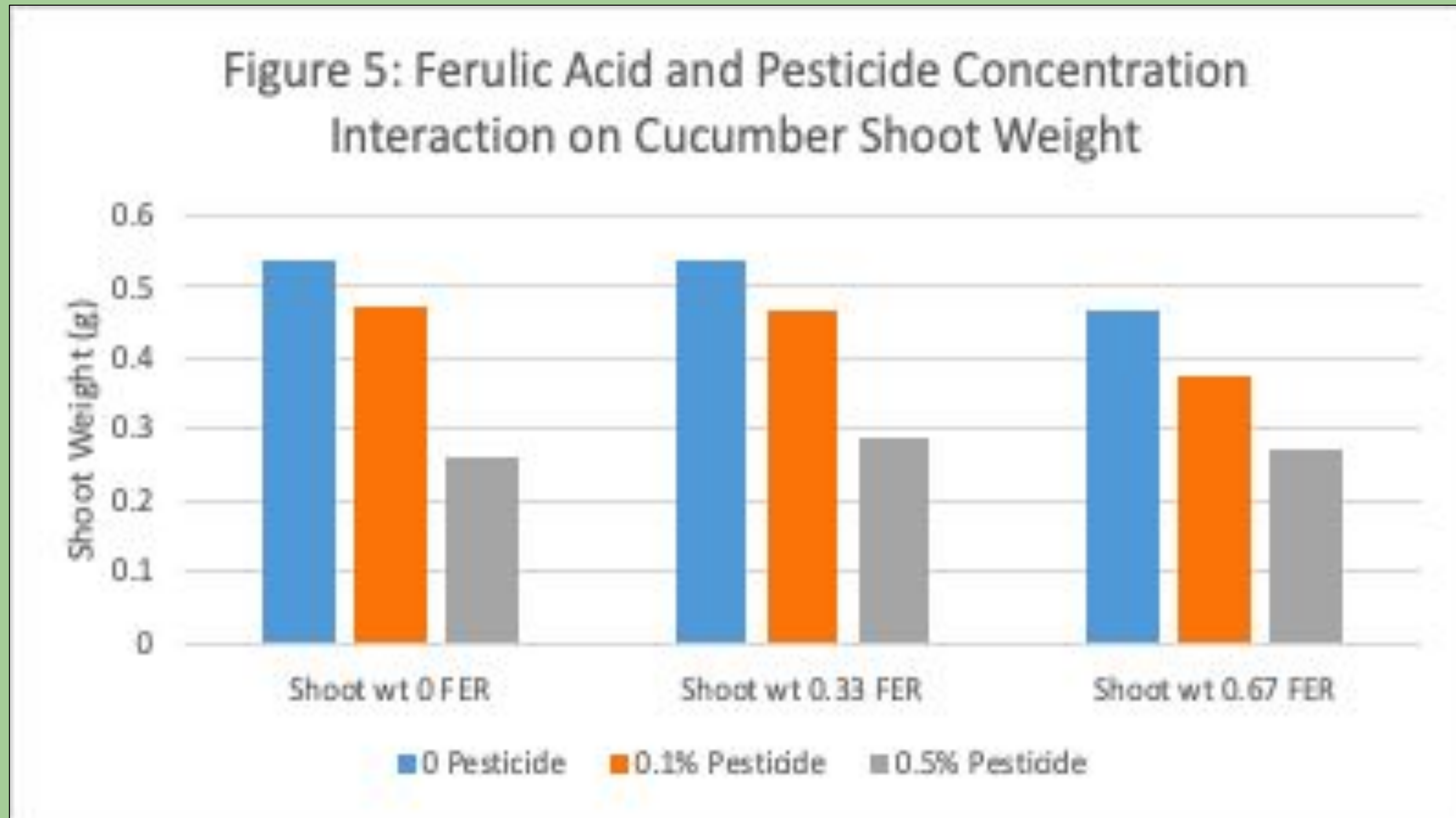


Ferulic Acid Variable



# Results

- Cucumbers undergo acclimation to ferulic acid.
- 5 ppt of Pesticide potentially maximally inhibitive for ferulic acid interaction.



- Pesticide effect remained constant through 14 days.

# Conclusions:

- Fields with poor drainage will be exceptionally susceptible to residual insecticide.
- Testing chemicals in isolation do not illustrate the true extent of their impacts.
- Field studies may contain many unknown variables.
- Interactions between chemicals provide immense research potential





# References

Edwards, C.A., (1966). Insecticide Residues in Soils. *Residue Reviews*.

Einhellig, F.A, (1994). Mechanism of Action of Allelochemicals in

Allelopathy. *ACS Symposium Series Vol. 582*. pp 96-116

Einhellig F.A.(1996). Interactions involving allelopathy in cropping

systems. *Agron. J.* 88:886-893.

FAO. (2019). Specifications and evaluations for agricultural pesticides

Zeta-Cypermethrin. *FAO*.

Lehman, M. E., & Blum, U. (1999). Influence of pretreatment stresses on

inhibitory effects of ferulic acid, an allelopathic phenolic acid. *Journal of Chemical Ecology*, 25(7),

1517-1529.

Lyo S., Blum U., (1990). Effects of ferulic acid, an allelopathic compound, on net P, K, and water uptake

by cucumber seedlings in a split-root system. *Journal of Chemical Ecology* 16: 2429-2439.

Merchant, M., (2018). When is Sevin not Sevin? *Insects in the City*.

# Combined Effects of Allelochemical and Pesticide Treatment on the Growth of Cucumber Plants

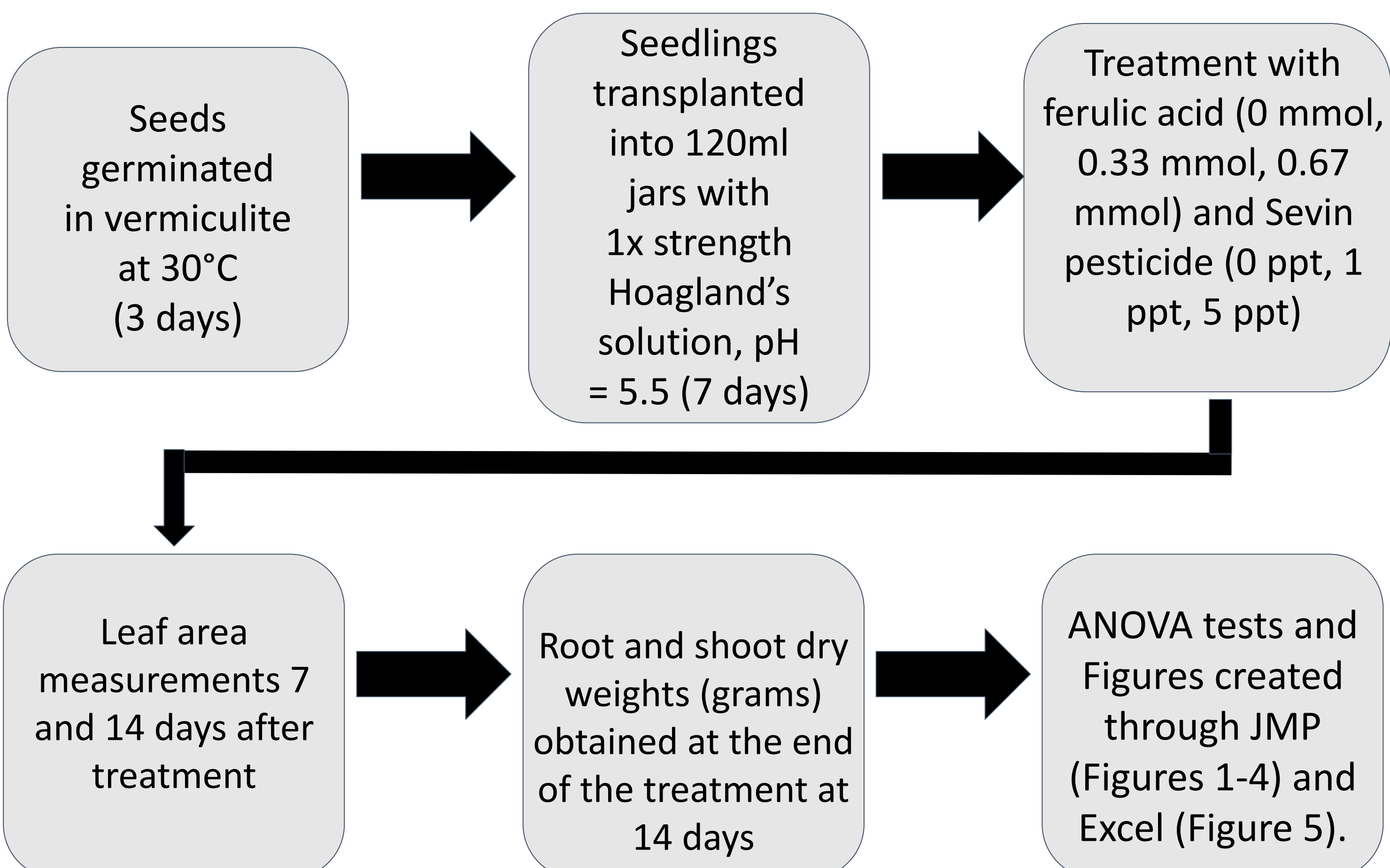
## Introduction

- Allelochemicals such as ferulic acid inhibits plant growth<sub>1</sub>.
- Sevin pesticide is a common insecticide used to protect homegrown plants, but is a toxic stressor at root level<sub>2</sub>.
- The interaction between both ferulic acid and pesticide may create an unique inhibition effect.



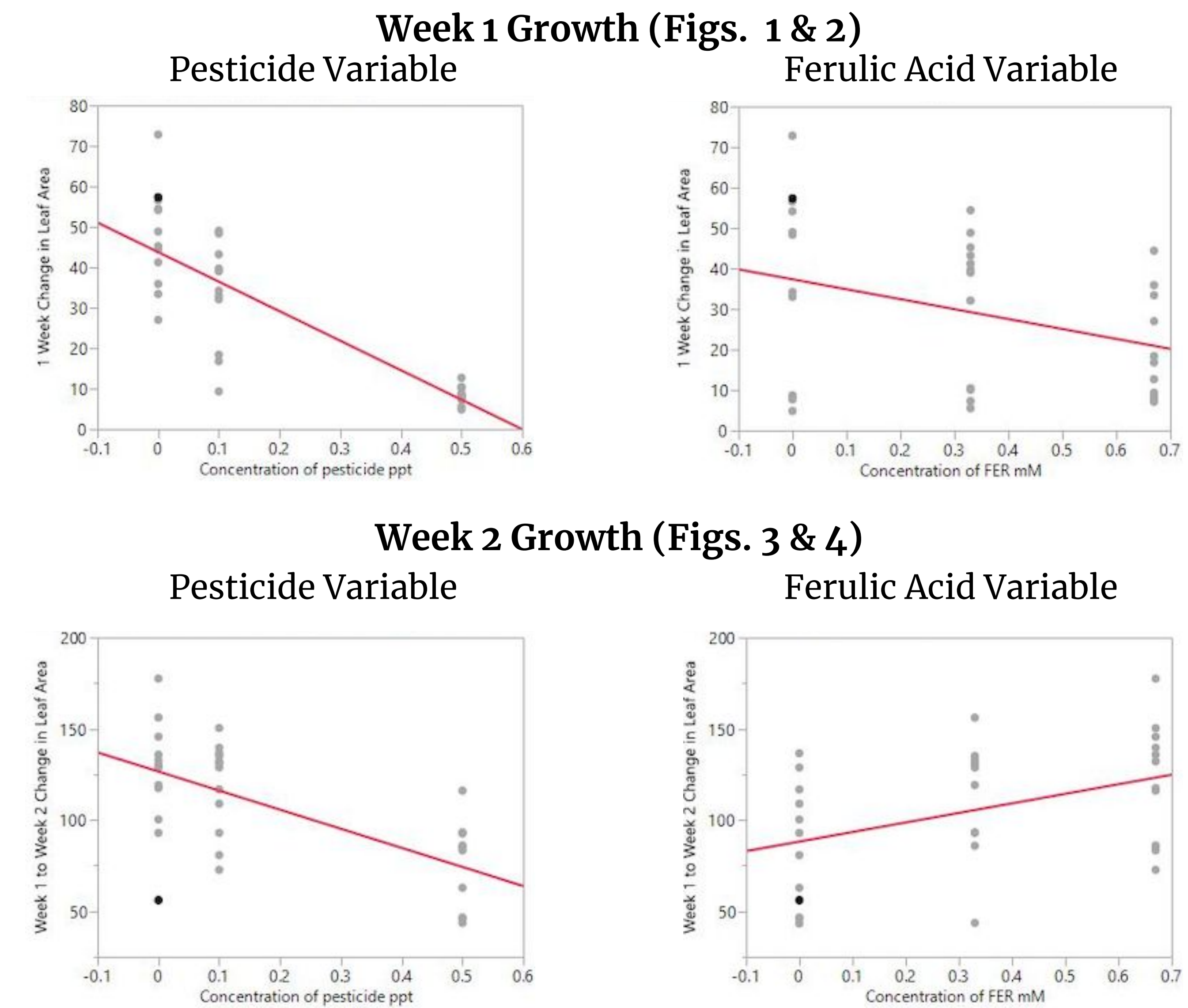
Cucumber plants placed in hydroponic Nutrient System

## Methods



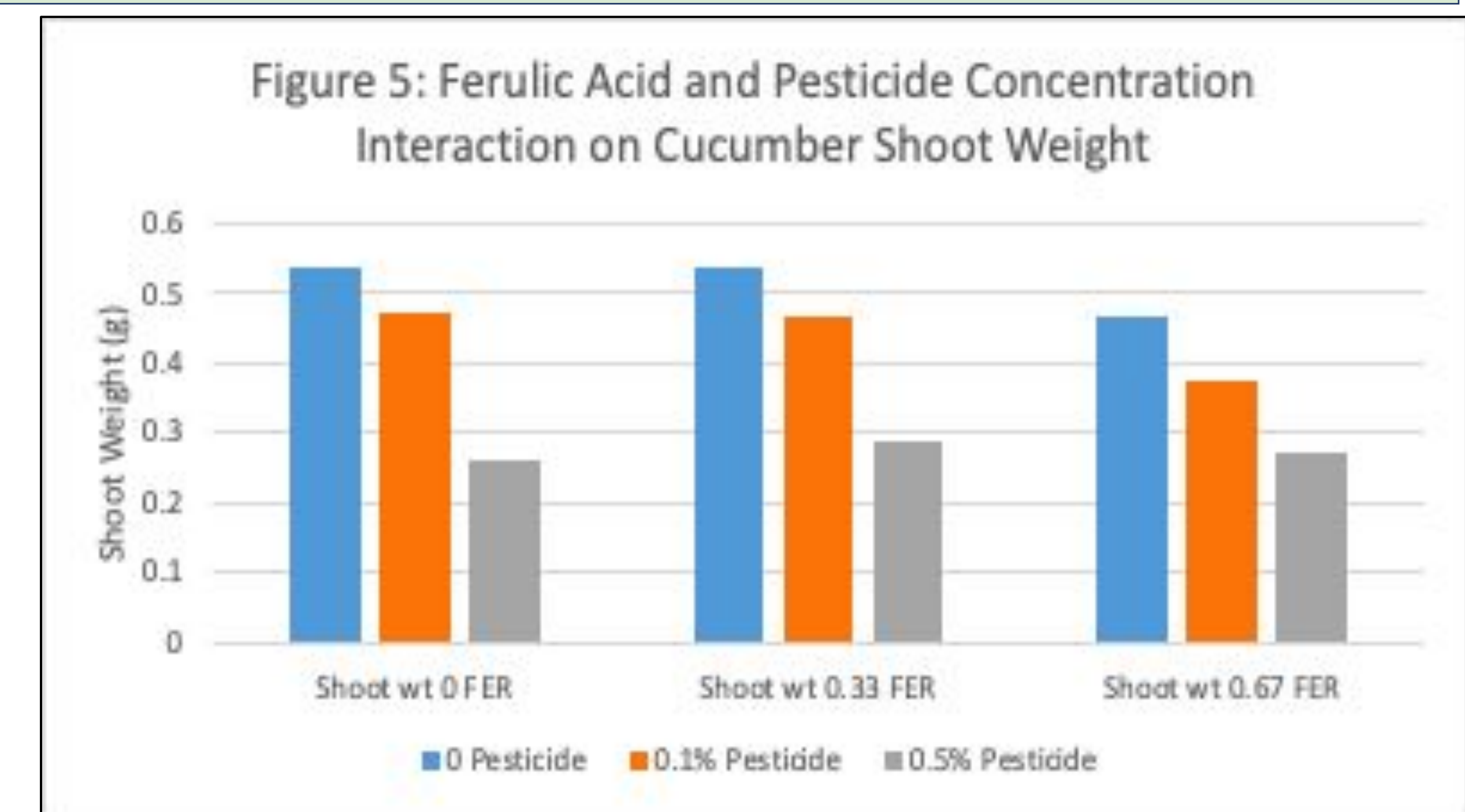
## Results

- Significant interactions of ferulic acid and pesticides found in root and shoot weights after two weeks.
- Pesticide was the dominant inhibitor of growth.
- Increased ferulic acid quantities were inhibitory throughout week 1, but stimulatory in week 2.



## Conclusions

- Cucumbers undergo acclimation to ferulic acid<sub>3</sub>.
- 5 ppt of Pesticide potentially maximally inhibitive for ferulic acid interaction<sub>4</sub>.
- Pesticide effect remained constant through 14 days.



## References

Acknowledgements: Thank you to my research mentor Dr. Mary Lehman for her guidance on this project.

- 1) Einhellig, F.A. (1994). Mechanism of Action of Allelochemicals in Allelopathy. *ACS Symposium Series* Vol. 582. pp 96-116
- 2) FAO. (2019) FAO SPECIFICATIONS AND EVALUATIONS FOR AGRICULTURAL PESTICIDES ZETA-CYPERMETHRIN. *FAO*.
- 3) Lehman, M. E., & Blum, U. (1999). Influence of pretreatment stresses on inhibitory effects of ferulic acid, an allelopathic phenolic acid. *Journal of Chemical Ecology*, 25(7), 1517-1529.
- 4) Einhellig F.A. (1996). Interactions Involving Allelopathy in Cropping Systems. *Agron. J.* 88:886-893.