

Influence of nutritional characteristics of *Hydrilla verticillata* on two biological control agents

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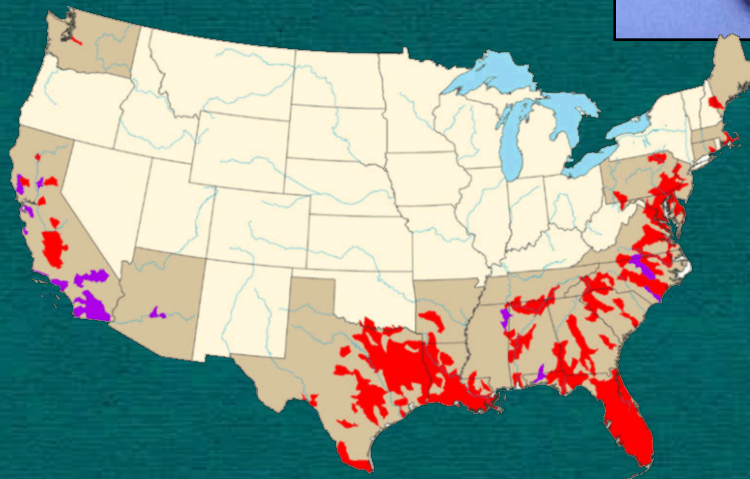
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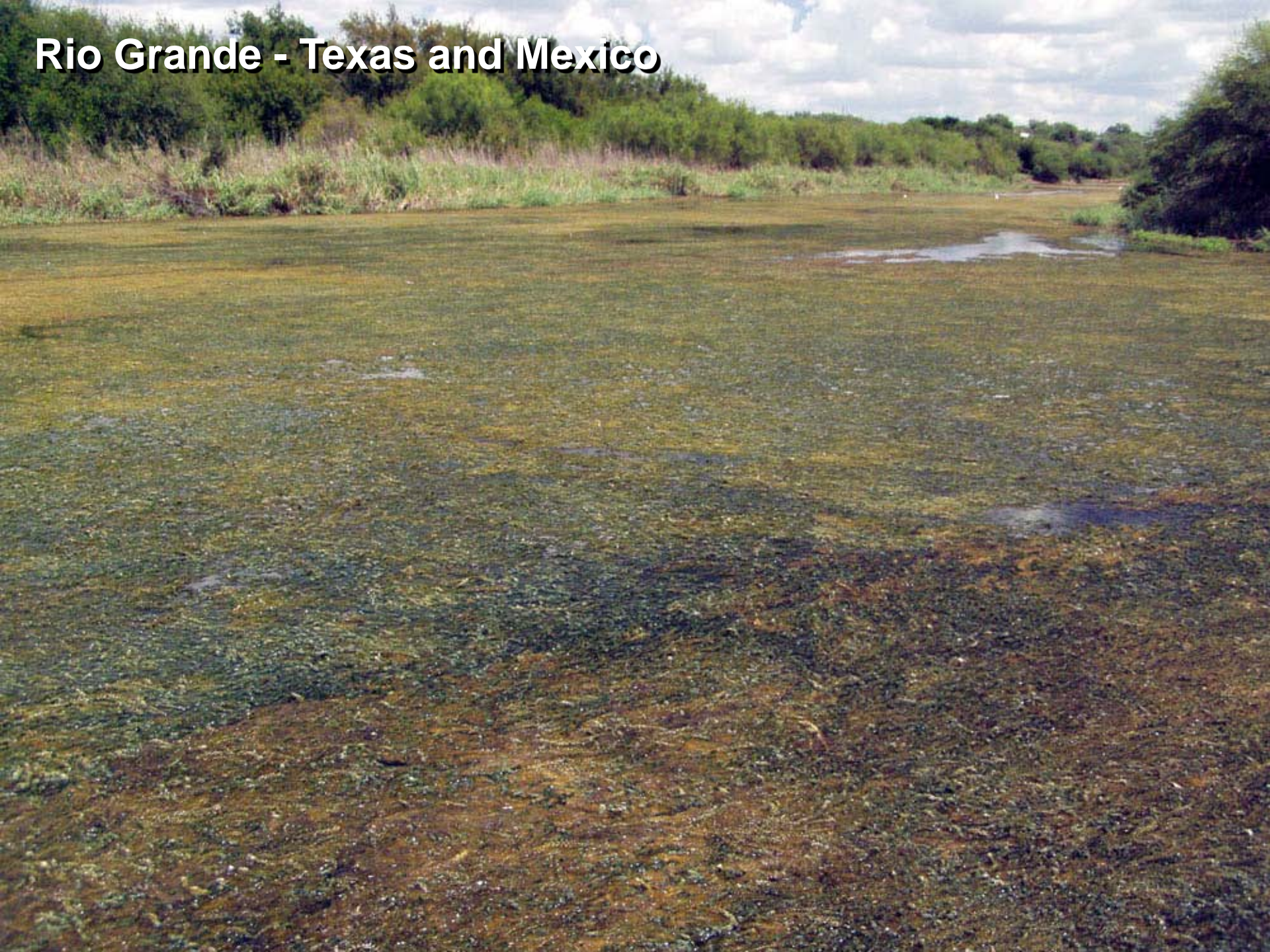
Biocontrol for Nature Symposium

Hydrilla verticillata

- First introduced in Florida
- 1950's – aquarium trade
- Asia, Africa, Australia
- Submersed plant
- Rooted in sediment
- Forms extensive mats
- Tubers and turions
 - Extended survival
- US Problem
 - Southeast
 - California
 - East/West Coast



Rio Grande - Texas and Mexico



Lake Somerville, TX



Lake Okahumpka, FL



Nickajack Reservoir, AL



Biological Control Agents

Hydrellia pakistanae



Mycoleptodiscus terrestris
(Mt)

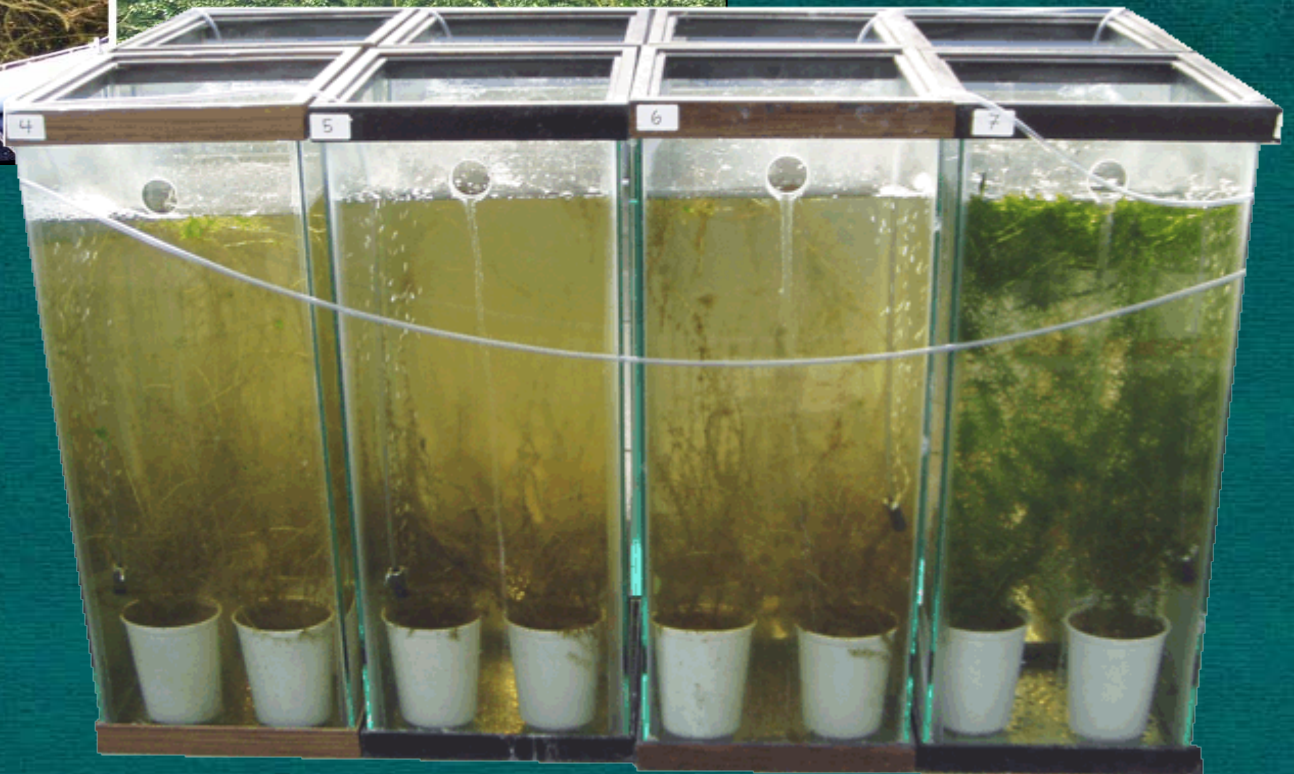


Hydrellia spp. present

Hydrellia spp. absent

Herbivory

Disease



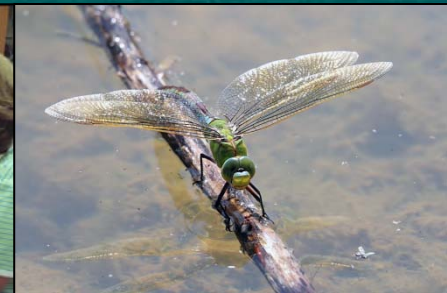
Efficacy

Herbivore

- Temperature
- Parasitism
- Predation
- Water flow
- Canopy formation
- Physical characteristic
- **Nutrition**

Disease

- Temperature
- Ph
- Density
- Canopy formation
- Physical characteristics
- Water flow
- **Nutrition**

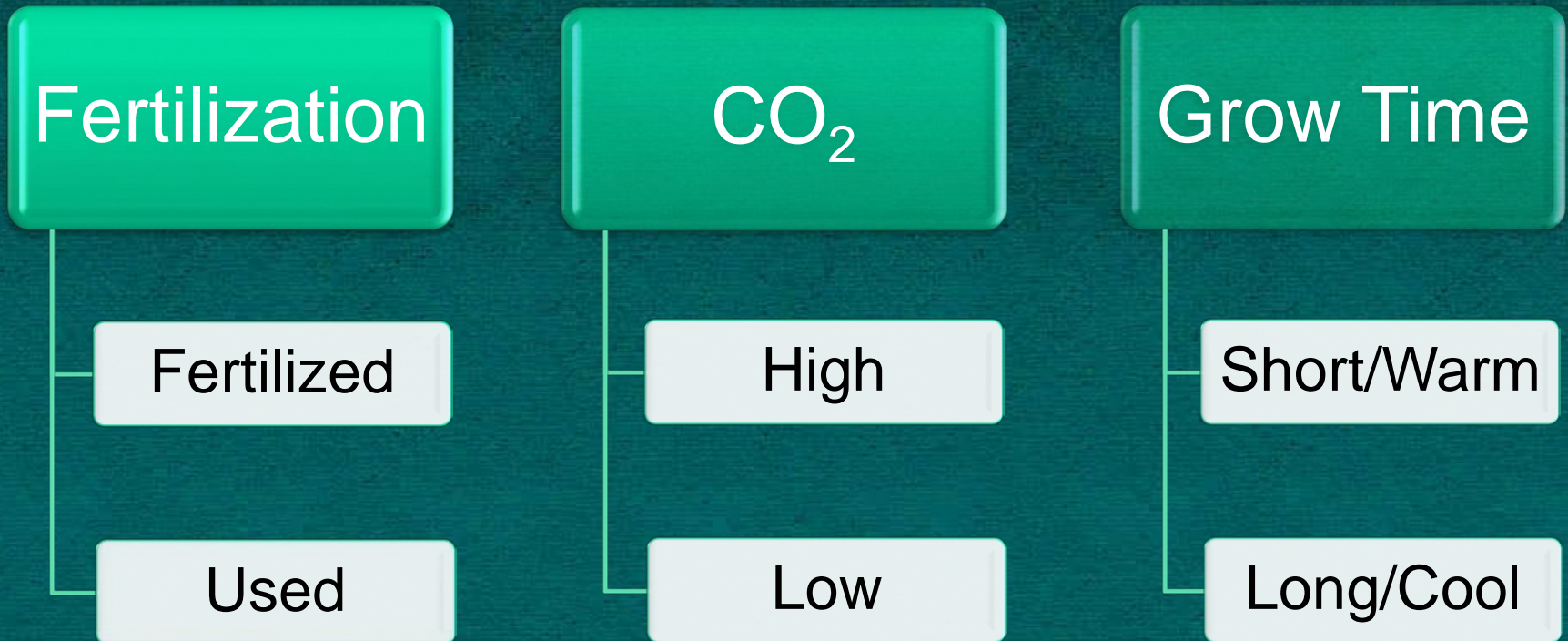


Herbivore

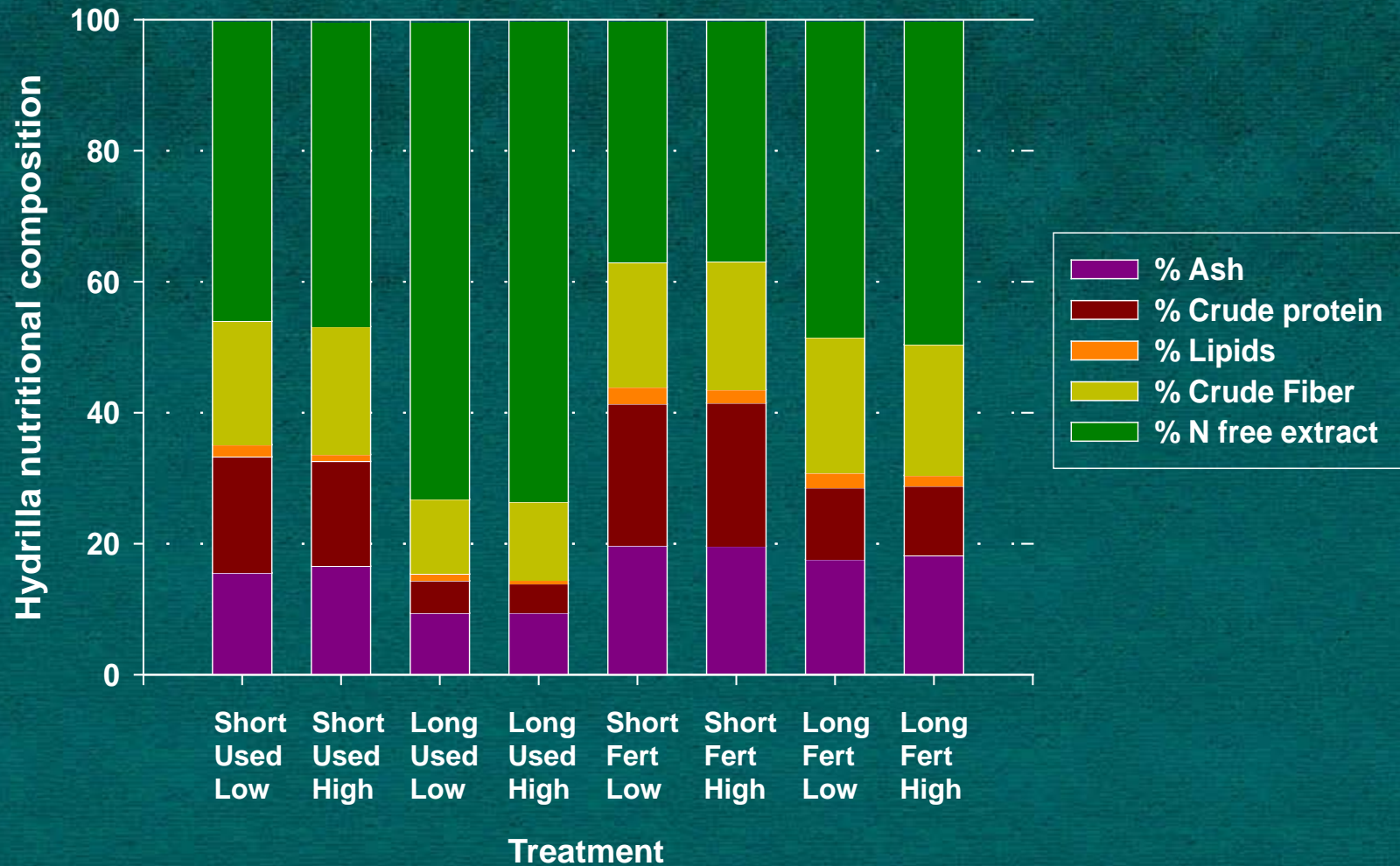


Hydrillia pakistanae
Hydrilla leaf-mining fly
Copyright 1997 USDA-ARS

Treatments



Nutritional composition of hydrilla following growth under different treatment combinations



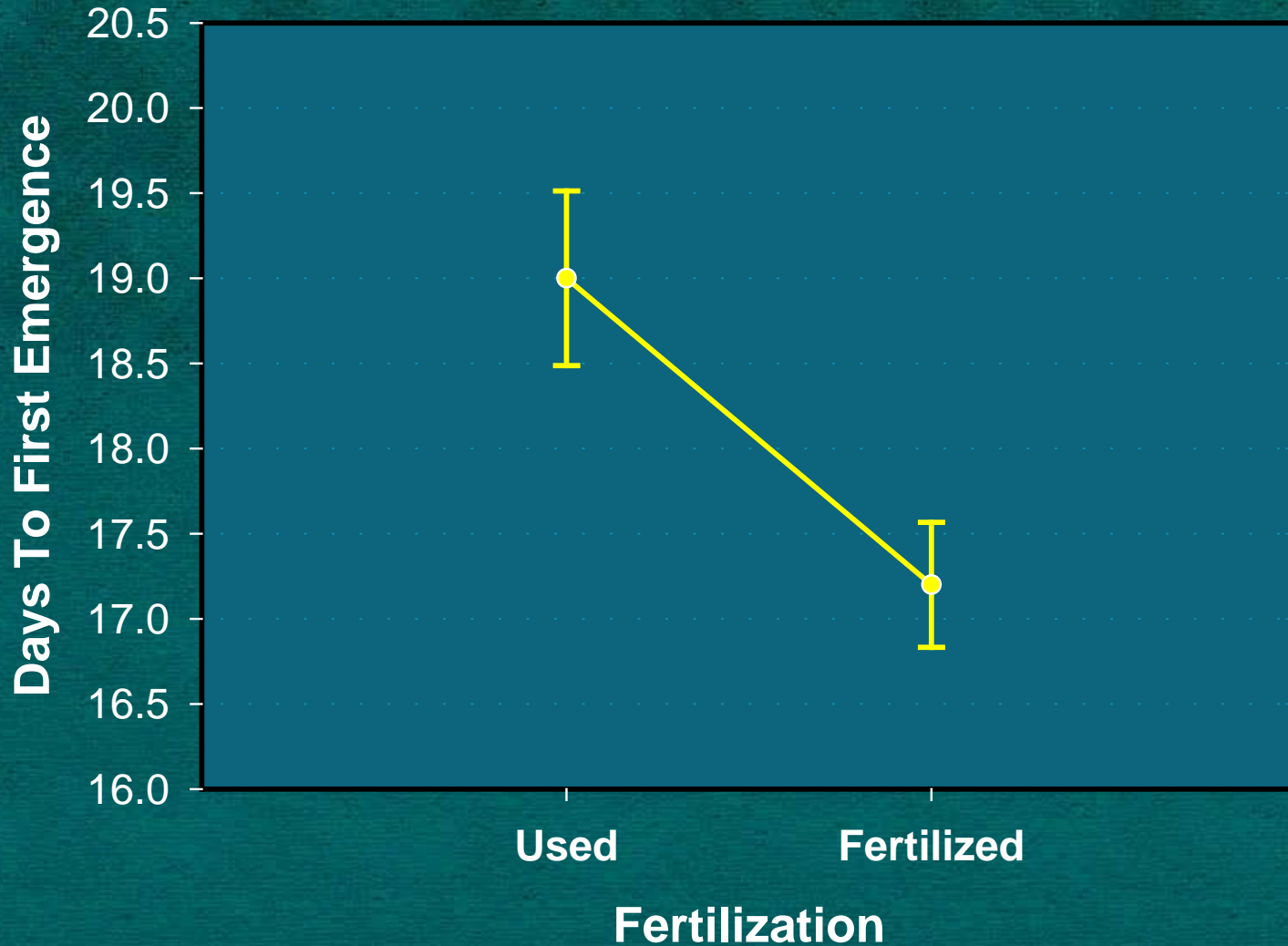
Methods

- In each container:
 - 40 g hydrilla
 - 50 eggs
- Adults removed as emerged
- Small oviposition boxes
 - Counted eggs
 - Assessed crowding
 - Determined fly weight

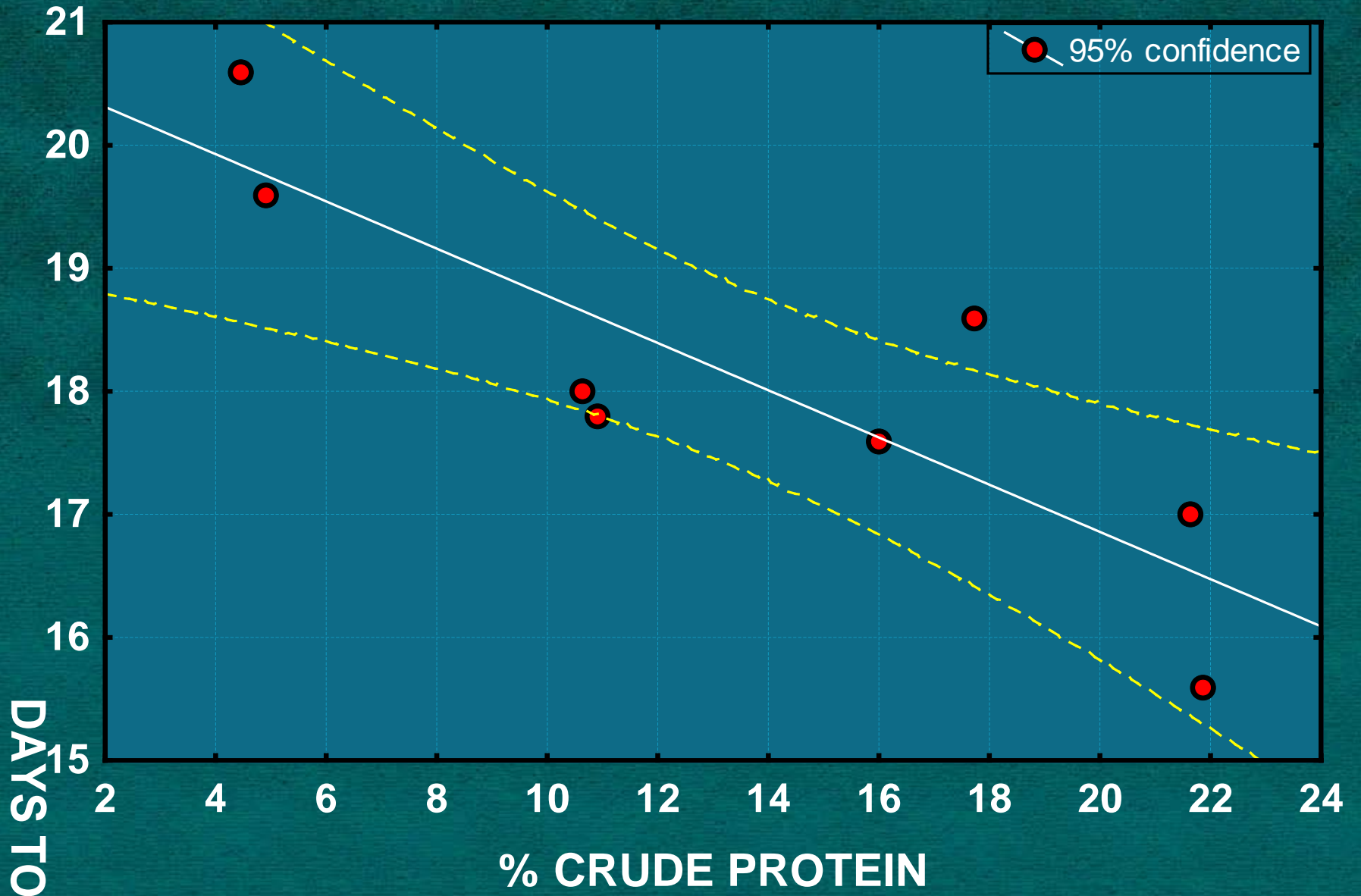


Days to First Emergence

Various fertilization levels



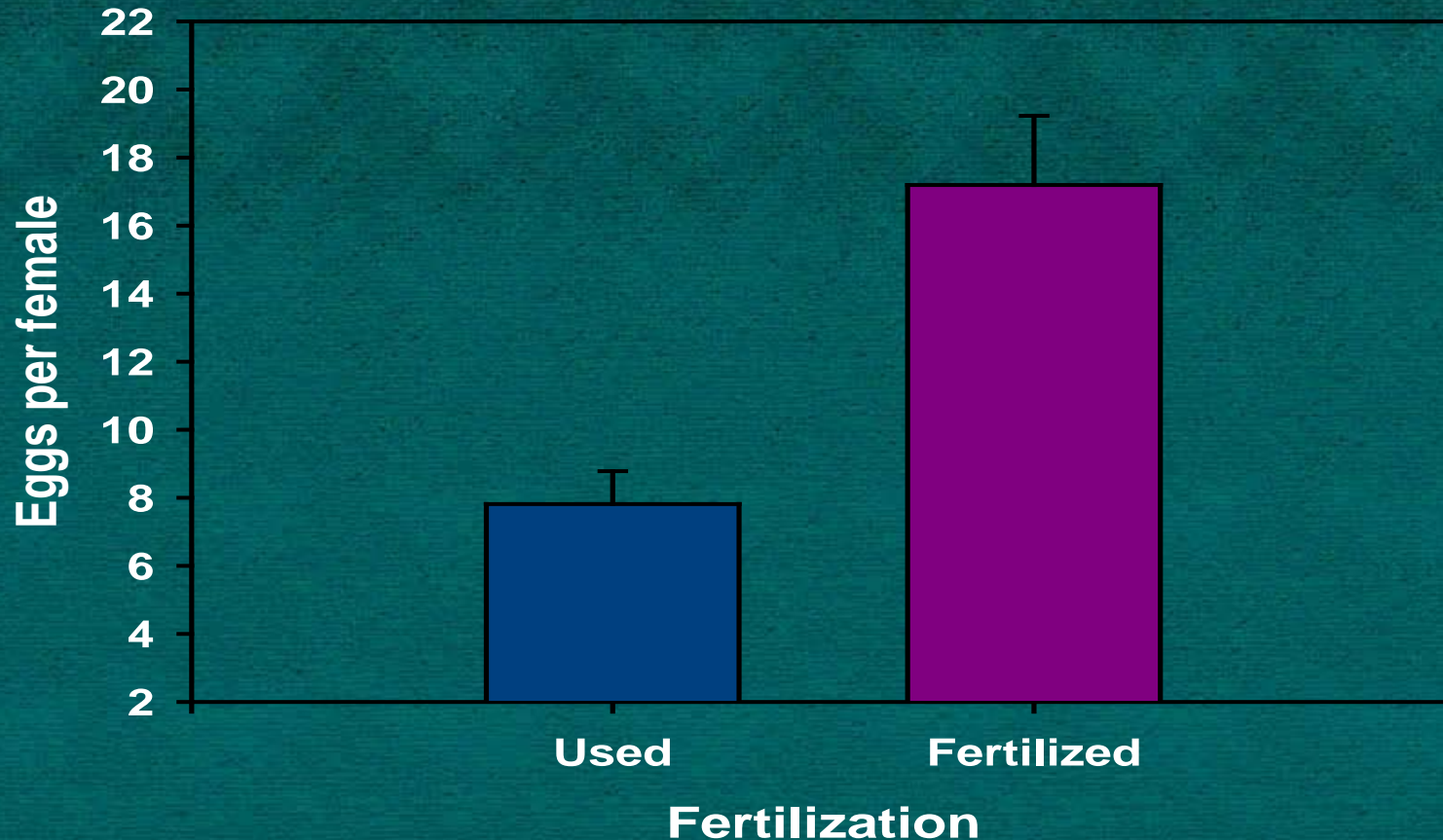
Correlation: $r = -.8573$



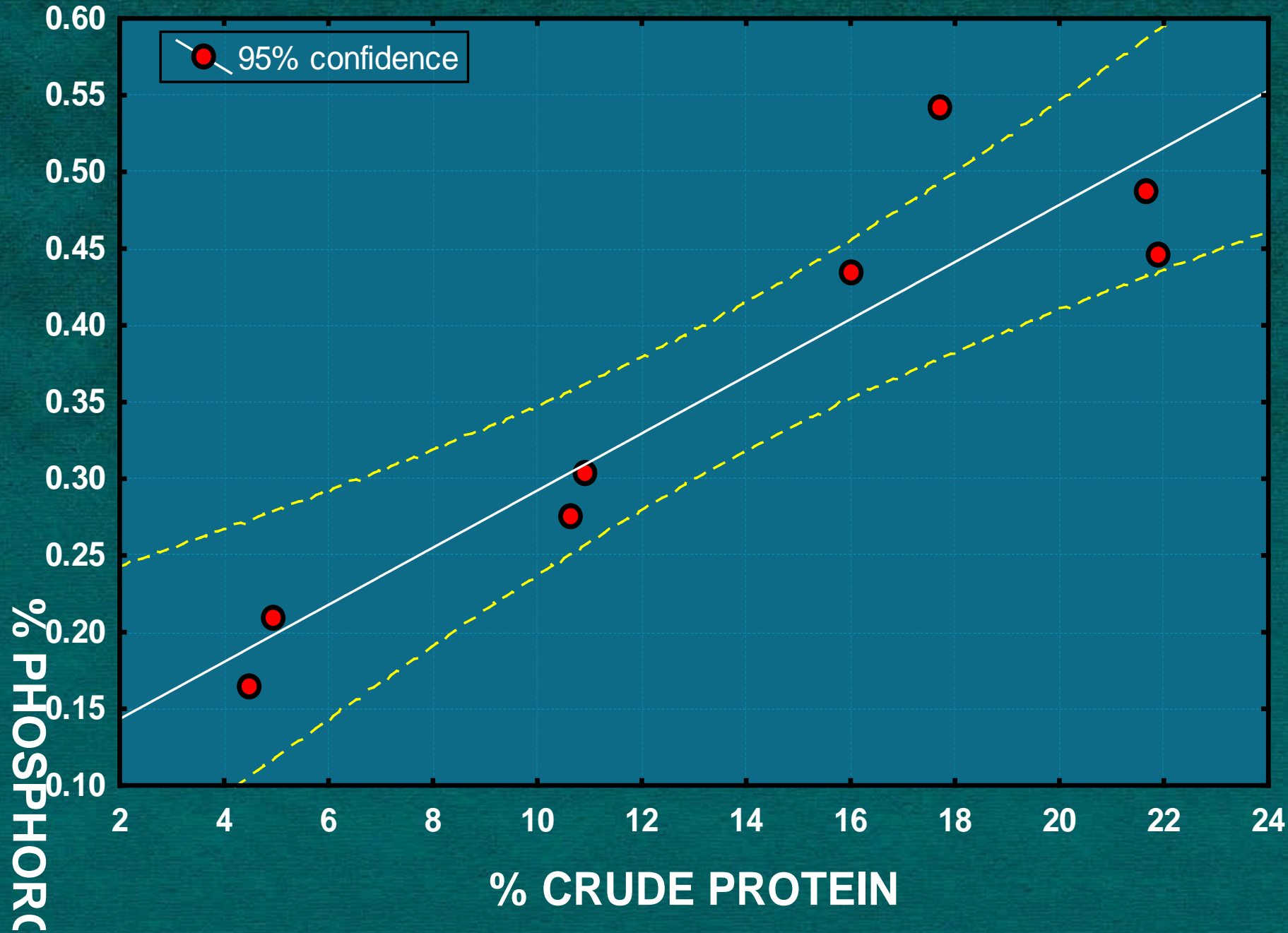
Eggs Per Female

Various fertilization levels

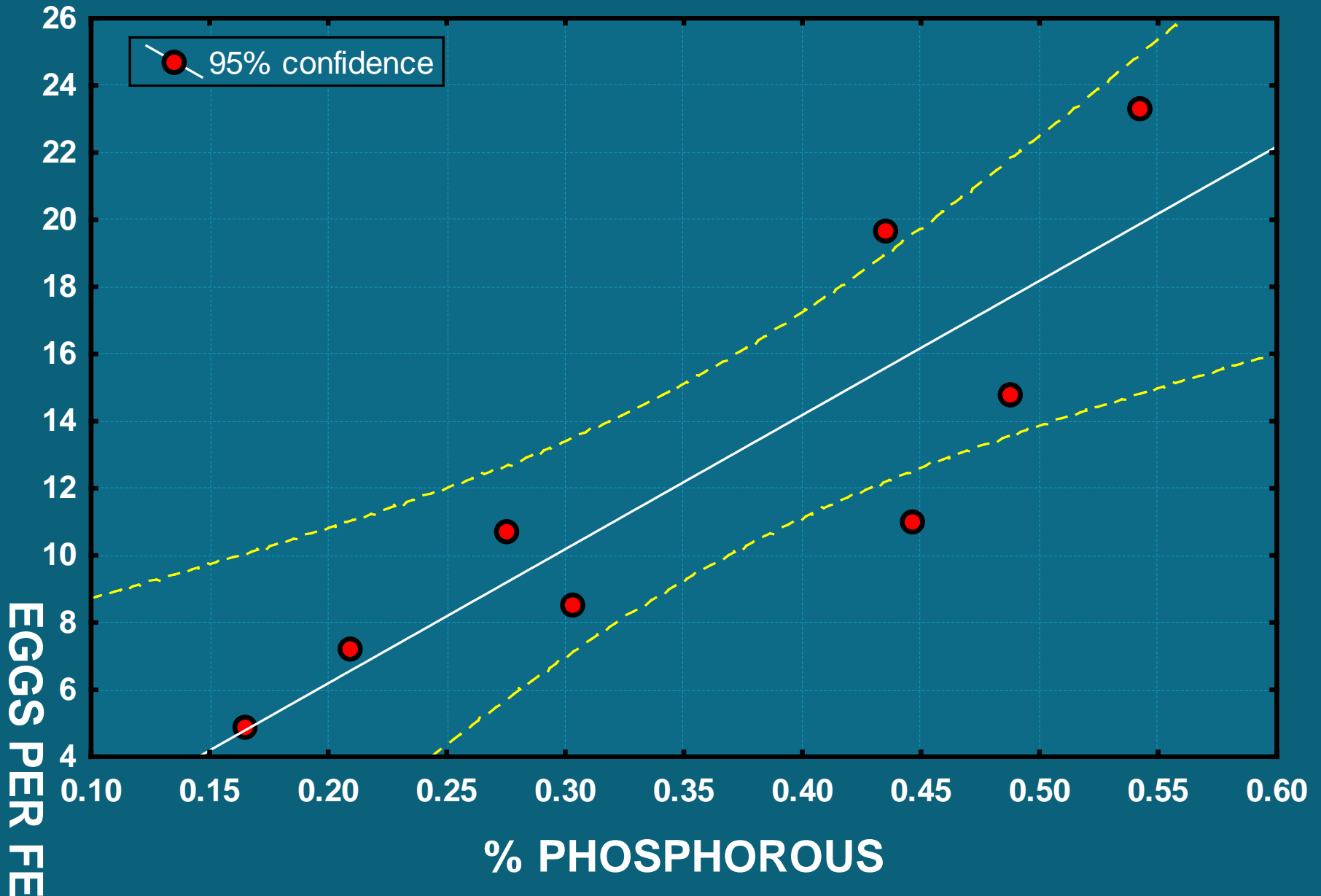
Eggs per female for different fertilization levels.



Correlation: $r = .92688$



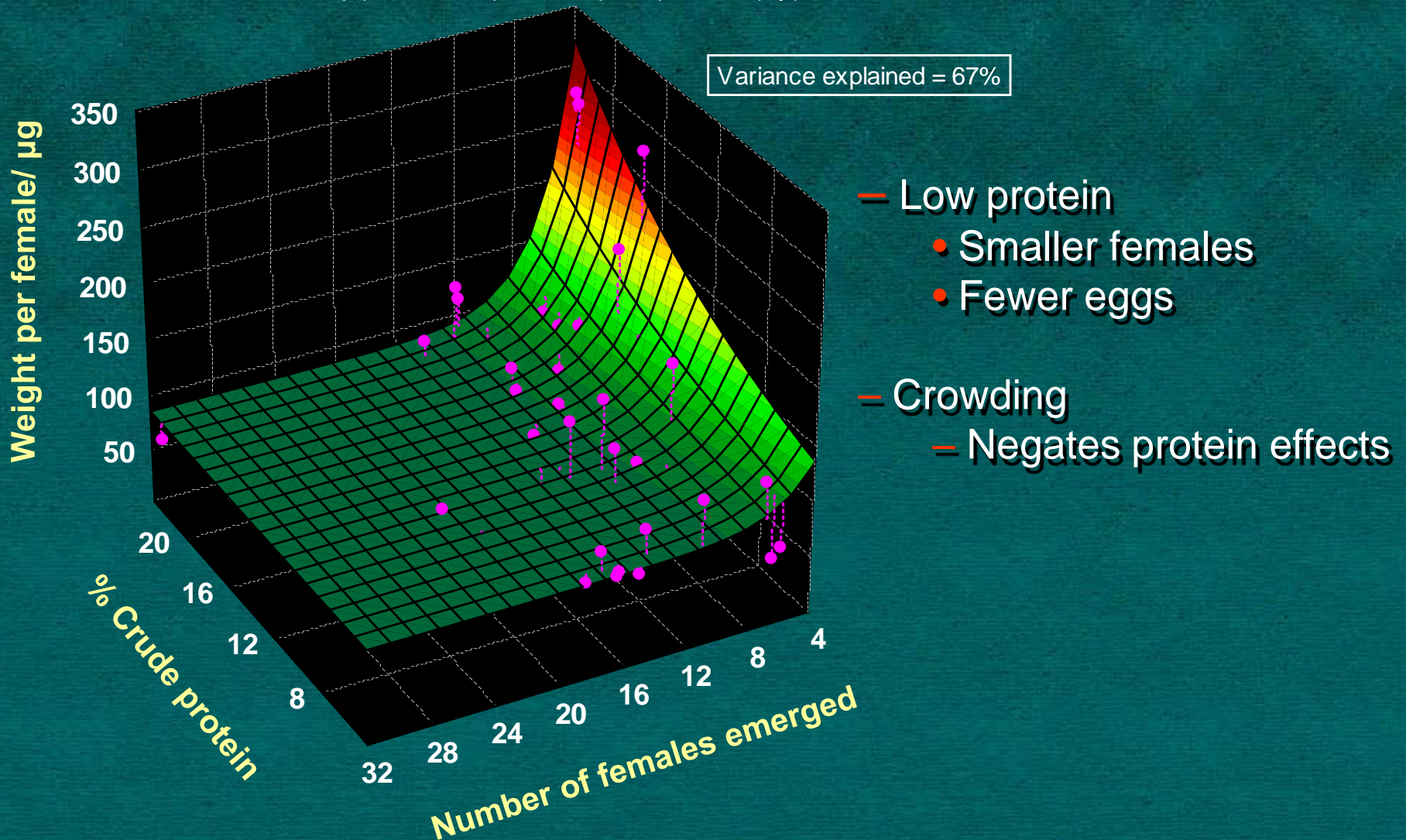
Correlation: $r = .86985$



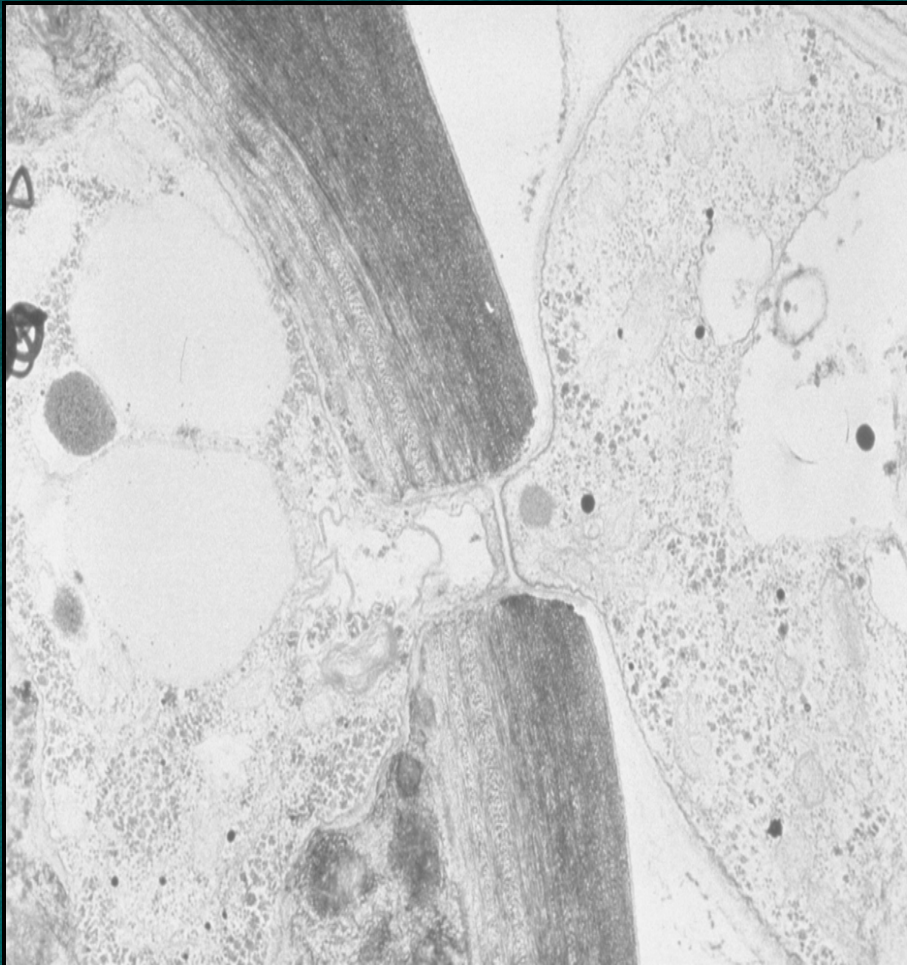
Nutritional influences

Model: Exponential growth ($y=c+\exp(b_0+b_1*x_1+b_2*x_2 \dots)$)

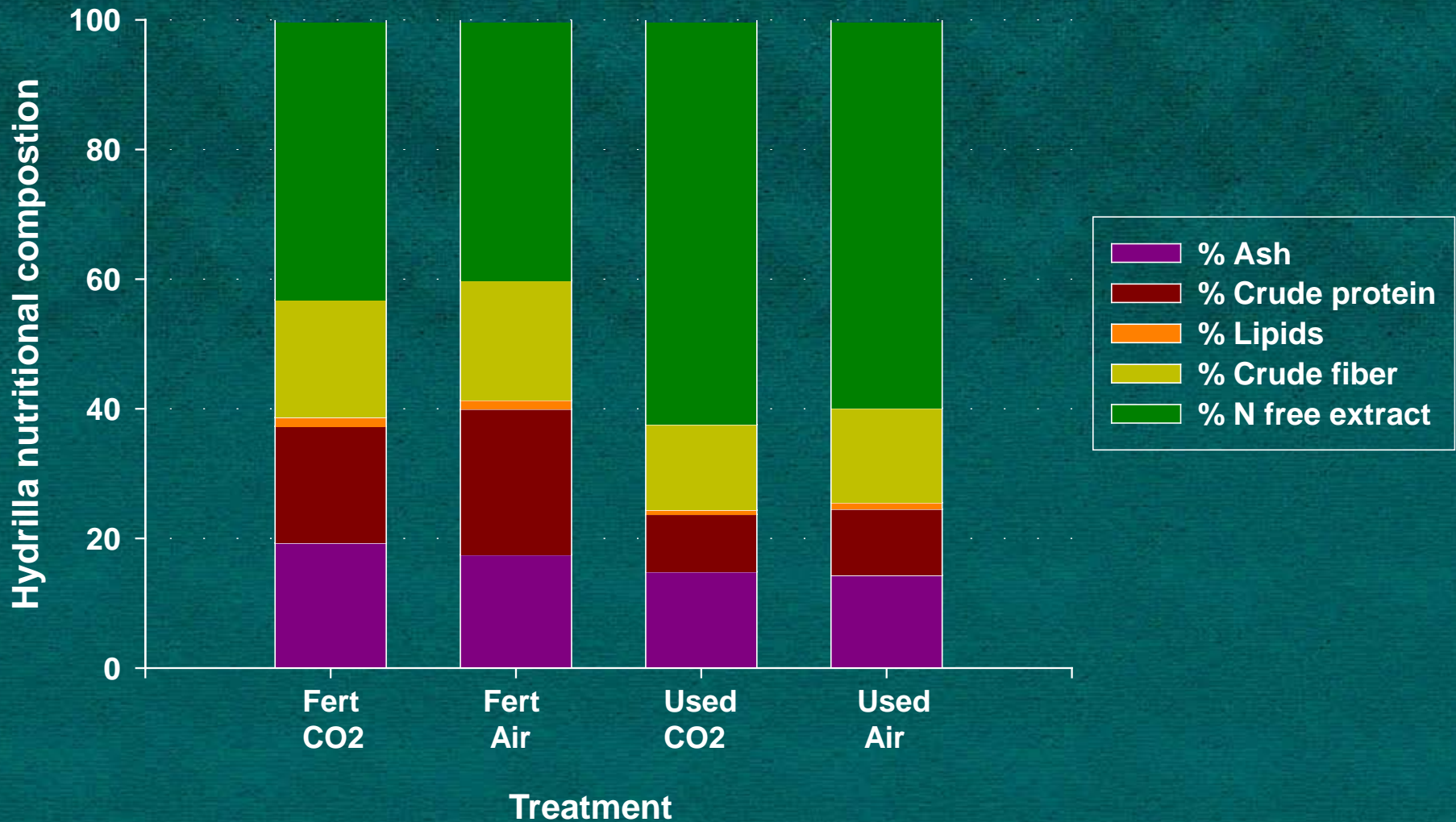
$$z=84.5538+\exp(5.26134+(.081049)*x+(-.41639)*y)$$



Pathogen Experiment



Nutritional composition of hydrilla grown under different treatment regimes.

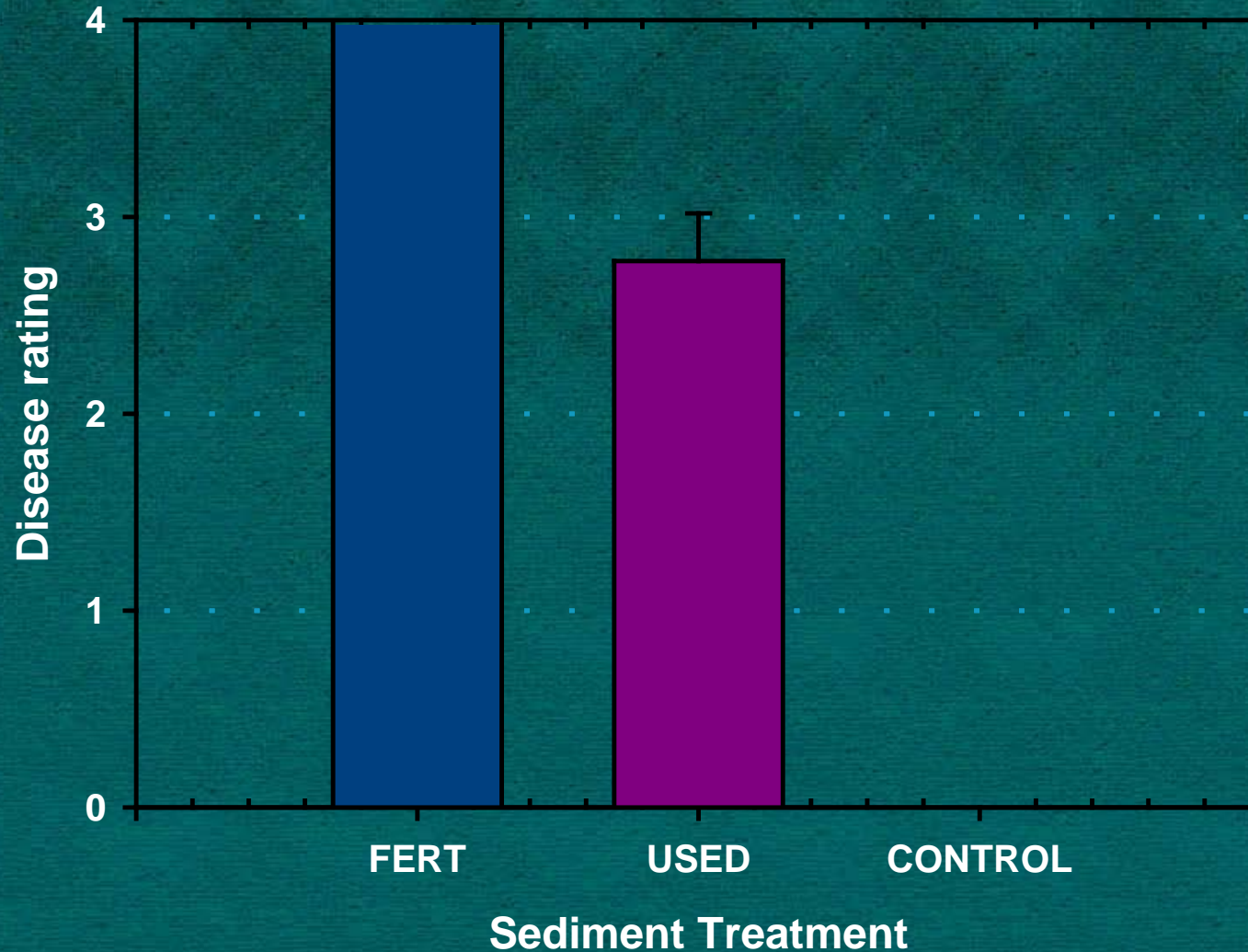


Methods

- In each container:
 - 250 ml flask
 - 150 ml deionized water
 - 1 to 5 cm hydrilla sprig
- Inoculated with:
 - Liquid Mt
 - Rate = 0.1 ml/L

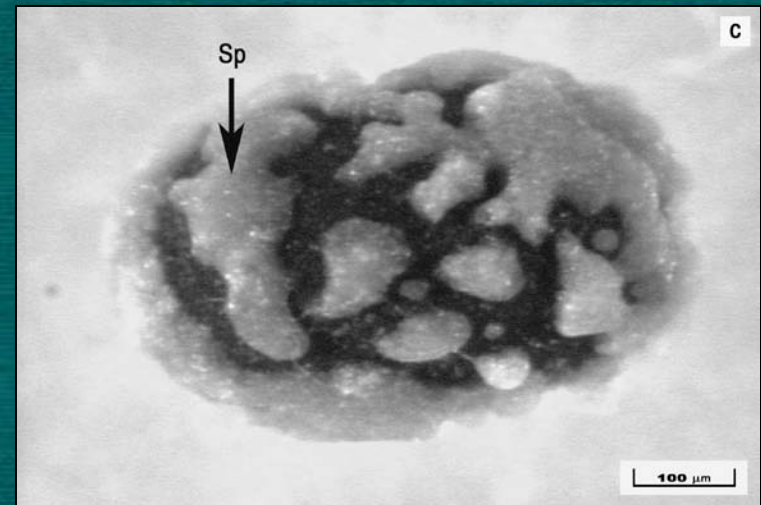


Disease rating of hydrilla sprigs 14 days post inoculation with *Mycoleptodiscus terrestris*: 4 = tissues disintegrated; 3 = chlorotic and flaccid; 2 = chlorotic; 1 = slight chlorosis; 0 = green and healthy

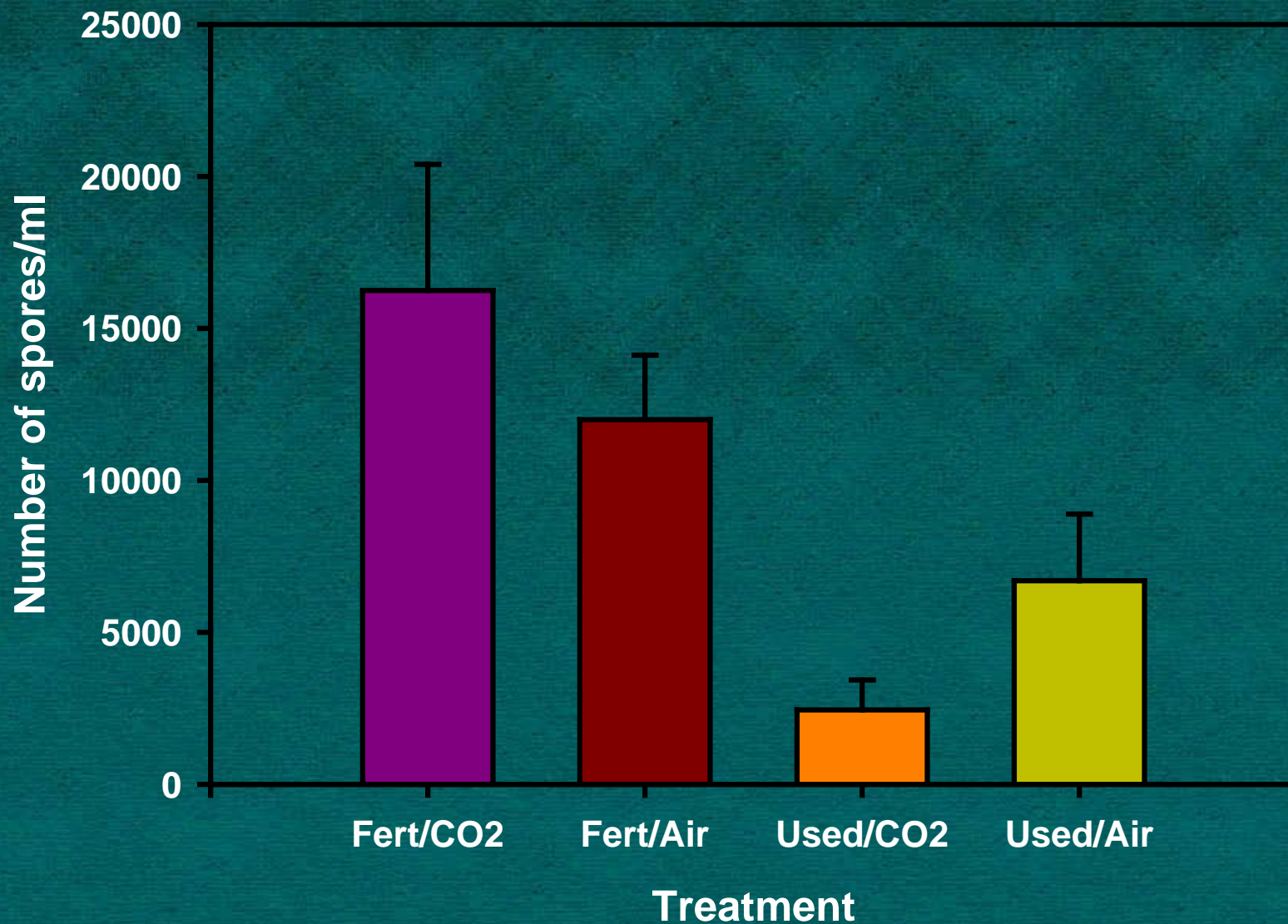


Mycoleptodiscus terrestris

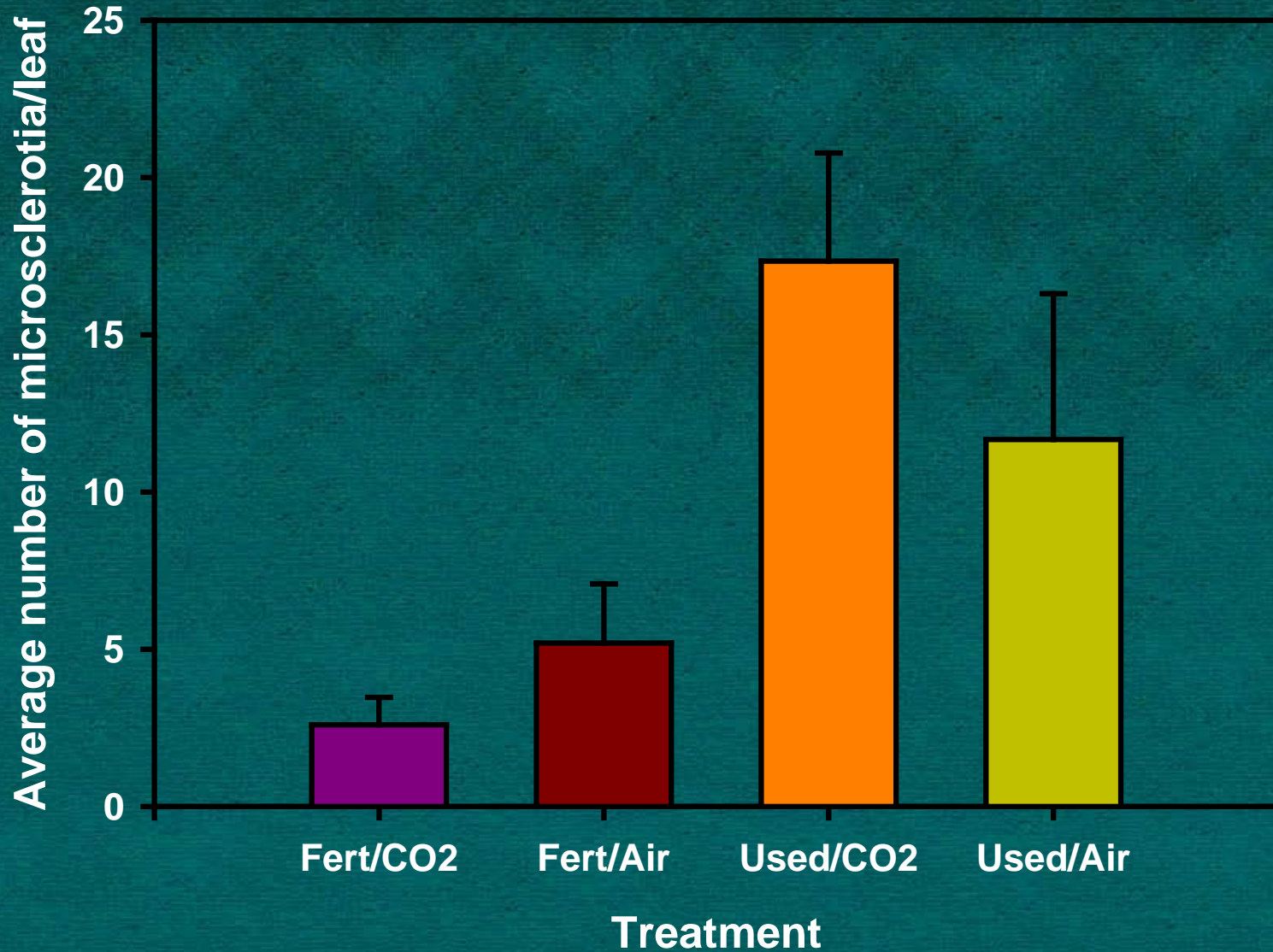
- Two structures
 - Spores
 - Reproduction
 - Unicellular or multicellular
 - Reproductive
 - Distributional cells
 - Microsclerotia
 - Survival
 - Multicellular
 - Hard
 - Resistant
 - Resting body



Number of spores/ml water containing a hydrilla sprig 14 days post inoculation with Mt

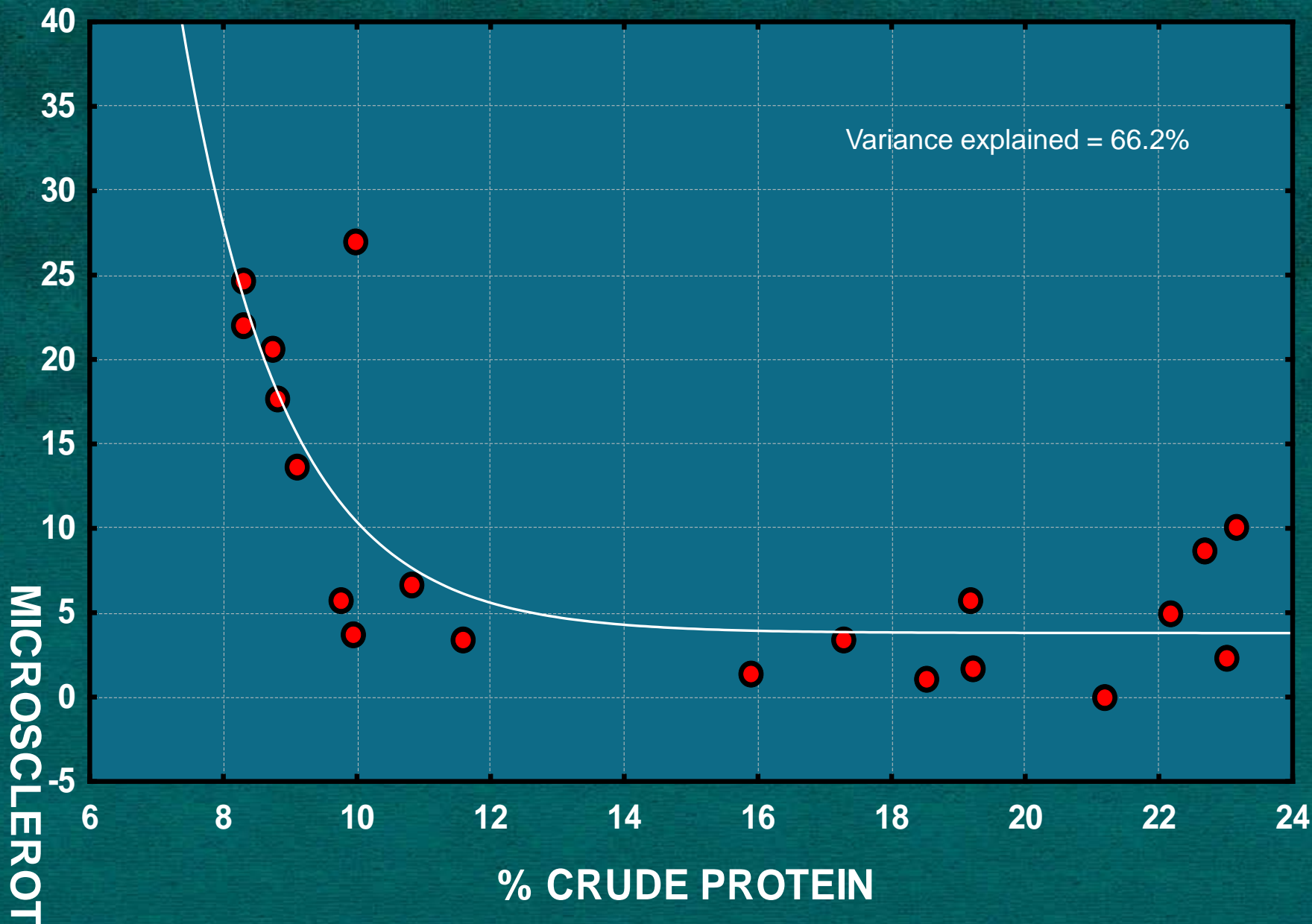


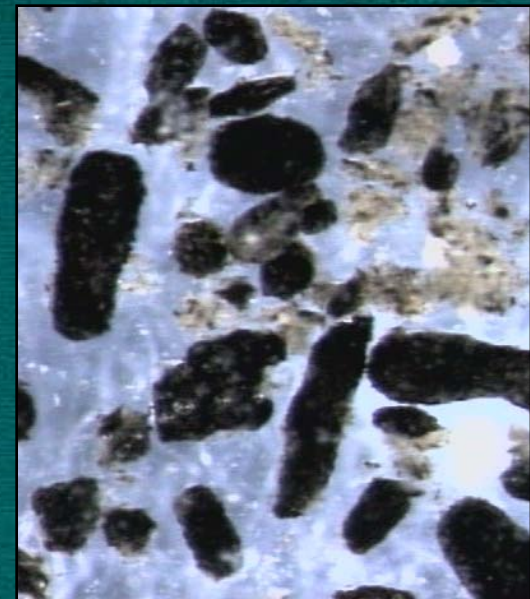
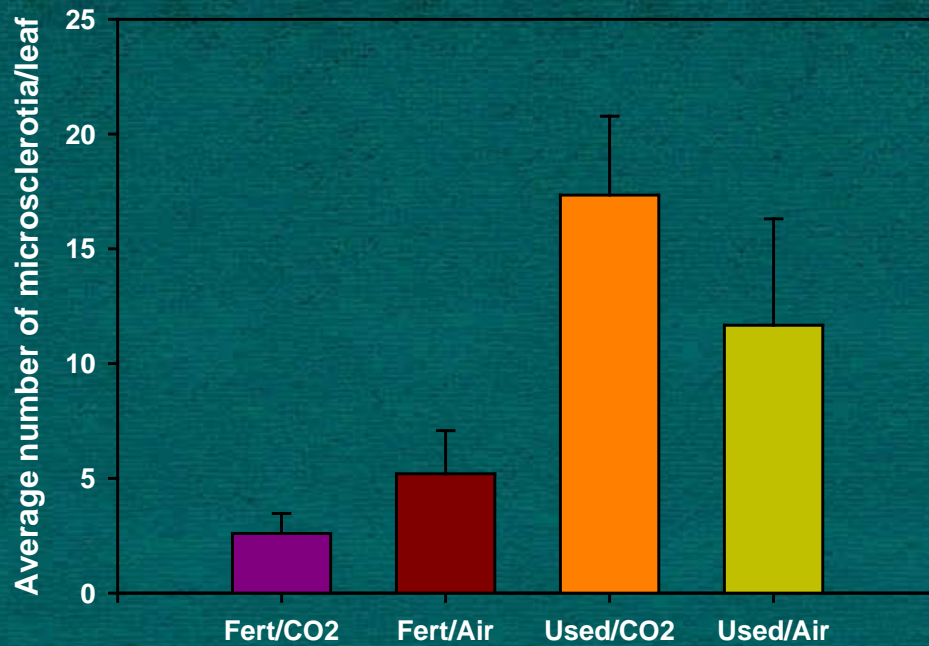
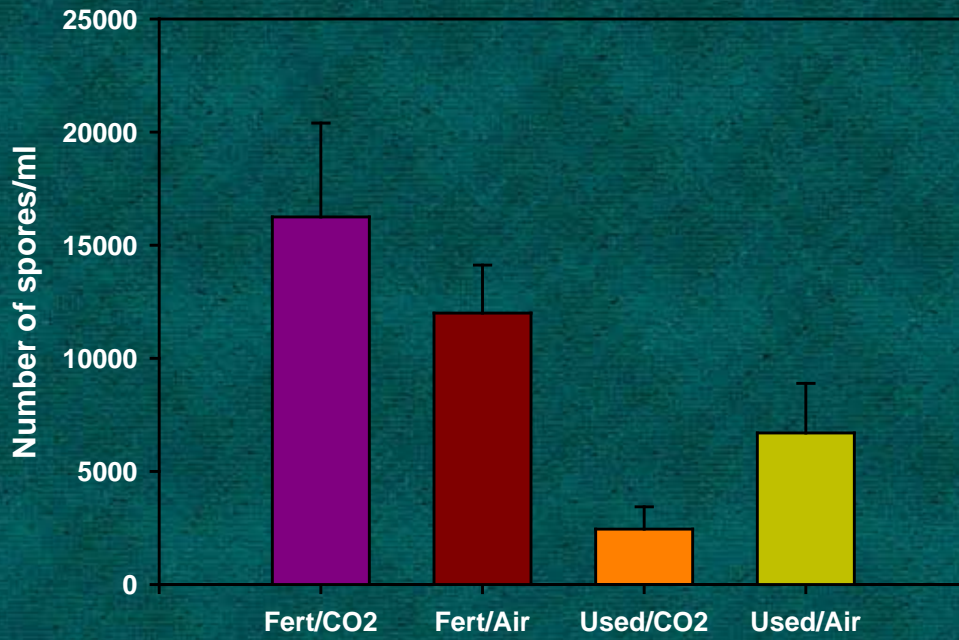
Average number of microsclerotia/leaf 14 days post inoculation with Mt



Model: Exponential growth ($y=c+\exp(b_0+b_1*x_1+b_2*x_2 \dots)$)

$$y=3.7951+\exp(8.38821+(-.6504)*x)$$





Plant nutrition

High protein

- *H. pakistanae*

- Increased eggs



- Increased damage



- *M. terrestris*

- Increased spores



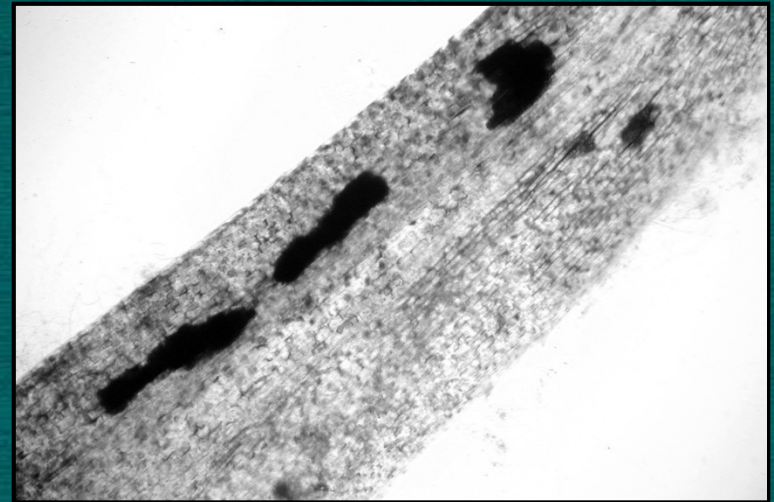
- Increased disease



Plant Nutrition

Low protein

- *H. pakistanae*
 - Fewer eggs
 - Smaller females
 - Promotes insect dispersal
- *M. terrestris*
 - Fewer spores
 - Fewer sporodochia
 - Shift to survival mode



Acknowledgements

- Dwilette McFarland
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