

# Disease Management for Vegetable Production in Florida



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# What is a plant disease?

Any **problem** with a plant that causes

- a reduction in yield OR
- abnormal appearance



# Types of plant disease

- **Non-infectious:**

- can not be spread from a diseased plant to a healthy plant



- **Infectious:**

- caused by living organisms



# Non-infectious disease

- Temperature – low & high
- Water – drought & flooding
- Hail, Wind, Lightning
- Nutrition - deficiency
- Pesticide/Herbicide
- Chemical
- Air Pollution
- Other – soil compaction, high salt





# Infectious disease

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- Caused by a living organism that is capable of infecting healthy plant





# What causes infectious disease?

- causal agents

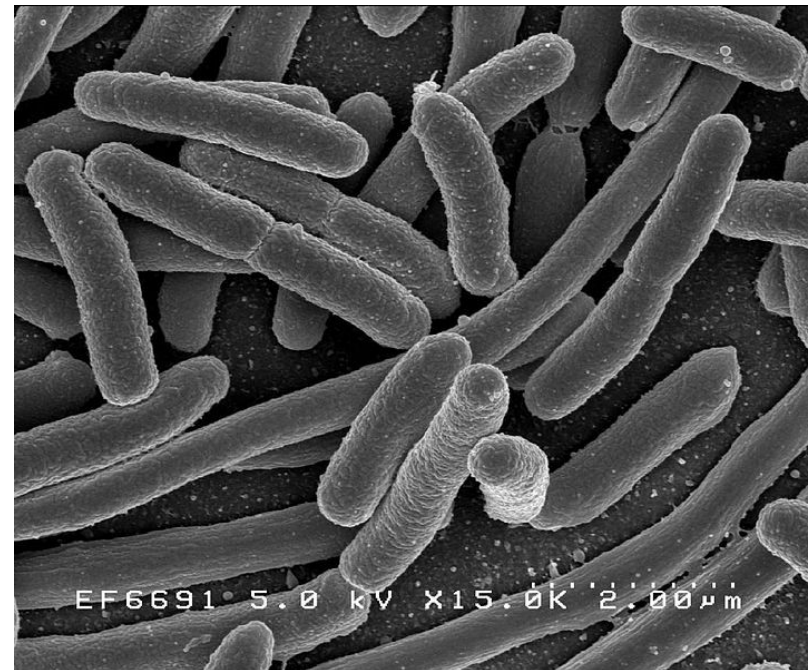
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- Bacterium
- Fungus/Fungal-Like Organism (Oomycete)
- Virus
- Nematode
- Phytoplasma
- Parasitic Seed Plant



# Bacteria

– single-celled pathogens



[http://en.wikipedia.org/wiki/File:EscherichiaColi\\_NIAID.jpg](http://en.wikipedia.org/wiki/File:EscherichiaColi_NIAID.jpg)

<http://www.apsnet.org/edcenter/intropp/PathogenGroups/Pages/Bacteria.aspx>

# Bacterial spot of tomato

(*Xanthomonas perforans*)



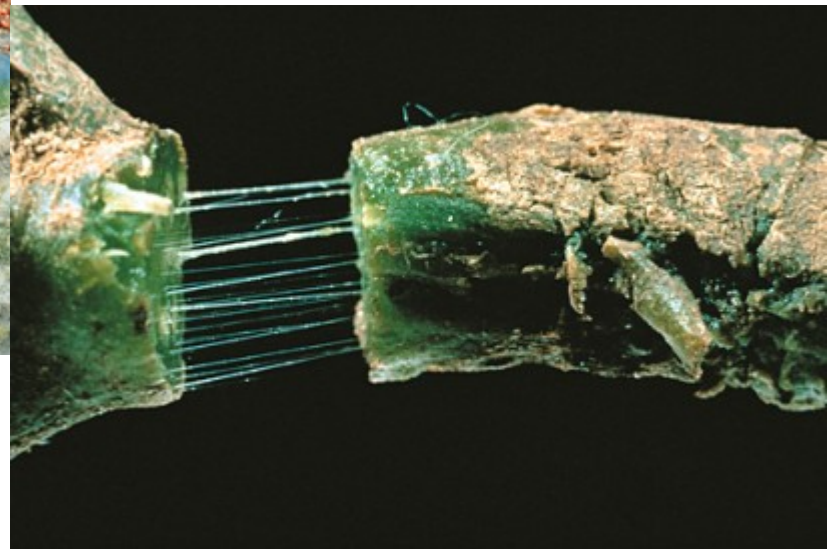


# Bacterial wilt of tomato

(*Ralstonia solanacearum*)



<http://www.apsnet.org/edcenter/intropp/PathogenGroups/Pages/Bacteria.aspx>



# Citrus canker

(*Xanthomonas citri* subsp. *citri*)



# Crown gall

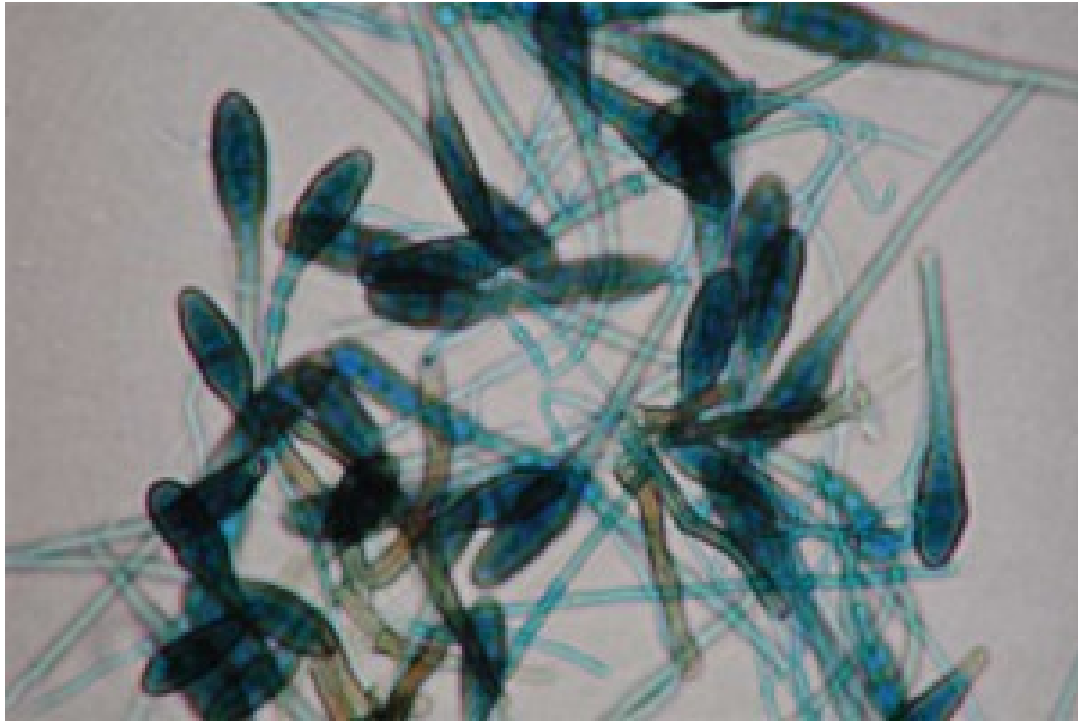
(*Agrobacterium tumefaciens*)

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<http://www.apsnet.org/edcenter/intropp/HungryPlanet/Chapter5/Pages/ImageGallery.aspx>

# Fungi/Fungal-like organisms





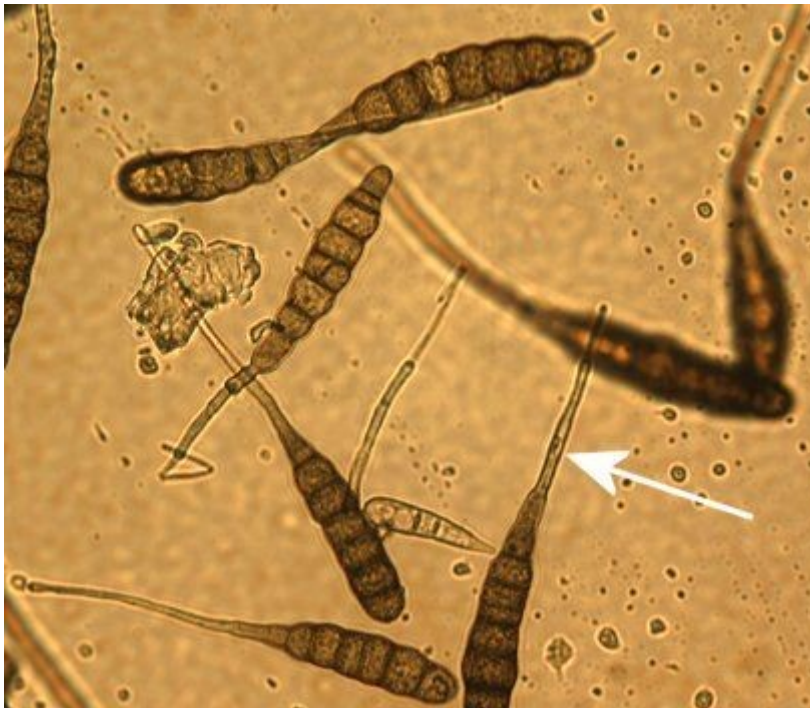
*Botrytis cinerea*  
- conidia & conidiophores

<http://www.apsnet.org/EDCENTER/INTROPP/HUNG RYPLANET/CHAPTER10/Pages/ImageGallery.aspx>



# Early blight of tomato

(*Alternaria solani*)



<http://www.apsnet.org/edcenter/intropp/lessons/fungi/ascomycetes/Pages/PotatoTomato.aspx>

# Downy mildew of cucurbits

(*Pseudoperonospora cubensis*)



- dichotomously branched sporangiophore
- lemon-shaped sporangia

# Late blight of tomato

*Phytophthora infestans* – Great Famine (Ireland)





# Phytophthora blight of squash

(*Phytophthora capsici*)



# Nematodes



<http://www.apsnet.org/edcenter/intropp/lessons/Nematodes/Pages/LesionNematode.aspx>



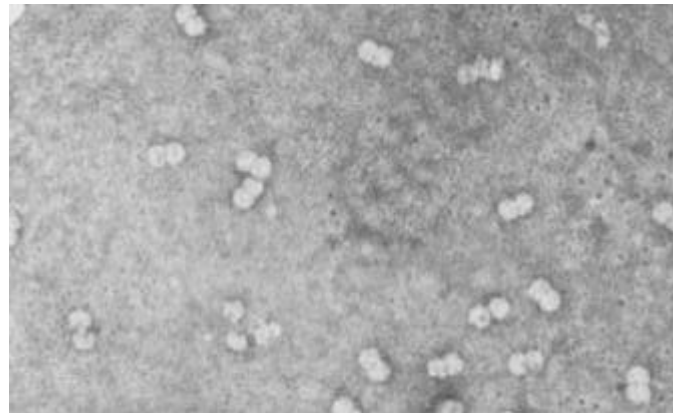
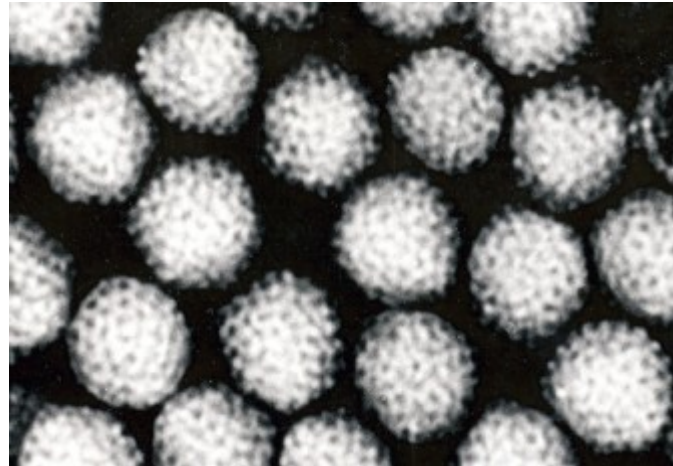
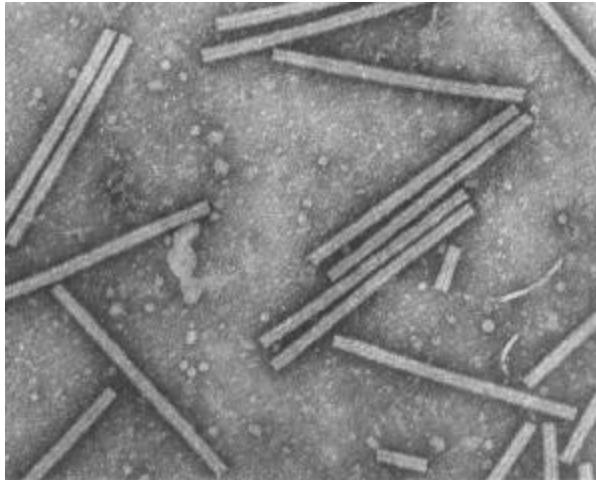


# Root-knot nematode on okra





# Viruses





# Tomato yellow leaf curl virus (TYLCV)



# Bean golden mosaic virus

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# Phytoplasma

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- specialized bacteria that are obligate parasites of plant phloem tissue and transmitting insects (vectors)
- lack of a cell wall

# Aster yellows disease of lettuce

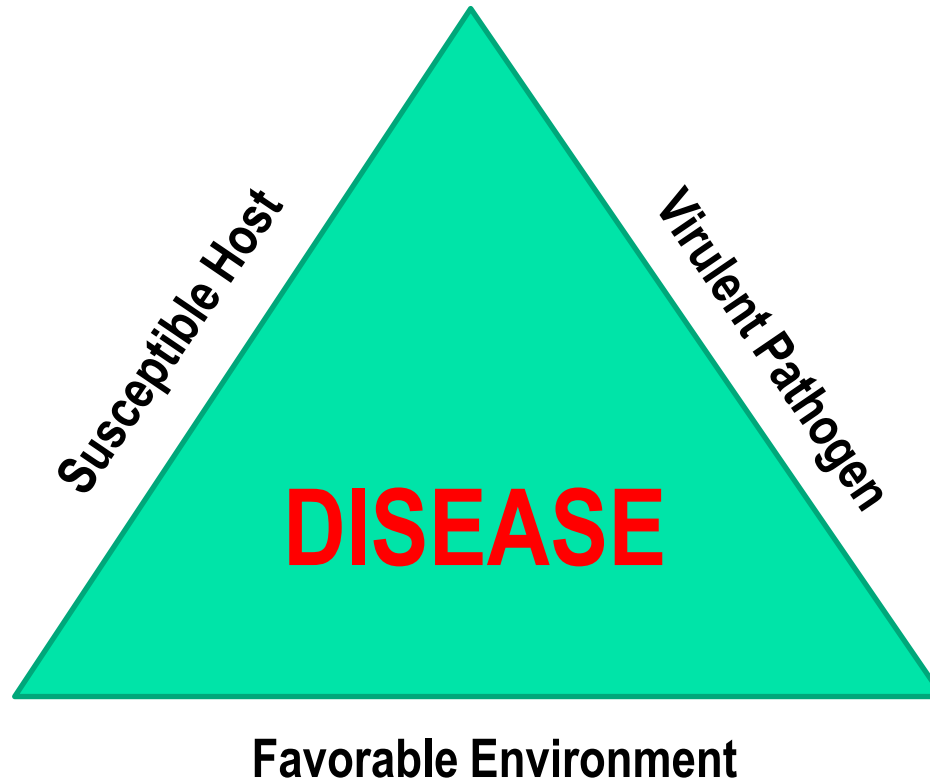


<http://www.apsnet.org/edcenter/intropp/HungryPlanet/Chapter5/Pages/ImageGallery.aspx>



# Disease Triangle

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# Management of vegetable diseases

- Prevention
- Monitoring
- Accurate diagnosis
- Disease thresholds
- Management tools





# Prevention

- Plant materials: seed, transplants
- Irrigation water
- Tools
- Workers



# Monitoring

## ■ Scouting

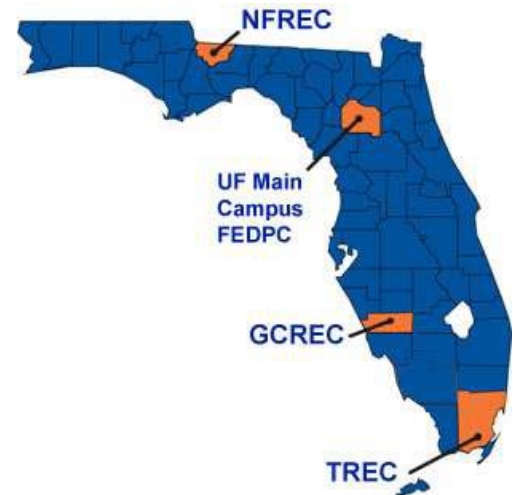
- identify symptom, vector
- review alerts from

diagnostic clinic  
scouting company  
grower magazine  
newsletter



# Diagnosis

- **Timely & Accurate**
  - consult extension agents & diagnostic clinic



# Florida Extension Plant Diagnostic Clinic

Located in Homestead, FL at the UF/IFAS Tropical Research and Education Center



## Plant Diagnostic Form

PLEASE PRINT CLEARLY

TYPE OF CLIENT:  
Arborist | Farmer | Nursery | Lawn care  
Other: \_\_\_\_\_

1

Today's Date: \_\_\_\_\_

Name: \_\_\_\_\_

Company: \_\_\_\_\_

Address: \_\_\_\_\_

City/Zip: \_\_\_\_\_

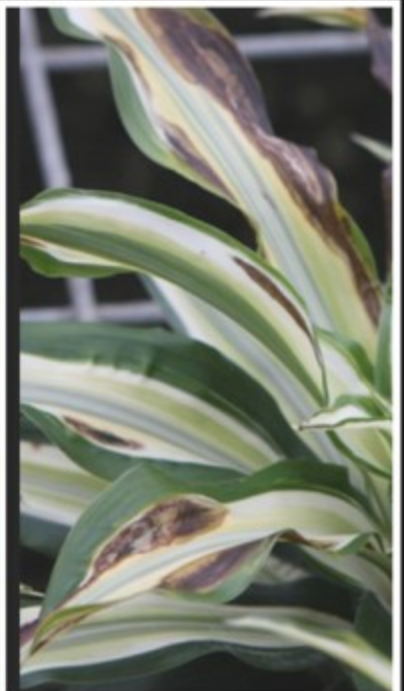
County: \_\_\_\_\_

In addition to submitter listed above send

2

Host Plant Name: \_\_\_\_\_

Cultivar Name: \_\_\_\_\_





# Plant diagnostics - procedures

[illegible]

**Sampling  
Packing  
Submission**

The image shows two pages of a handwritten ledger from the University of California, Berkeley, dated 1962. The pages contain handwritten entries in a ledger format with columns for dates, descriptions, and amounts. The entries are written in cursive and include various dates and descriptions of transactions.

**Page 1 (Left):**

- Header:** UC BERKELEY, 1962, 1962
- Table:**

DATE	DESCRIPTION	AMOUNT
1/1/62	...	...
1/2/62	...	...
1/3/62	...	...
1/4/62	...	...
1/5/62	...	...
1/6/62	...	...
1/7/62	...	...
1/8/62	...	...
1/9/62	...	...
1/10/62	...	...
1/11/62	...	...
1/12/62	...	...
1/13/62	...	...
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1/30/62	...	...
1/31/62	...	...

**Page 2 (Right):**

- Header:** UC BERKELEY, 1962, 1962
- Table:**

DATE	DESCRIPTION	AMOUNT
2/1/62	...	...
2/2/62	...	...
2/3/62	...	...
2/4/62	...	...
2/5/62	...	...
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2/8/62	...	...
2/9/62	...	...
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2/24/62	...	...
2/25/62	...	...
2/26/62	...	...
2/27/62	...	...
2/28/62	...	...
2/29/62	...	...
2/30/62	...	...

## FORMS

**Observation**  
**Symptoms and Sign**  
**APS Manuals**  
**Books**  
**WWW**



## Final Report

**Written**

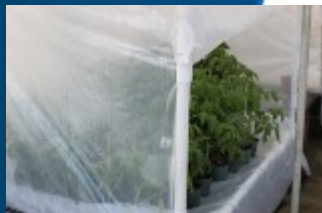
## Call



## Culturing

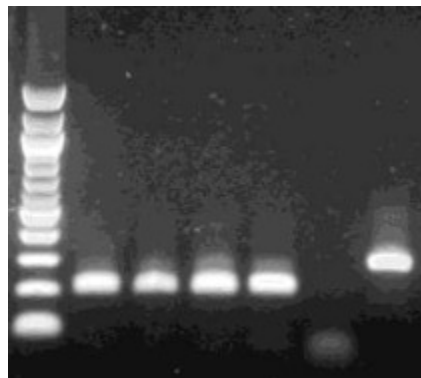
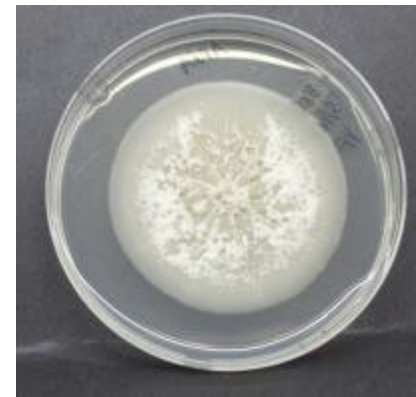
### Moist Chamber

**Expert advise  
(Abiotic, insects)**



**Microscopy**  
**Thin Sectioning**  
**Cellophane Tape**  
**Dissection**  
**Oozing**  
**Kits**







# DDIS

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- Distance Diagnostics and Identification System
- <http://ddis.ifas.ufl.edu/>



# Economic threshold

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- Understand effect of a specific disease on yield loss
- Determine when chemical control is necessary
  - based on the threshold at which level a disease causes a significant yield loss





# Optimal control strategies

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- Crop genetic resistance
- Cultural
- Biological
- Chemical



# Host Resistance

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- affect disease progress by reducing the amount of inoculum
- most economical & effective

TYLCV: South FL

TSWV: North FL



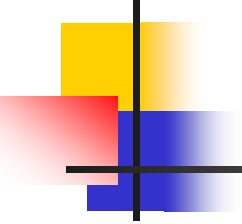
## Cultural Control

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- reducing the primary inoculum via sanitation, OR
- reducing the rate of disease increase by modifying the crop environment

### **Inoculum reduction**

- remove infected plant
- destroy alternative host

- 
- 
- prune to remove infected parts
  - clean tool
  - rotate crops
  - change practices (drip irrigation)
  - use disease free seed and propagating material
  - sterilize soil (steam treatment, solarization)



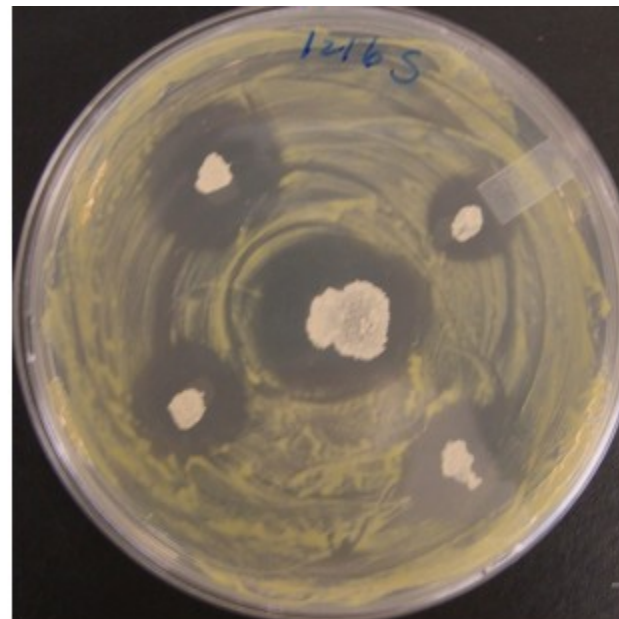
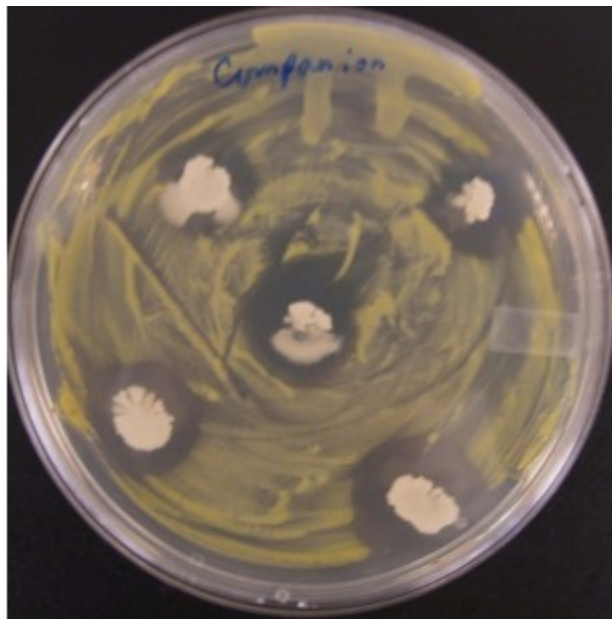




# Biological Control

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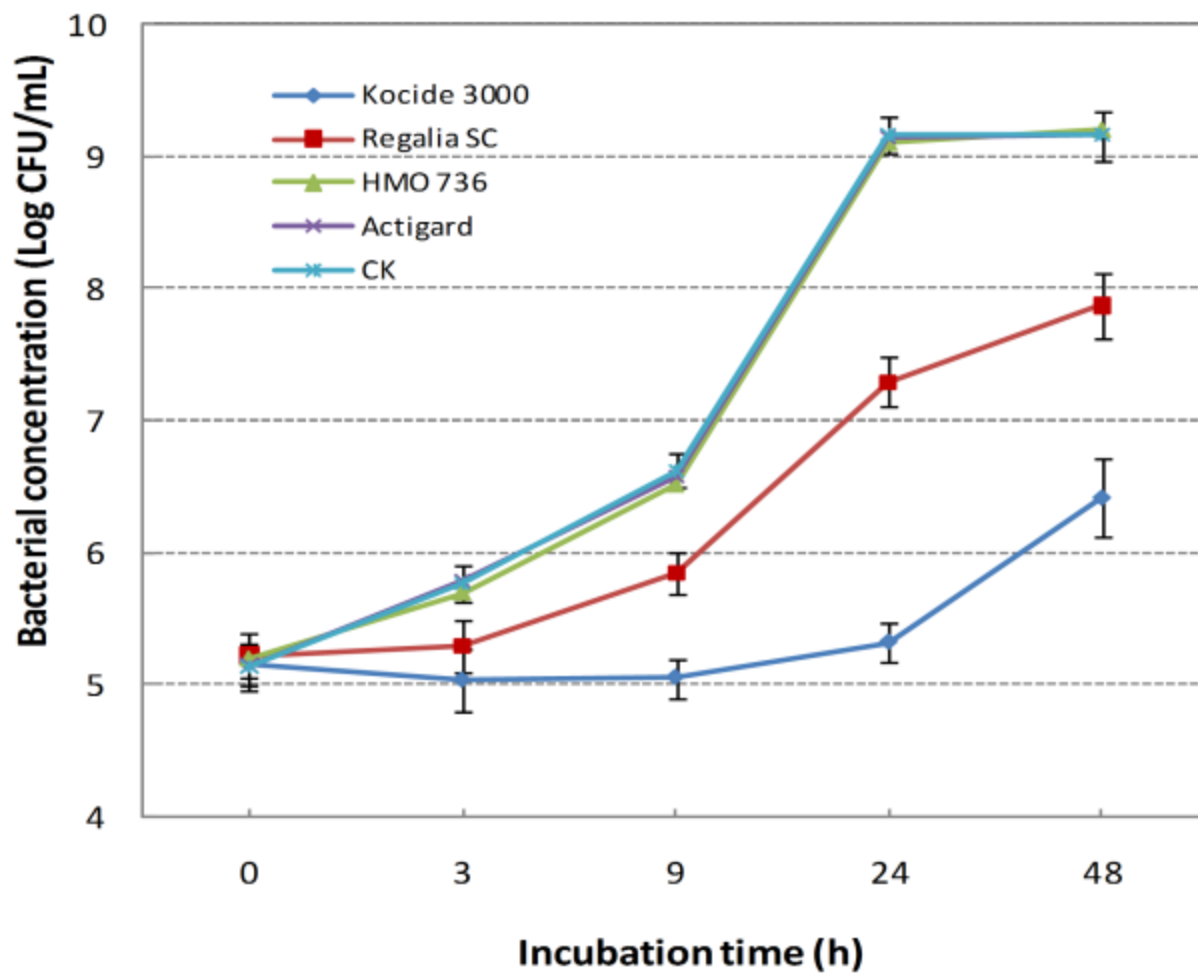
- affects the rate of pathogen buildup
  - Parasite
  - Competitor – nutrition & space
  - Antibiosis
  - Induction of host resistance



**Fig. 3.** Antibiosis of the isolate from biological product Companion® (left) and BU EXP 1216S (right) against *X. perforans* on NA plates.



**Induced resistance in tobacco to CMV by a PGPR strain (B) vs. control (A)**

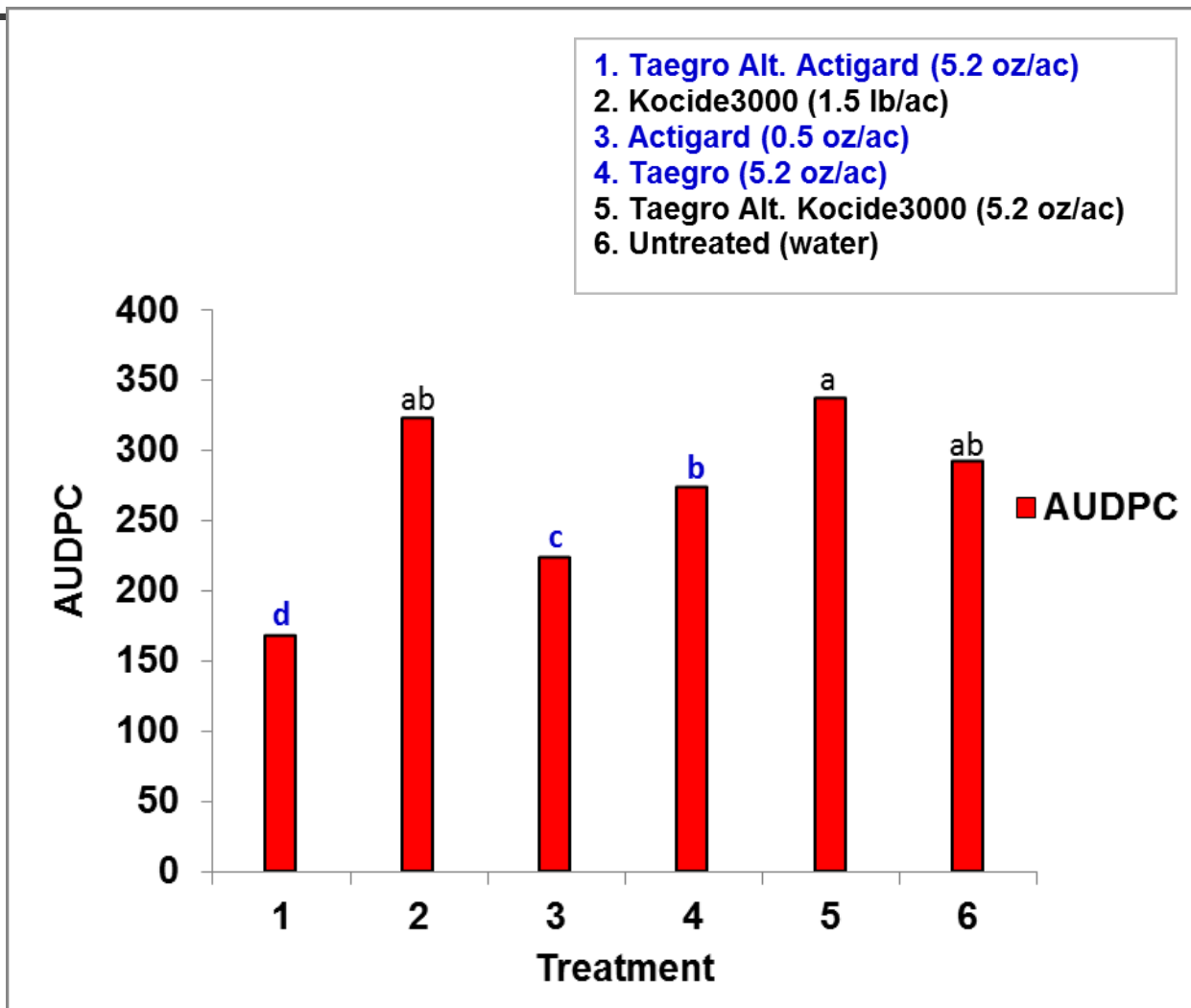


**Fig. 4.** *In vitro* effect of the biological products on growth of *X. perforans* compared to the bactericide (Kocide 3000) and control (CK).



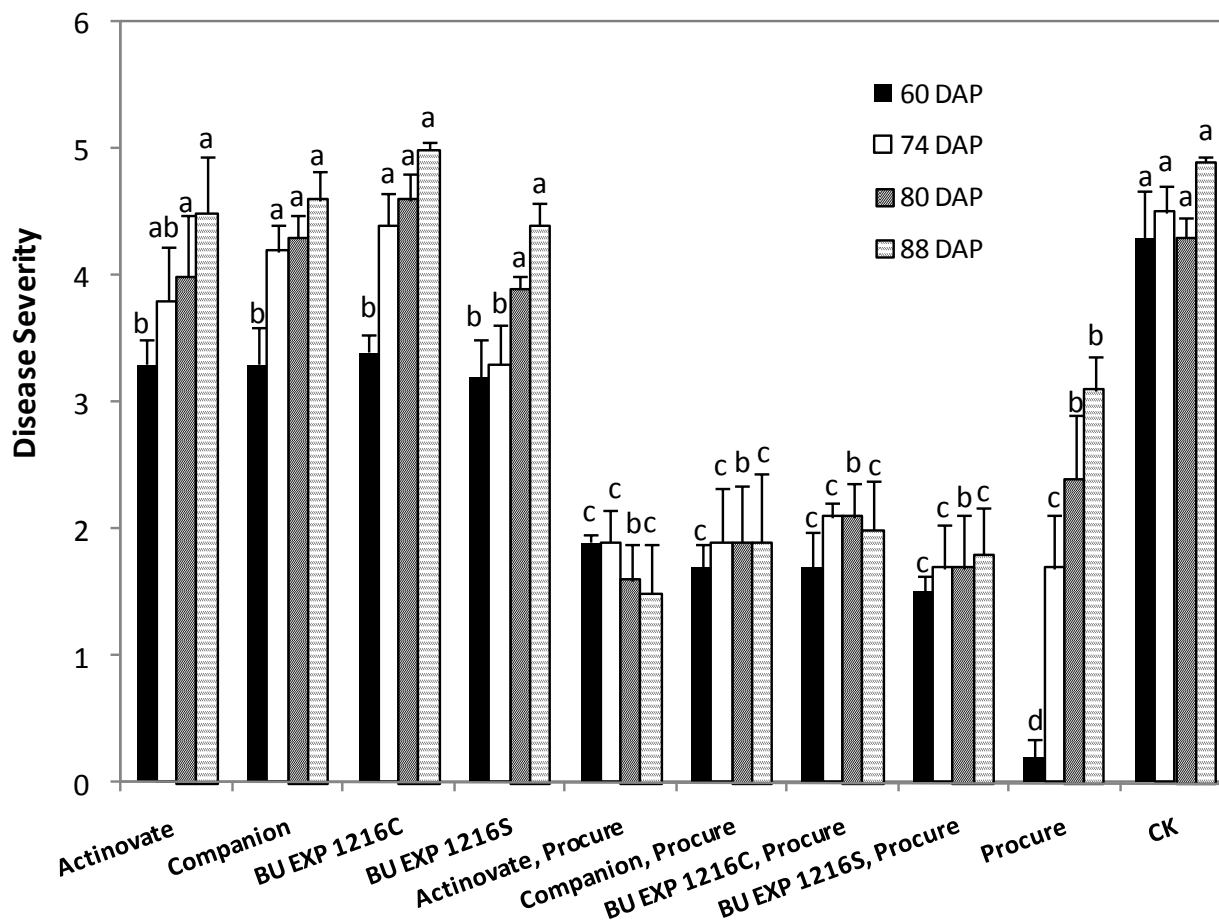
# Bacterial spot of tomato

(Homestead, 2012-2013)



# Powdery mildew on squash

## (Homestead, 2009-2010)



# Chemical Control

- affect the amount of inoculum available at the beginning of the season (i.e., soil fumigation) and/or reduce the rate of disease development
- Why: - kill pathogen
  - delay/stop pathogen growth
- Fungicides: protectant & systemic



# Considerations

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- Accurate identification of the pathogen  
e. g. PM vs. DM in bitter melon
- Life cycle of pathogen
- Proper timing
- Temperature
- Moisture
- Beneficials
- Residue of fungicide
- Right chemical



# Resistance Management

Fungicides must be used based on recommended fungicide resistance management strategies:

<http://edis.ifas.ufl.edu/pi131>

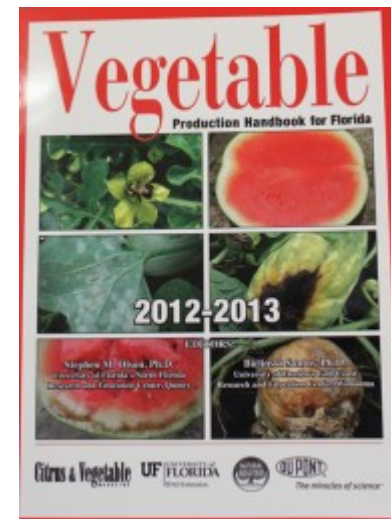


[http://www.huffingtonpost.com/2012/08/17/gmo-label-pesticides-health-proposition-37\\_n\\_1797609.html?utm\\_hp\\_ref=pesticides](http://www.huffingtonpost.com/2012/08/17/gmo-label-pesticides-health-proposition-37_n_1797609.html?utm_hp_ref=pesticides)



# References

- M. Paret, N. Dufault, T. Momol, J. Marois, and S. Olson. Integrated Disease Management for Vegetable Crops in Florida. <http://edis.ifas.ufl.edu/pp111>.
- Vegetable Production Handbook for Florida





# **Thank you !**

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