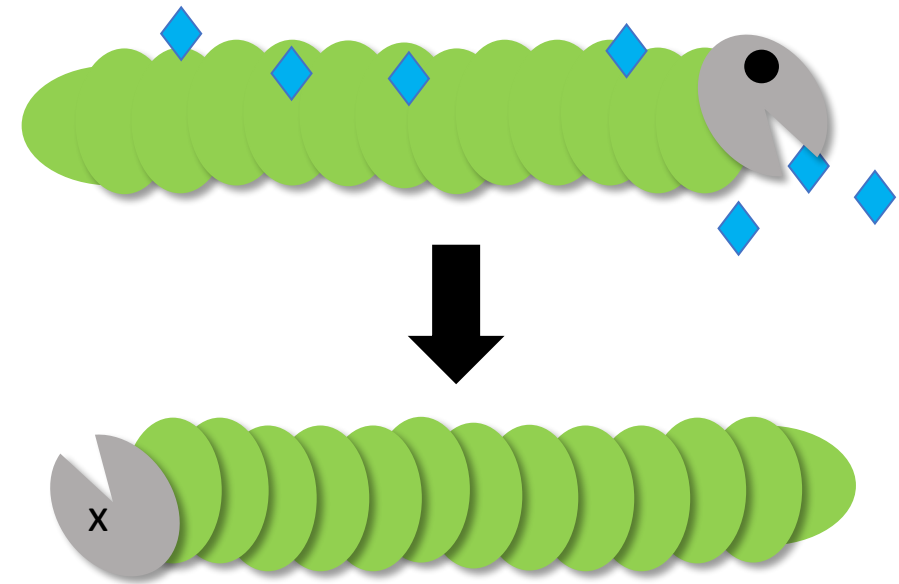


Get the best from biopesticides

Amara Dunn
Biocontrol Specialist, NYS IPM
December 13, 2022



**What do you think (hope)
you will learn today?**



“Experting...is devoting time to learning something and constantly practicing engaging with that topic.”

(Sam Killermann & Meg Bolger in Unlocking the Magic of Facilitation)

What I have planned for today:

- Modes of action of biopesticides
- Practical implications of MOAs
- What would you like to learn?

**Please ask
questions any
time!**

**I will ask you to
participate.**

A few definitions...

- "Insect" = insects + mites (arachnids)
- Pathogen = microbe that causes disease on plants
- Microbe = bacteria, fungi, viruses
- Pest = insects + plant pathogens

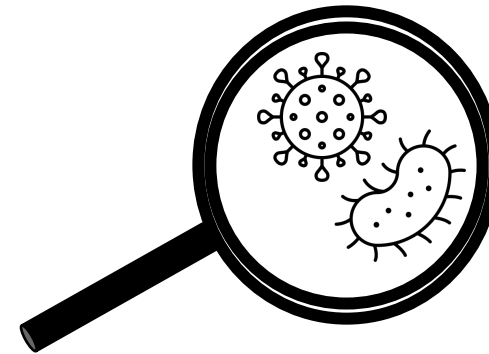
- Biopesticides...

Biopesticides are made from (active ingredient):

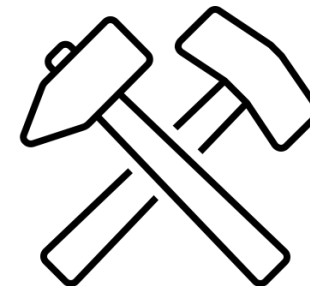
Plants



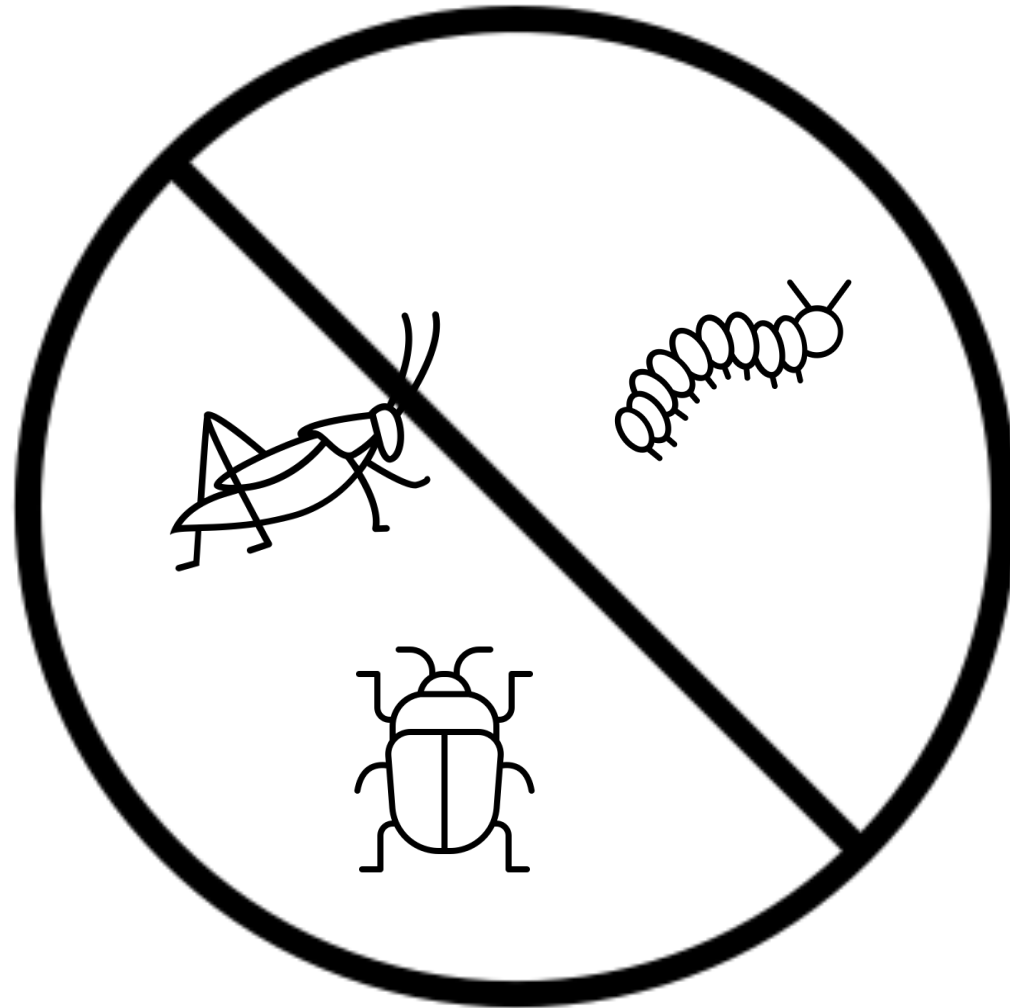
Microbes



Some natural minerals or chemicals



Biopesticides control pests



Biopesticides are pesticides

- The label is the law. Read and follow it.

Net Contents:
2.5 Gallons / 250 Gallons
EPA Reg. No. 70051-107

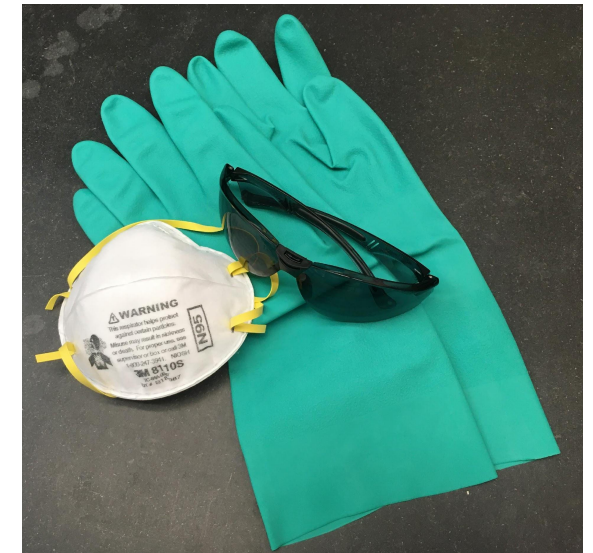


KEEP OUT OF REACH OF CHILDREN
CAUTION

ENVIRONMENTAL HAZARDS

For terrestrial uses: Do not apply directly to water, or to areas where surface water is present, or to intertidal areas below the mean highwater mark. Do not contaminate water when disposing of equipment washwater or rinsate.

This product **may be harmful to bees and other pollinating insects** exposed to direct treatment. Do not apply this product while bees or other pollinating insects are actively visiting the treatment area.



Biopesticide MOAs

- **Eat** - live microbe grows on/in pest
- **Poison** - biopesticide (or its products) kills the pest directly
- **Keep out** - live microbe grows on plant, leaving no room for pests
- **Turn on resistance** - turns on the plants' defenses before pest attacks
- **Grow strong plants** - makes plant stronger, healthier, more resilient
- **Repel** - pest avoids plants treated with biopesticide
- **Stop feeding** - stops pest from feeding; pest eventually starves
- **Stop growth** - stops pest from growing or molting; pest eventually dies
- **Stop reproduction** - hampers pest's ability to find a mate or produce eggs

Some notes about the pictures you'll see:

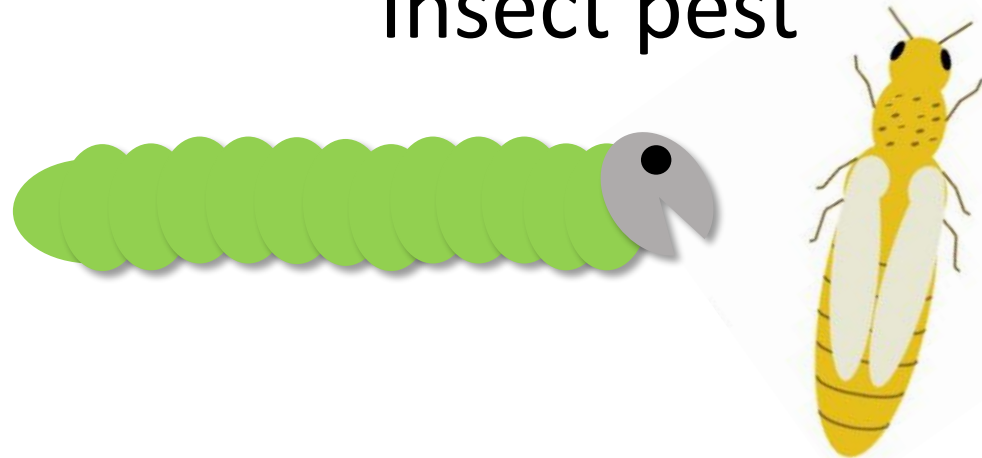
Pathogen

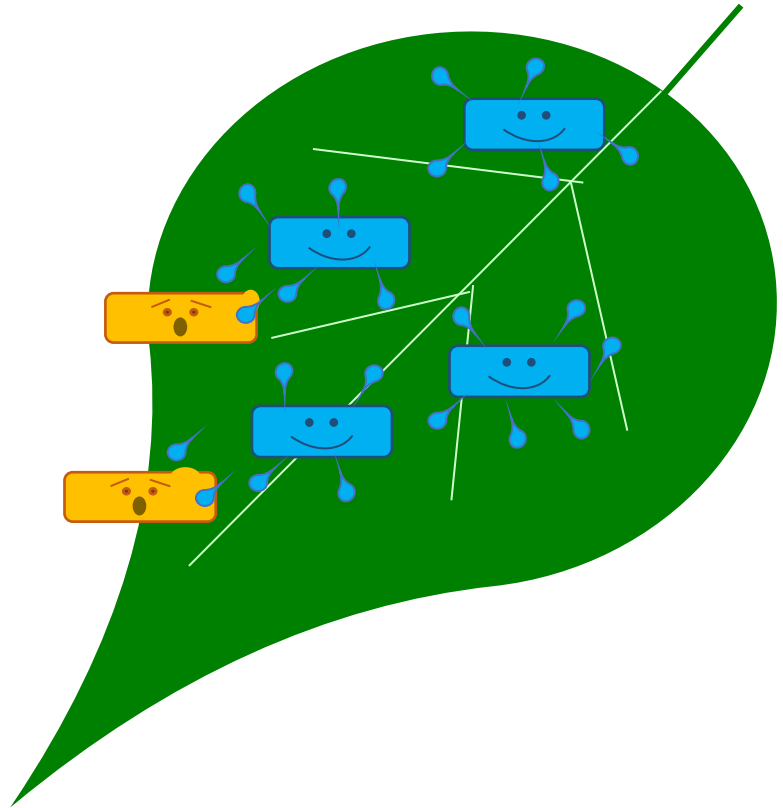
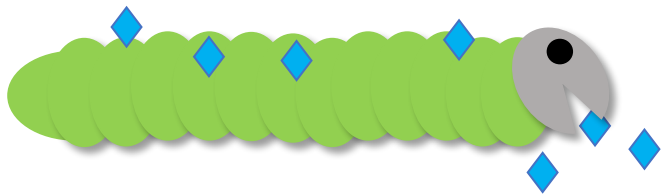


Biofungicide



Insect pest

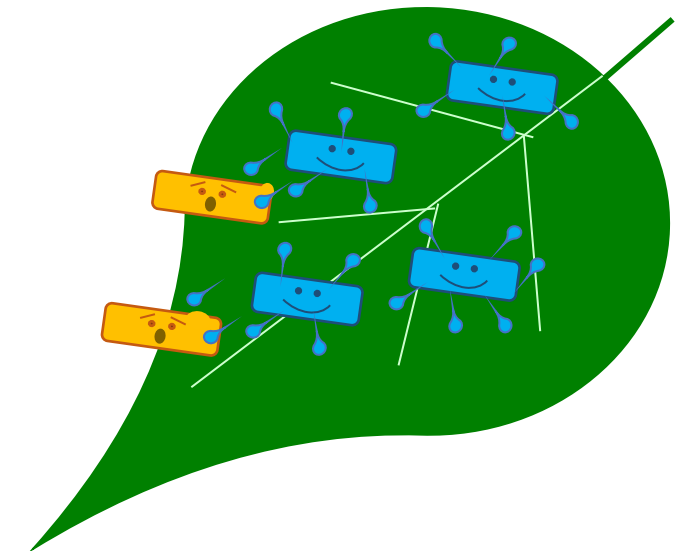
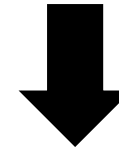
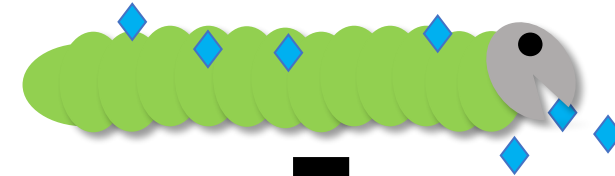




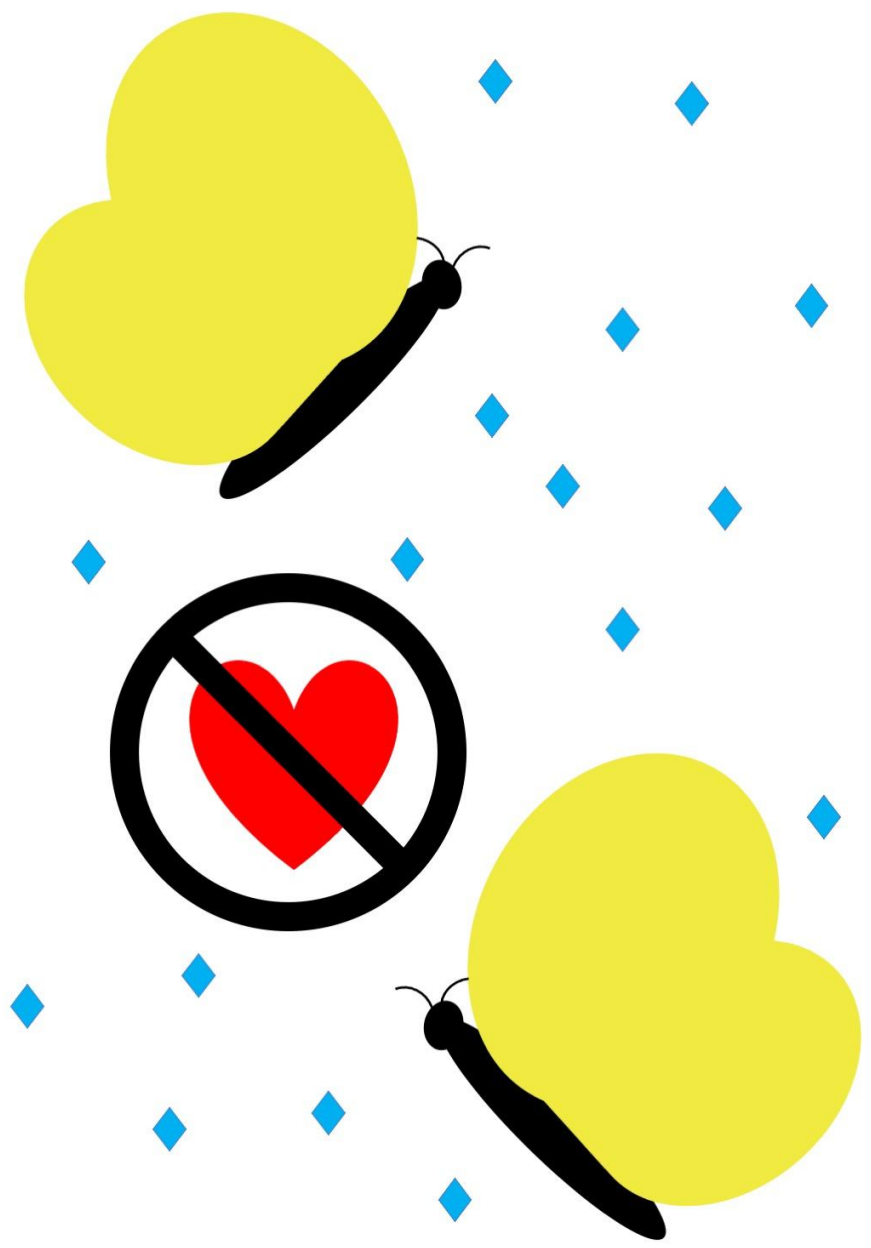
Poison (disease or insect)

- Biopesticide (or its products) kills the pest directly
- Contact and/or ingestion
- Bioinsecticide example:
 - products containing *Bacillus thuringiensis* subsp. *kurstaki* (DiPel, etc.)
- Biofungicide examples:
 - Double Nickel (*Bacillus amyloliquefaciens* strain D747)
 - MilStop, etc. (potassium bicarbonate)

Might be alive



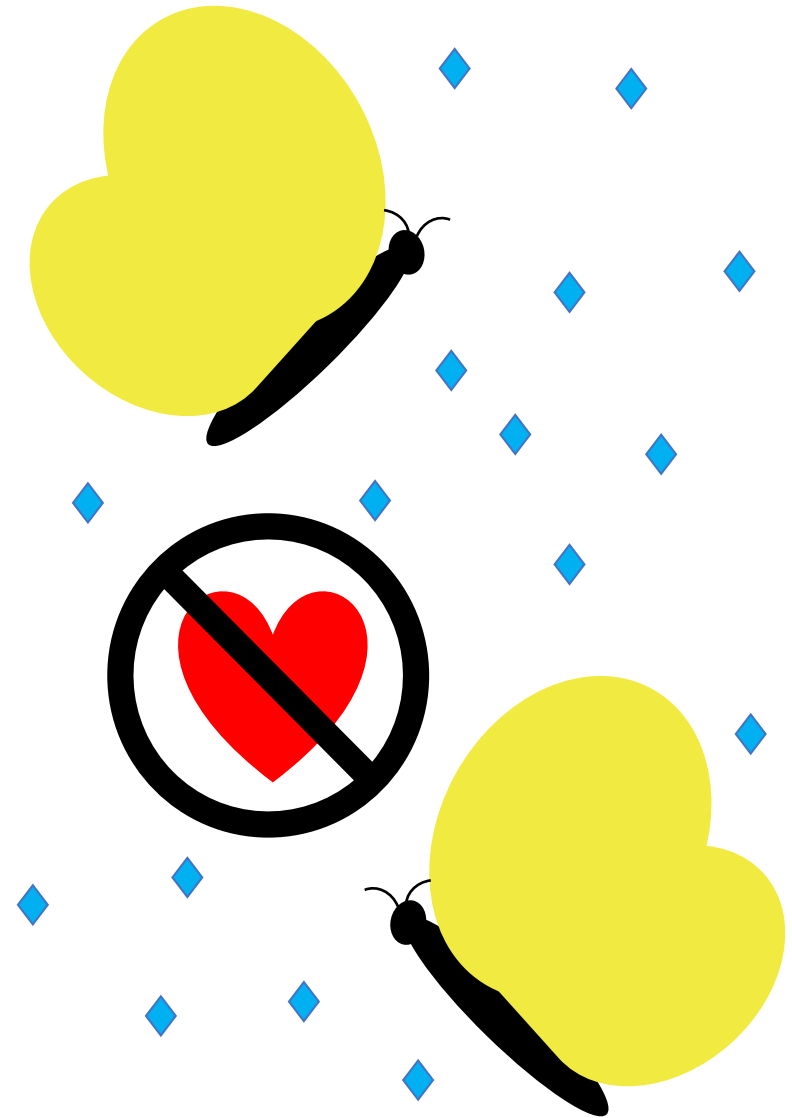
What does this mean?

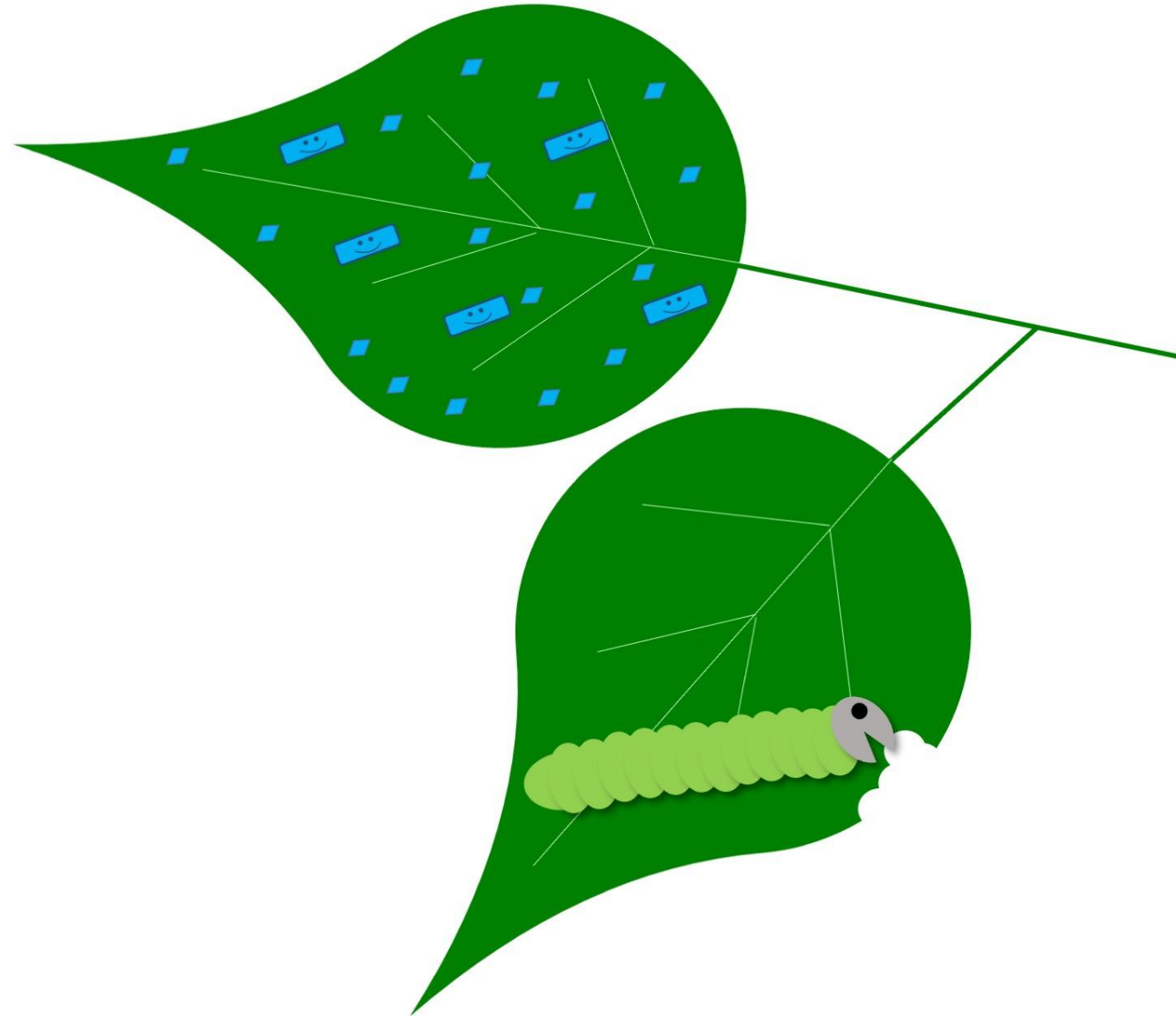


Stop reproduction (insect)

- Hampers pest's ability to reproduce
- Two main types:
 1. Pheromones
 2. Reduced egg laying
- Examples:
 - Grandevo (*Chromobacterium subtsugae* strain PRAA4-1 & spent fermentation product)

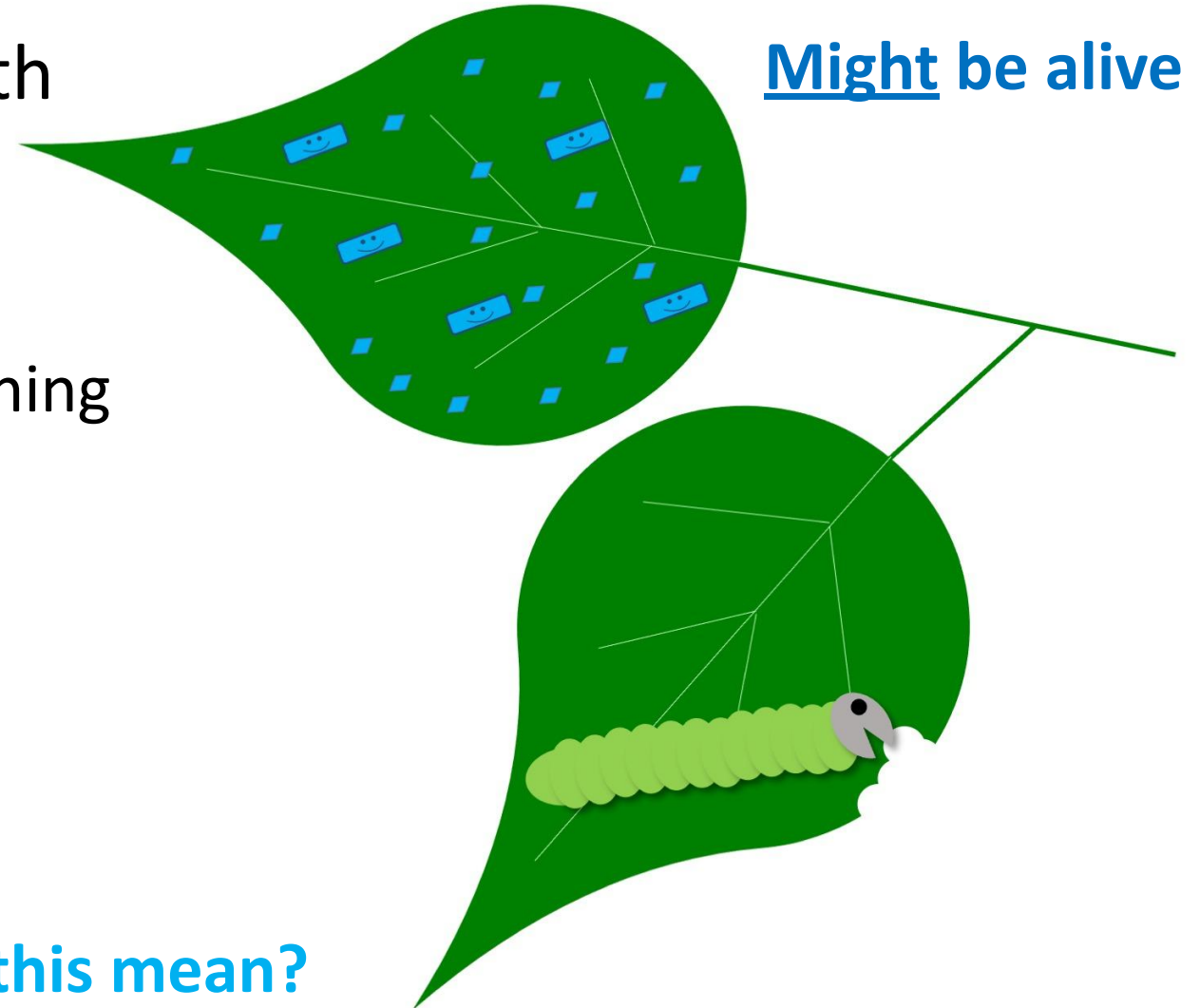
What does this mean?





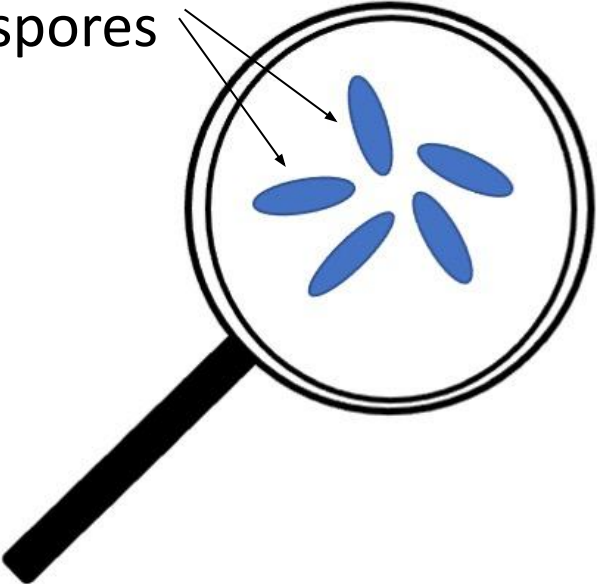
Repel (insect)

- Pest avoids plants treated with biopesticide
- Examples:
 - At least some products containing azadirachtin (e.g., Aza-Direct)
 - Grandevo WDG (*Chromobacterium subtsugae* strain PRAA4-1 & spent fermentation product)

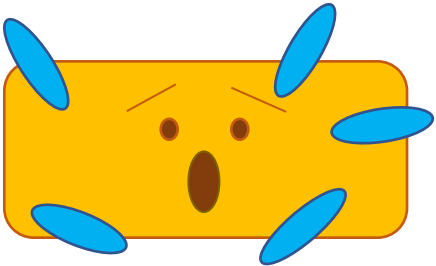
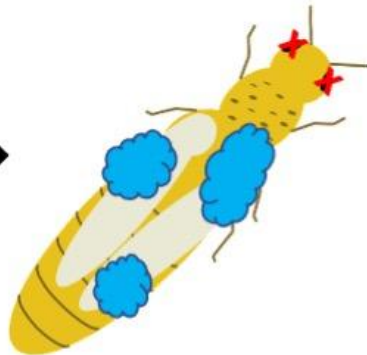
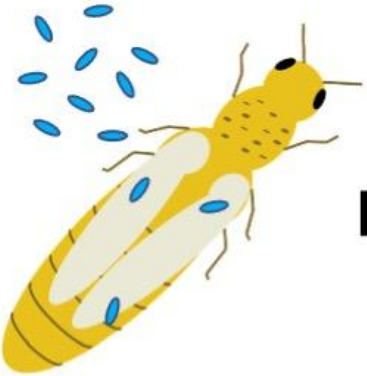
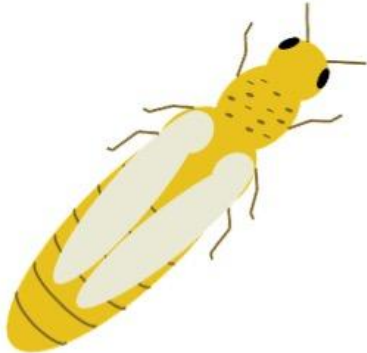


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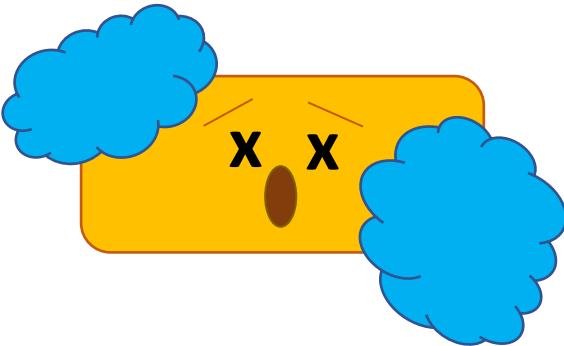
microscopic
spores



+



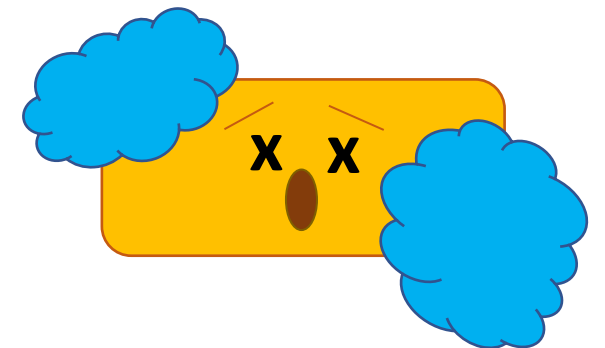
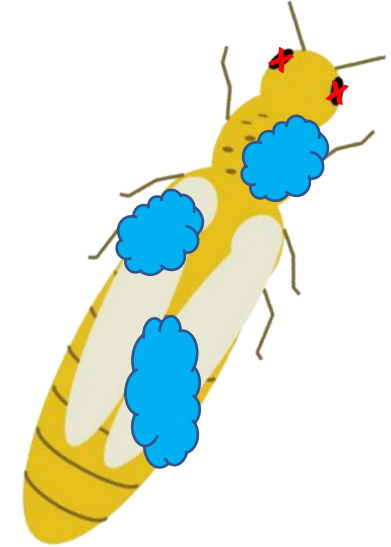
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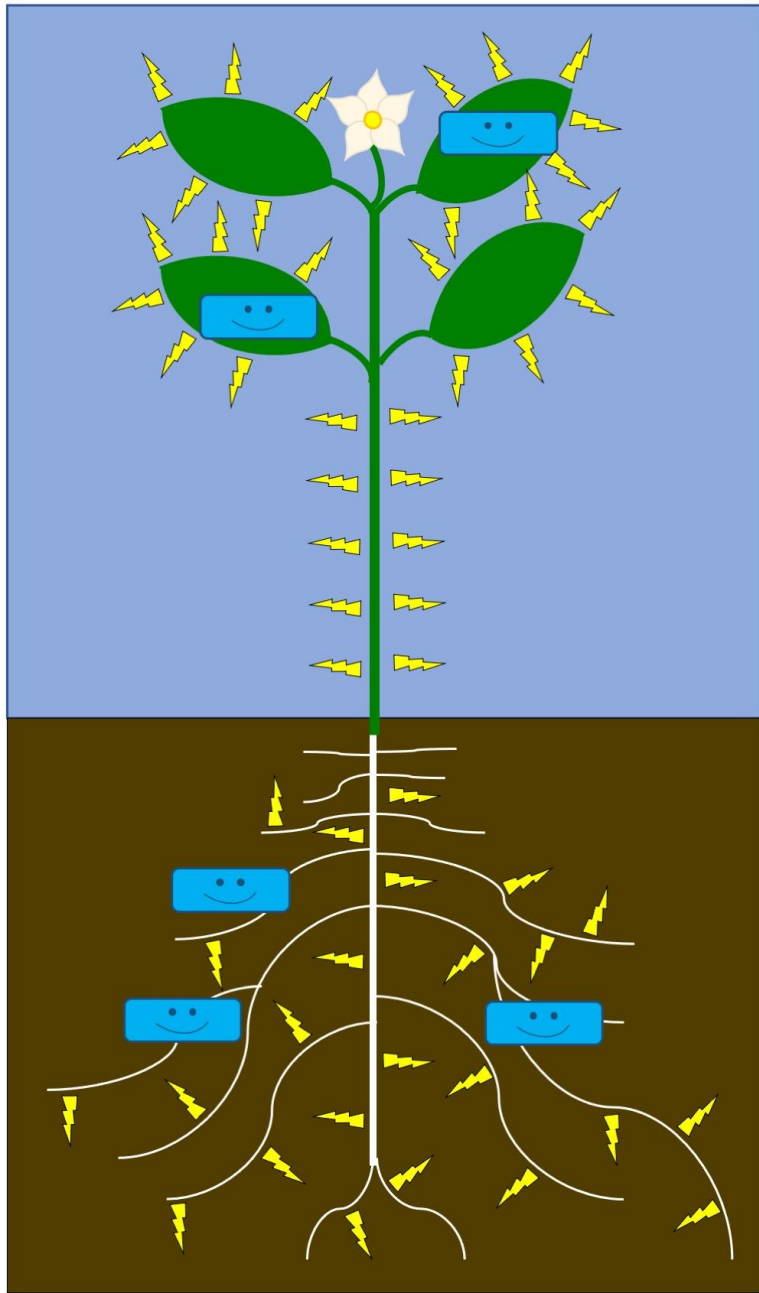
Eat (disease or insect)

Alive!

- Live microbe grows on/in pest
- Bioinsecticides
 - Fungi have contact activity; viruses require ingestion
 - Example:
 - *Beauveria bassiana* products (BotaniGard, etc.)
- Biofungicides
 - Example:
 - Contains (*Paraconiothyrium minitans* strain CON/M/91-08)



What does this mean?

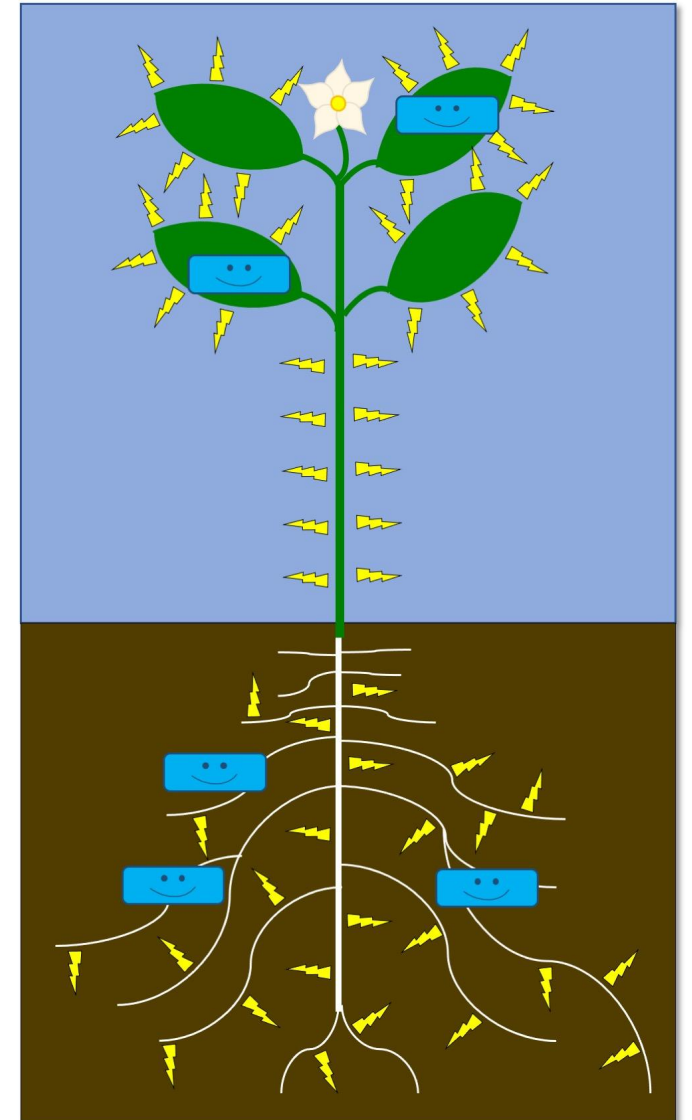


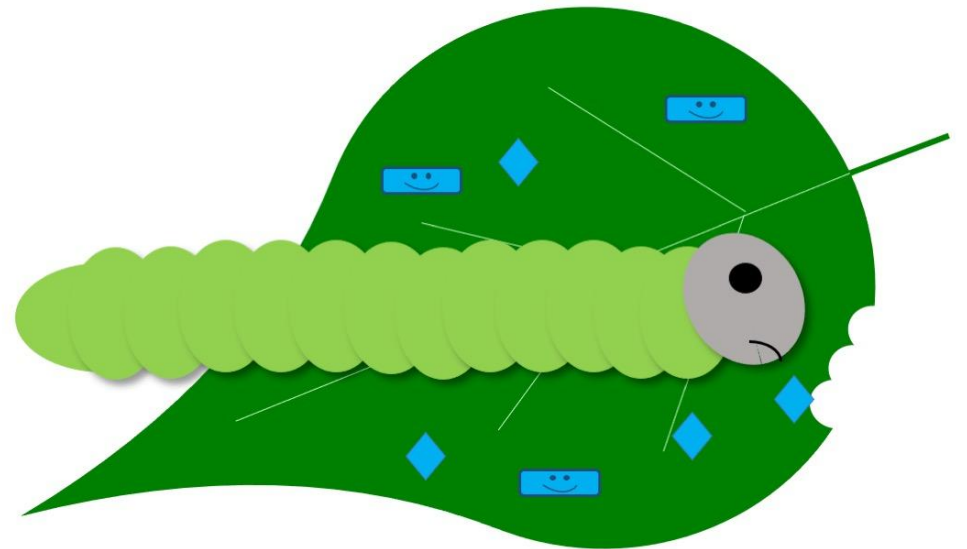
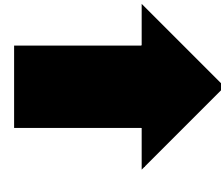
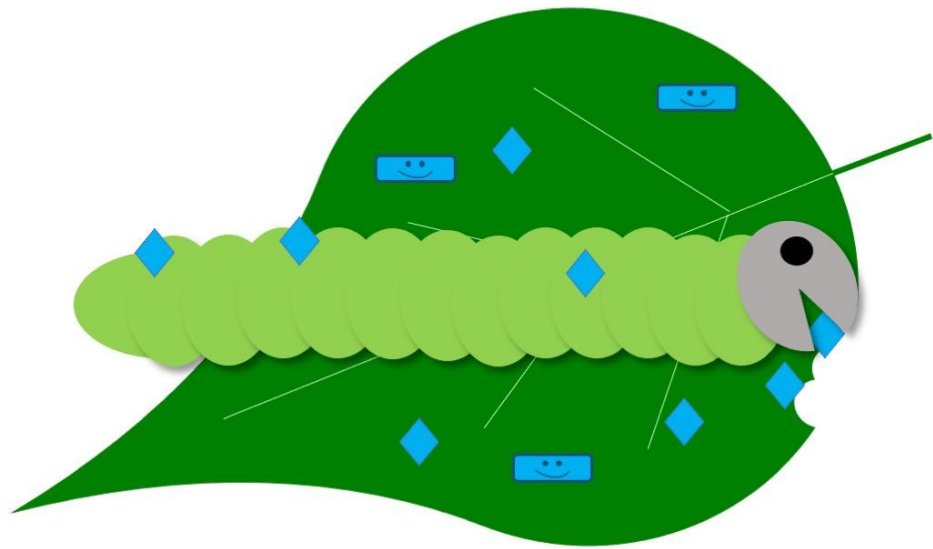
Turn on resistance (disease?)

- “turns on” plant’s natural defenses before attack
- Examples:
 - Regalia (giant knotweed extract)
 - Lifeguard WG (*Bacillus mycoides* isolate J)

What does this mean?

Might be alive

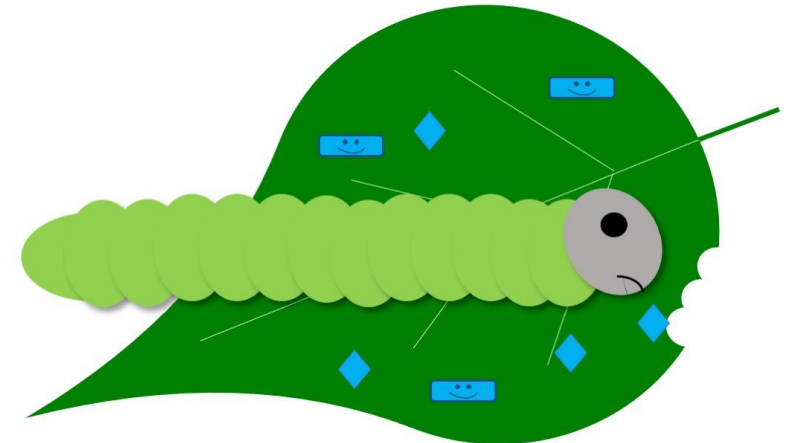
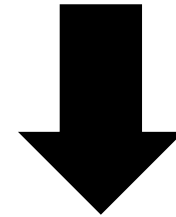
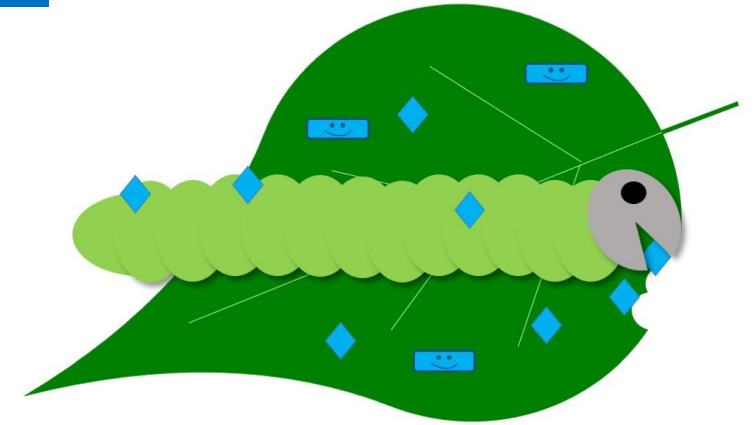




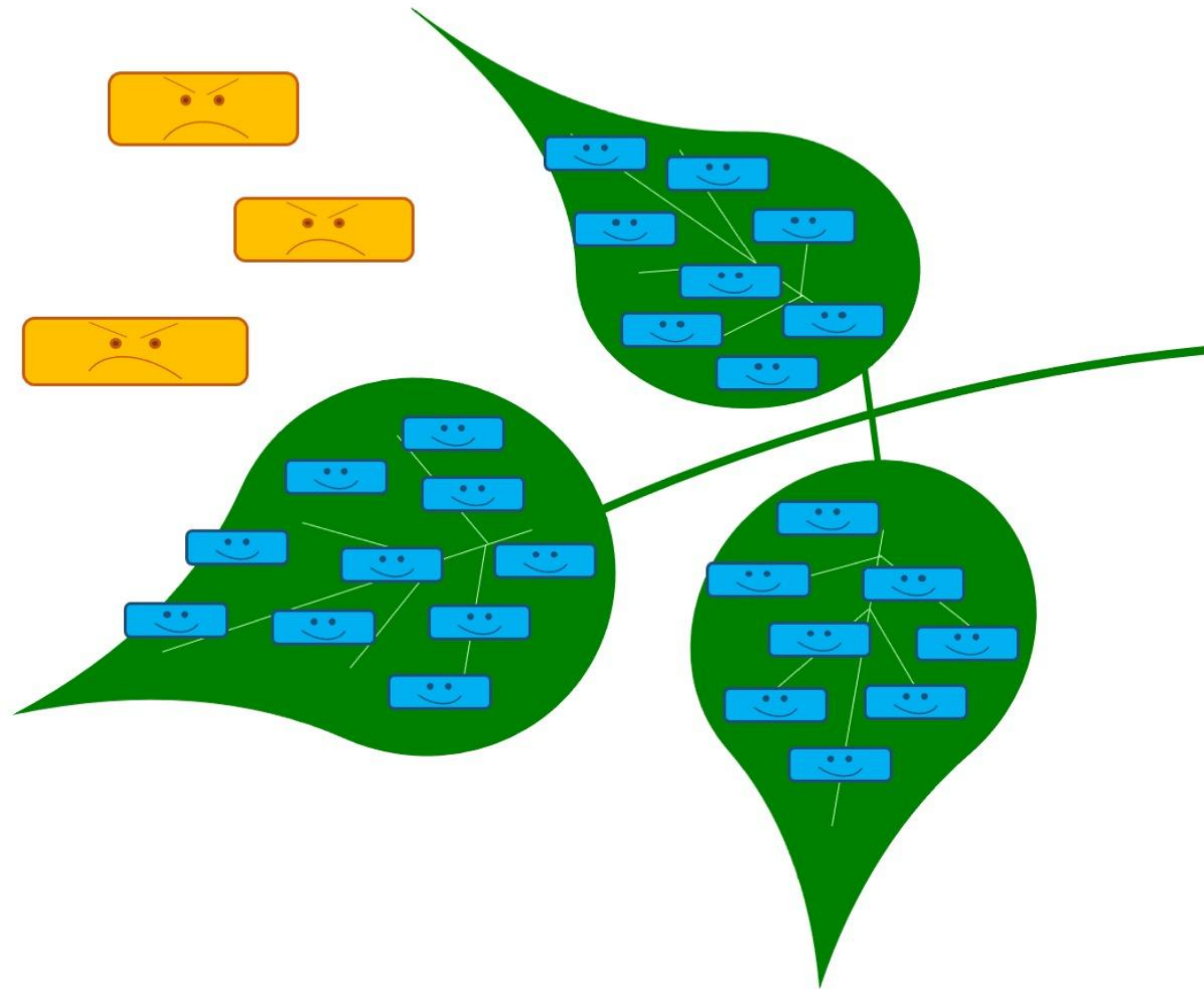
Stop feeding (insect)

Might be alive

- Stops pest from feeding, and pest eventually starves
- Contact and/or ingestion, depending on product
- Examples:
 - beetleGone! (*Bacillus thuringiensis* subsp. *galleriae* strain SDS-502)
 - At least some insect-killing viruses (e.g., Gemstar)

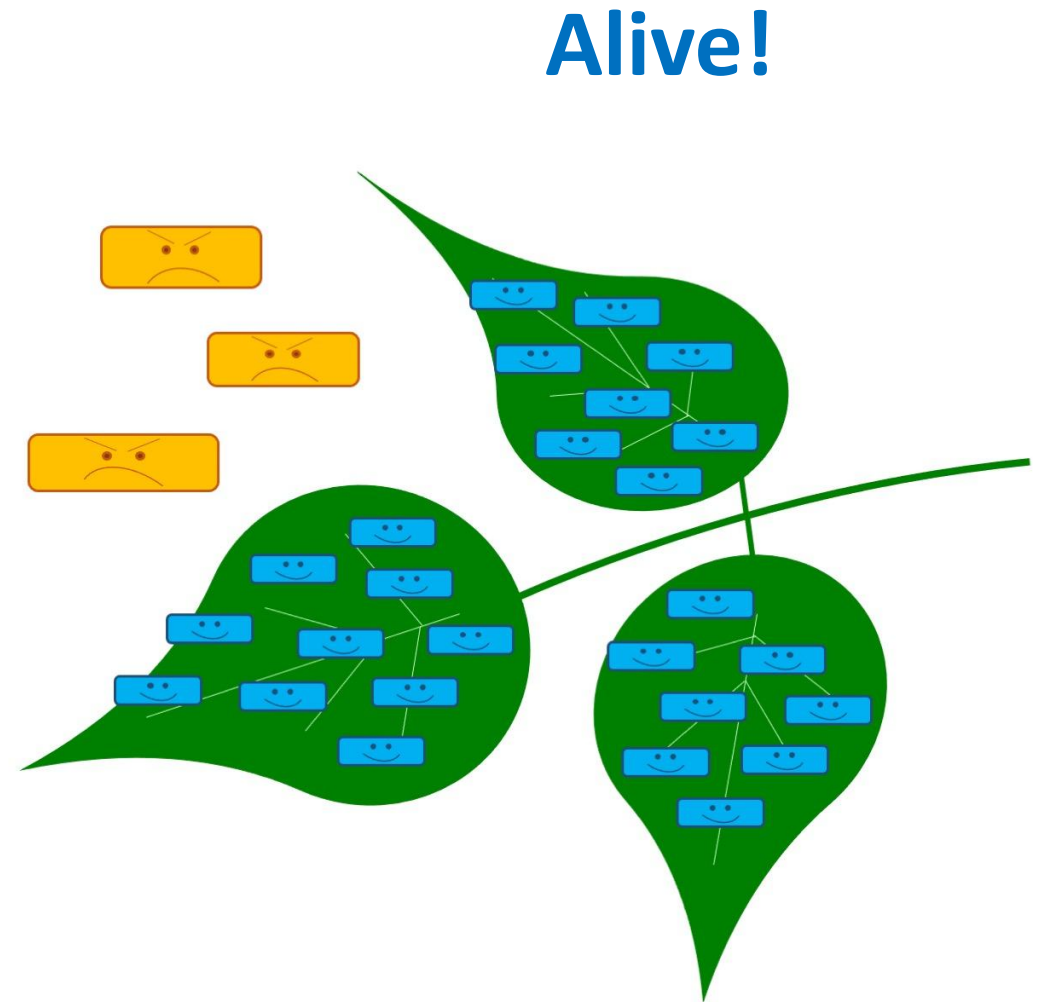


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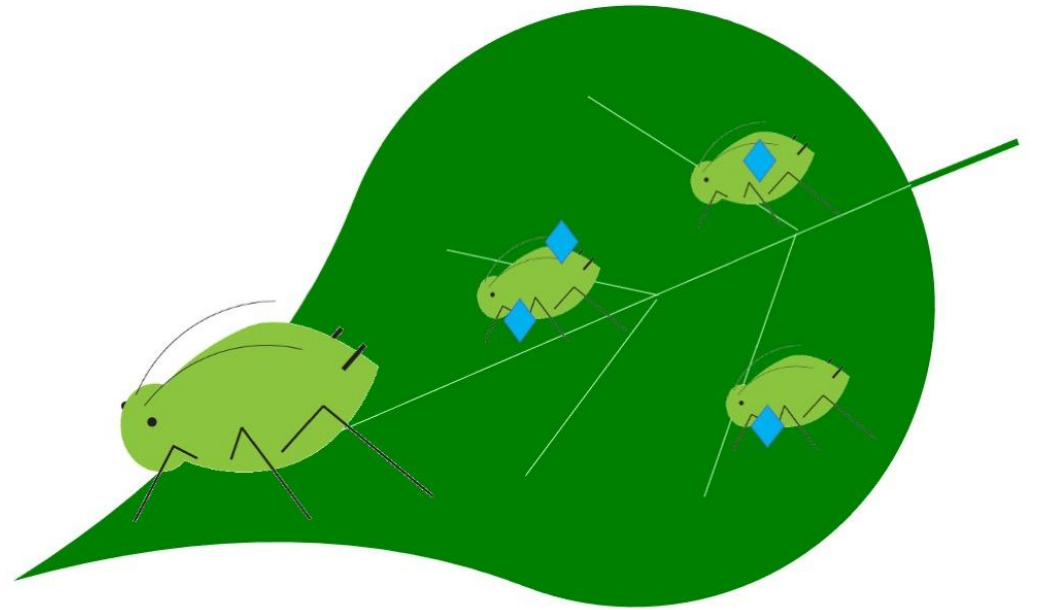
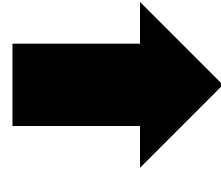
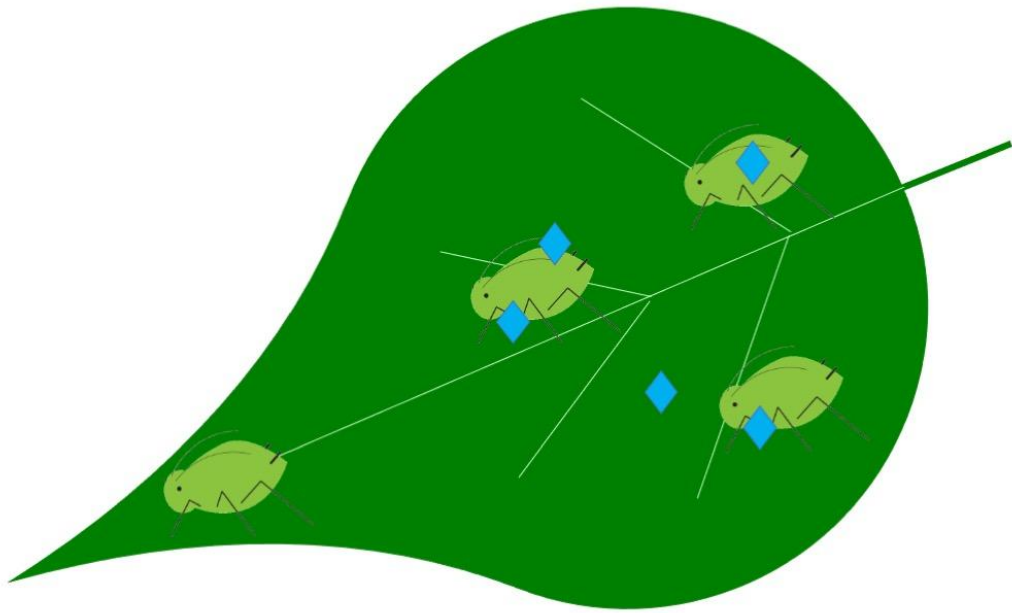


Keep out (disease)

- Live microbe grows on plant, leaving no room or nutrients for pathogen
- Examples:
 - Actinovate (*Streptomyces lydicus* WYEC 108)
 - Serifel (*Bacillus amyloliquefaciens* strain MBI 600)



What does this mean?

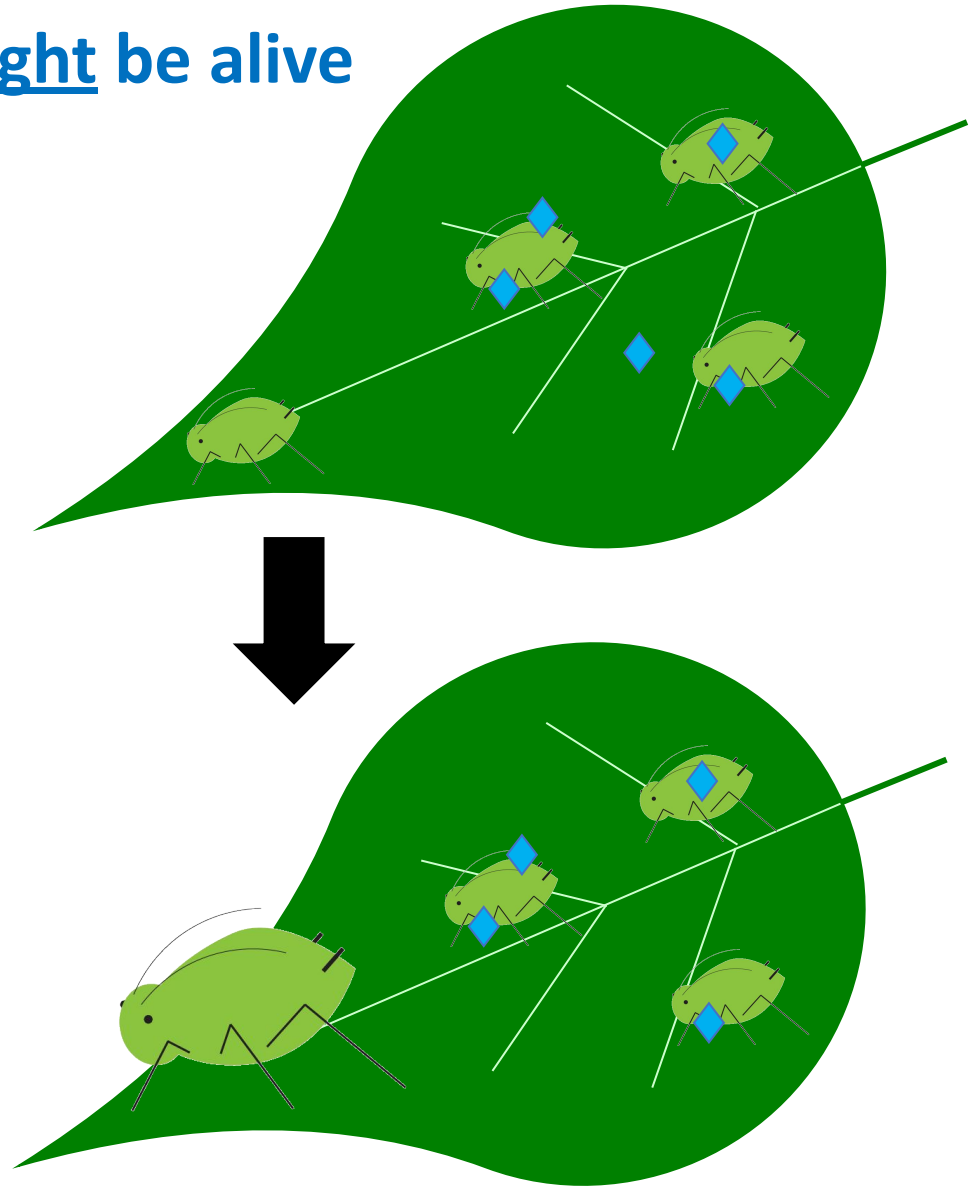


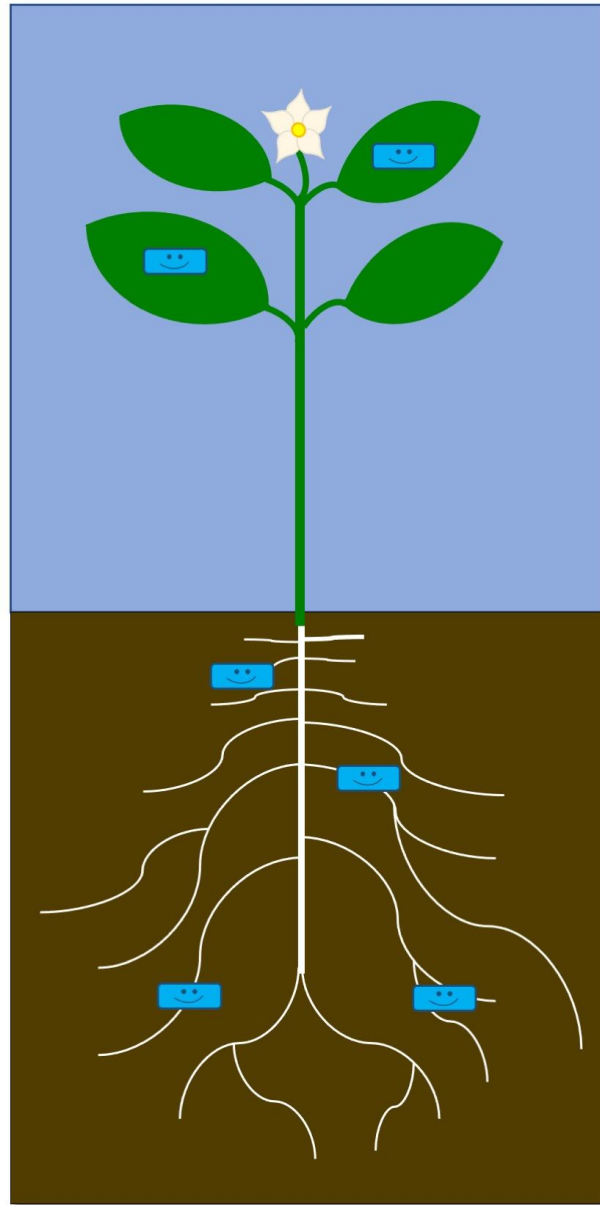
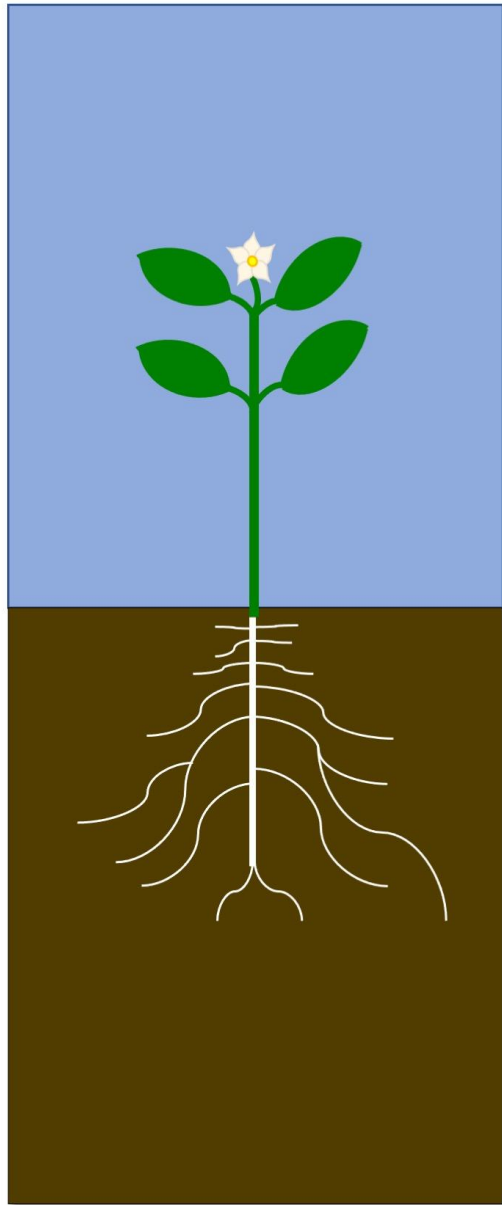
Stop growth (insect)

- Stops pest from growing or molting, and pest eventually dies
- Contact and/or ingestion, depending on product
- Examples:
 - At least some products containing azadirachtin (e.g., AzaGuard)
 - Products containing *Burkholderia* spp. strain A396 (Venerate, etc.)

What does this mean?

Might be alive

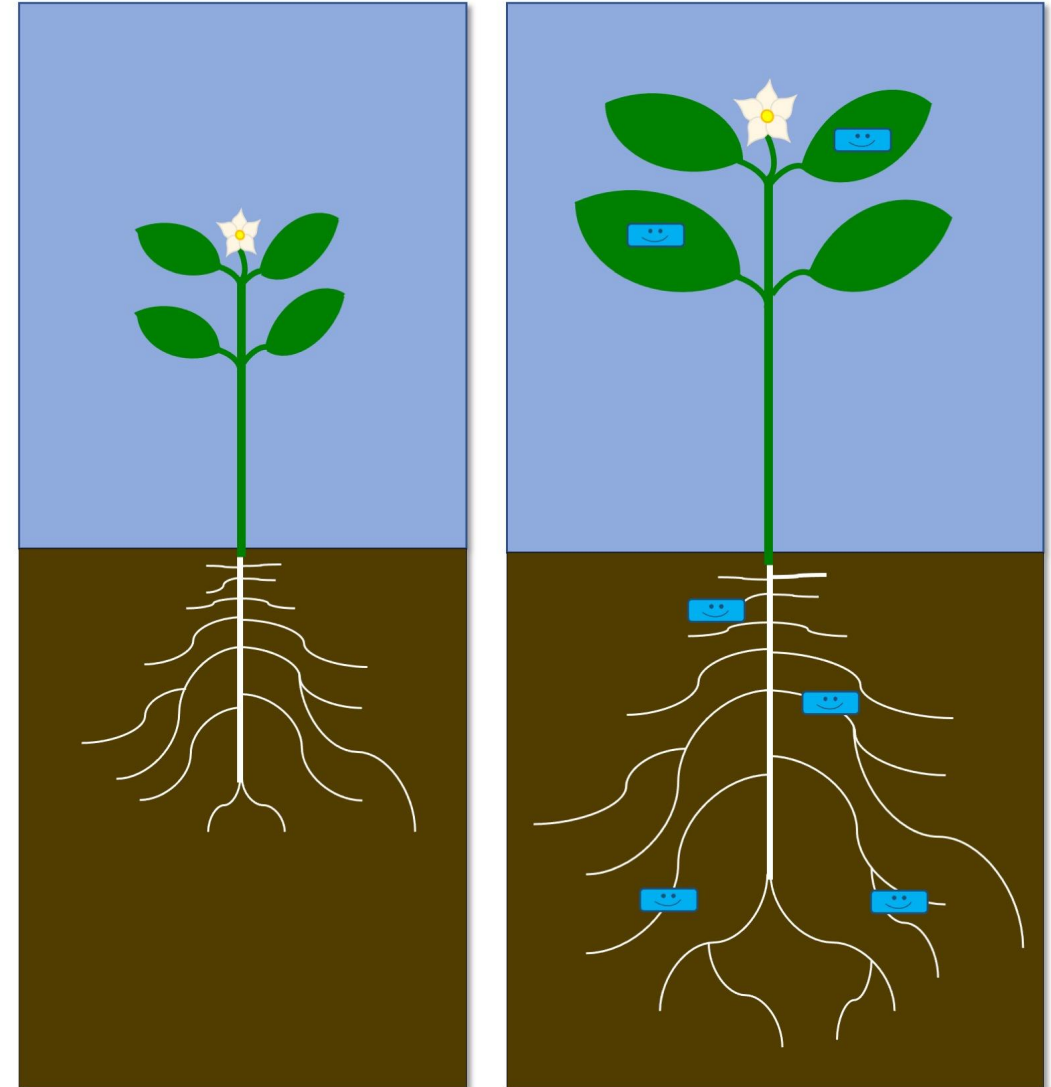




Grow strong plants (mostly disease) Might be alive

- Makes plant stronger, healthier, more resilient
- Examples:
 - Products containing *Bacillus subtilis* strain QST 713 (Serenade, Cease, etc.)
 - products containing *Trichoderma harzianum* (RootShield, etc.)
 - Sil-Matrix (potassium silicate) – absorbed into plant cuticle; keeps pathogens out & deters some insect feeding

What does this mean?



Thank you! Questions?

Amara Dunn



@biocontrol.nysipm

blogs.cornell.edu/biocontrolbytes/

arc55@cornell.edu

