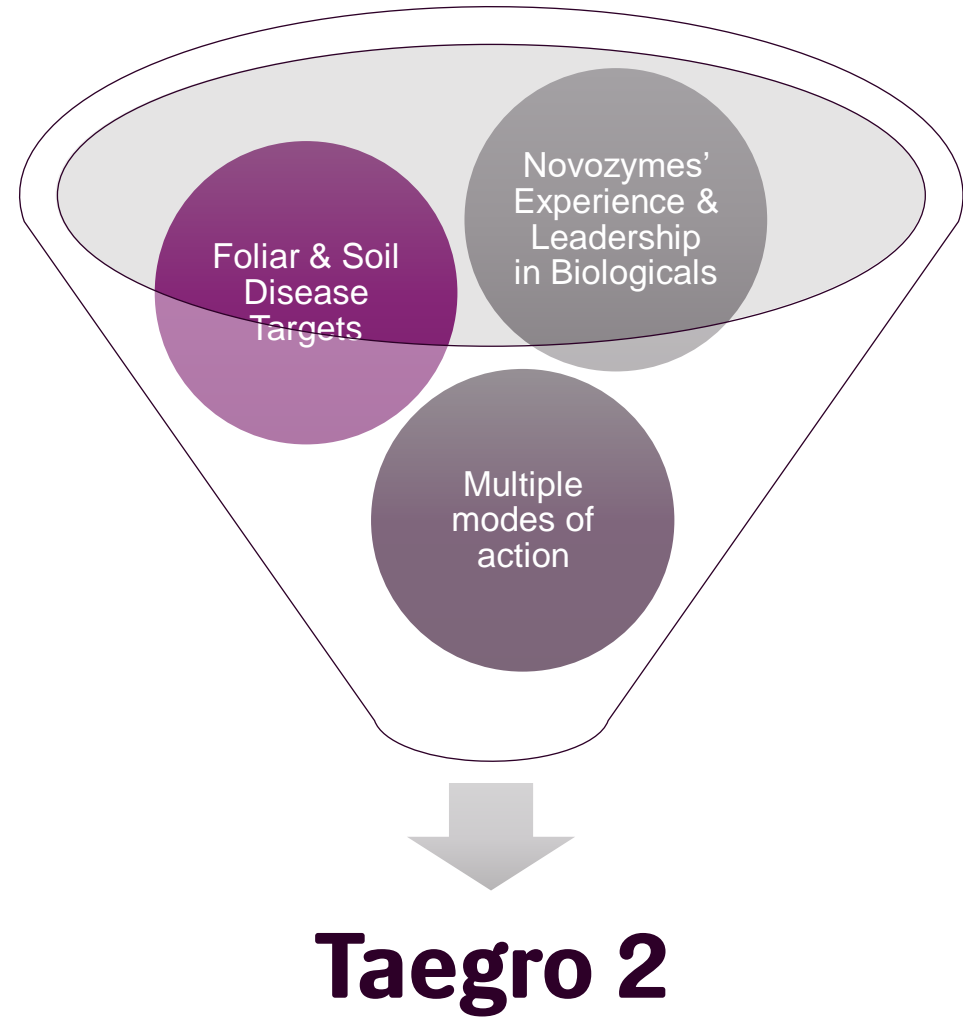




Taegro 2: Biofungicide

Taegro 2- A broad spectrum biofungicide

Factors driving biofungicides



Taegro® 2 Biofungicide

- **Active:** *Bacillus subtilis* var. *amyloliquefaciens* Strain FZB24
- **Description:** Bacterial based biofungicide/bactericide for suppressing soil borne and foliar diseases
- **Origin:** *Bacillus subtilis* var. *amyloliquefaciens* Strain FZB24 was originally isolated in Germany.
- **Modes of action**
 - Production of secondary metabolites-antibiotics
 - Competitive exclusion/interaction
 - Induction of plant systemic resistance or systemic acquired resistance



Taegro® 2
fungicide

FIRST AID	
IF ON SKIN OR CLOTHING:	<ul style="list-style-type: none"> Take off contaminated clothing Rinse skin immediately with plenty of water for 15–20 minutes Call a poison control center or doctor for treatment advice
IF IN EYES:	<ul style="list-style-type: none"> Hold eye open and rinse slowly and gently with water for 15–20 minutes. Remove contact lenses, if present, after the first 5 minutes, then continue rinsing eye Call a poison control center or doctor for treatment advice
IF INHALED:	<ul style="list-style-type: none"> Move person to fresh air If person is not breathing, call 911 or an ambulance, then give artificial respiration, preferably mouth-to-mouth if possible
IF SWALLOWED:	<ul style="list-style-type: none"> Call a Poison Control Center or doctor immediately for treatment advice Have person sip a glass of water if able to swallow Do not induce vomiting unless told to do so by the poison control center or doctor Do not give anything by mouth to an unconscious person
HOTLINE NUMBER:	Have the product container or label with you when calling a poison control center or doctor, or going for treatment. You may also contact 1-800-222-1222 for emergency medical treatment information.

ACTIVE INGREDIENT % w/w
Bacillus subtilis var. *amyloliquefaciens* Strain FZB24* 13.0%
OTHER INGREDIENTS 87.0%
Total 100.0%

*Contains a minimum of 1.0 x 10¹⁰ colony forming units (CFU)/gram.

KEEP OUT OF REACH OF CHILDREN
CAUTION
 See inside this booklet for additional Precautionary Statements, First Aid, complete Directions for Use, and Warranty.

Precautionary statements
HAZARDS TO HUMANS AND DOMESTIC ANIMALS
CAUTION - Causes moderate eye irritation. Avoid contact with eyes, skin, or clothing. Wear protective eyewear such as goggles, face shield or shielded safety glasses. Harmful if absorbed through skin, inhaled or swallowed. Avoid breathing dust or spray mist. Wash thoroughly with soap and water after handling and before eating, drinking, and chewing gum, using tobacco or using the toilet. Remove and wash contaminated clothing before reuse.

Batch code and expiration date
 [Batch code and expiration date to be inserted]

Novozymes Biologicals Inc.
 5400 Corporate Circle
 Salem, VA 24153, USA
 1-888-744-5662

EPA Registration Number: 70127-12
 EPA Establishment Number: 33967-NI-1
 Made in the USA 15001 10.16 2651-708

Net contents: 13.2 oz (375 g)

novozymes®
 Rethink Tomorrow



Features of Taegro® 2



Broad spectrum,
proven efficacy



Multiple modes of
action



Excellent tool for IPM



No/minimal
resistance



May be tank mixed or
used as rotational
partner



Approved for organic
use, OMRI-listed



Low REI, safe for
workers



Safe for beneficial
insects –
pollinators/bees



Compatibility with
fungicides,
insecticides,
fertilizers

Multiple application
methods – drip
irrigation, drench,
dip, foliar spray, in-
furrow, basal
directed




0-Day Pre Harvest
Interval

Taegro

Low use rate, 3-year shelf life, Performance and OMRI certified

1



Low rate

375g = 2.5 to 5 acres

2



Long shelf life

3 years

3



Performance & OMRI

Excellent Performance
OMRI Certified

Supplements synthetics for better IPM strategies



- ✓ Multi-site MOA
- ✓ Safe on beneficial insects
- ✓ Low re-entry intervals
- ✓ Zero day pre-harvest interval
- ✓ Extremely effective in rotational programs
- ✓ Resistance management
- ✓ Residue management



Technical Overview

Soil Disease Spectrum

20+ years of research

- *Rhizoctonia*
- *Fusarium*
- *Phytophthora*
- *Pythium*
- *Sclerotinia*
- *Verticillium*



Phytophthora in banana pepper field; MSU University Plant Pathology

Foliar Disease Spectrum

7 years of research

- Powdery Mildew (*Oidium lycopersici*)
(*Erysiphe necator*) (*Sphaerotheca fuliginea*)
- Botrytis (*Botrytis* sp.)
- Early Blight (*Alternaria solani*)
- Late Blight (*Phytophthora infestans*)
- Downy Mildew (*Bremia lactucae*)
- Bacterial Leaf Spot
(*Xanthomonas vesicatoria*)
- Bacterial Speck (*Pseudomonas syringae*)
- Lettuce Drop (*Sclerotinia minor*)
- Cottony Rot (*Sclerotinia sclerotiorum*)

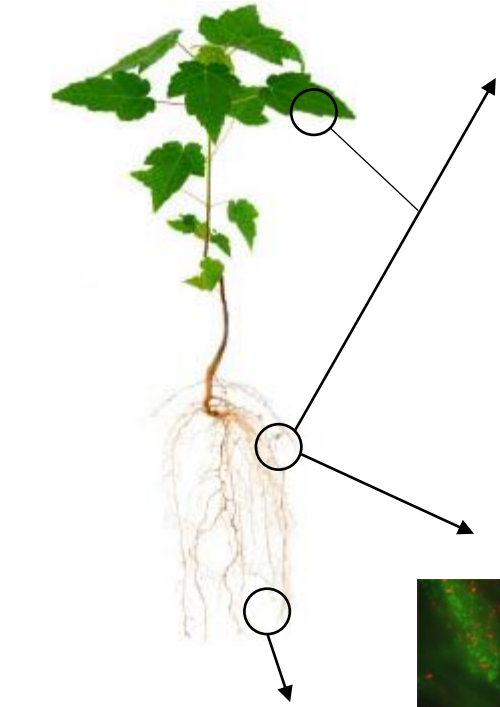
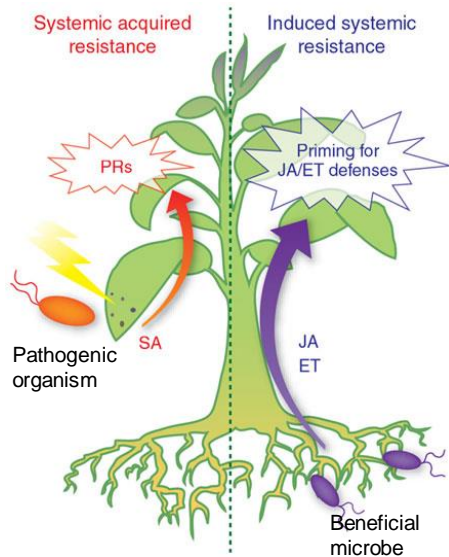


Powdery mildew on a cucurbit leaf, NC State Vegetable Pathology Lab

Modes of Action for Taegro is a combination of several mechanisms

Induction of Plant Resistance:

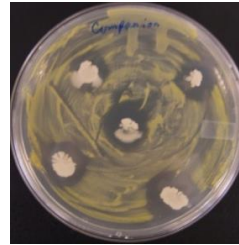
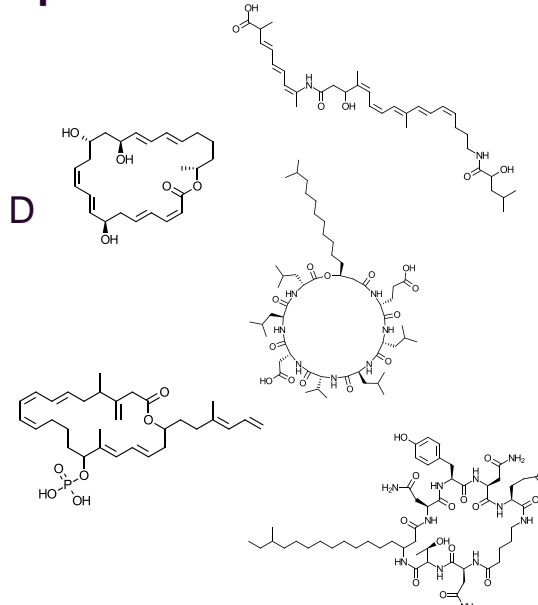
The bacteria can trigger a signal that can be translocated within the plant, also known as the ISR/SAR pathways.



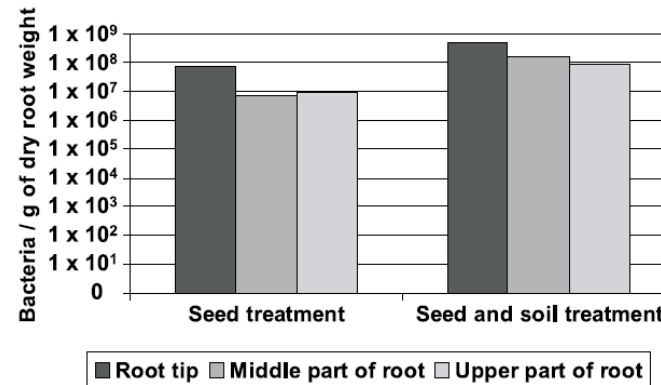
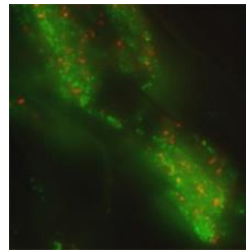
Promotion of Plant and Root Growth: Allow the plant to develop faster, healthier and less susceptible to disease

Antibiosis through production of:

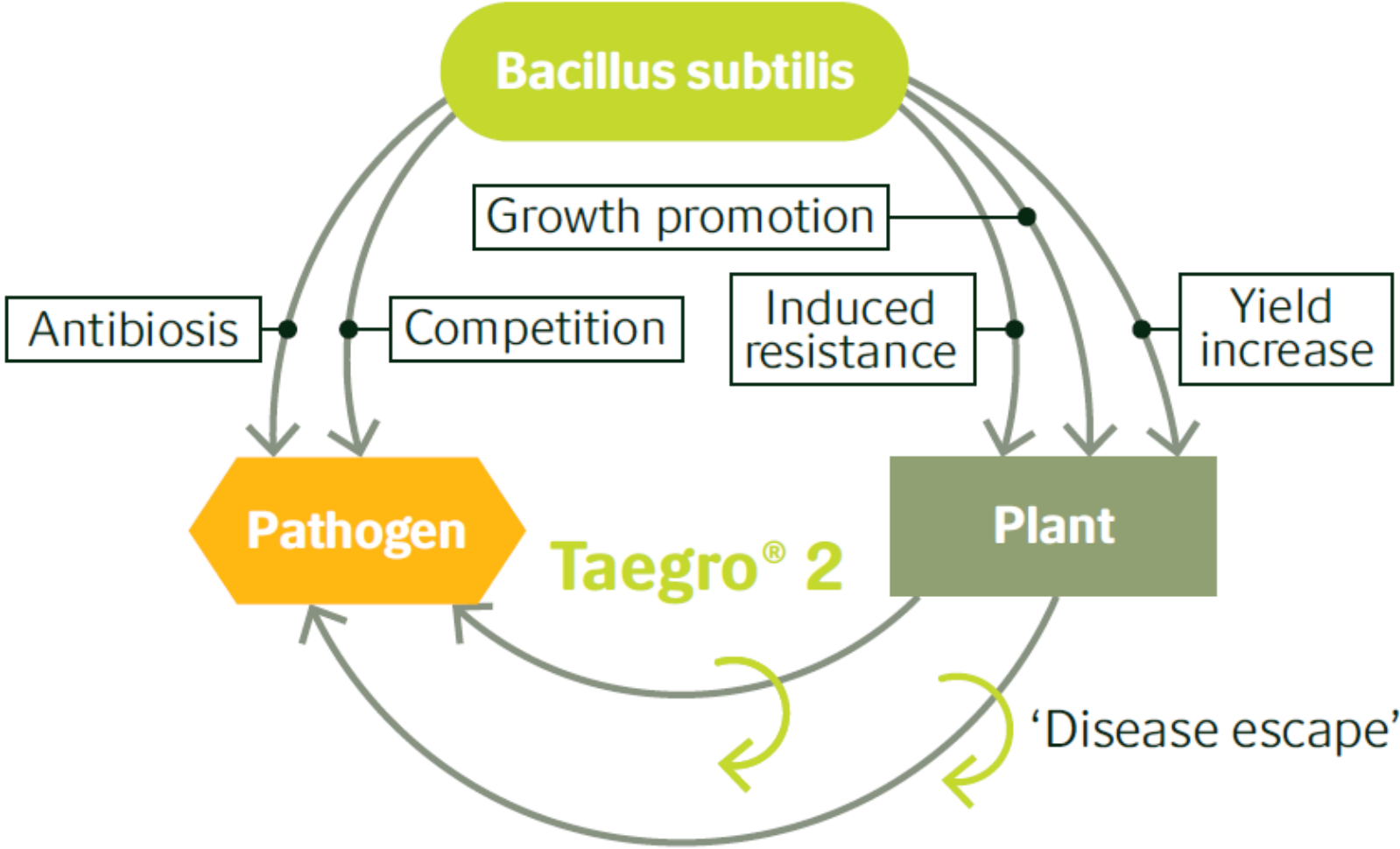
1. Surfactin
2. Macrolactin
3. Difficidin
4. Bacillene
5. Bacillomycin D
6. Fengycins
7. Bacillibactin



Competition for colonization of leaves and roots:



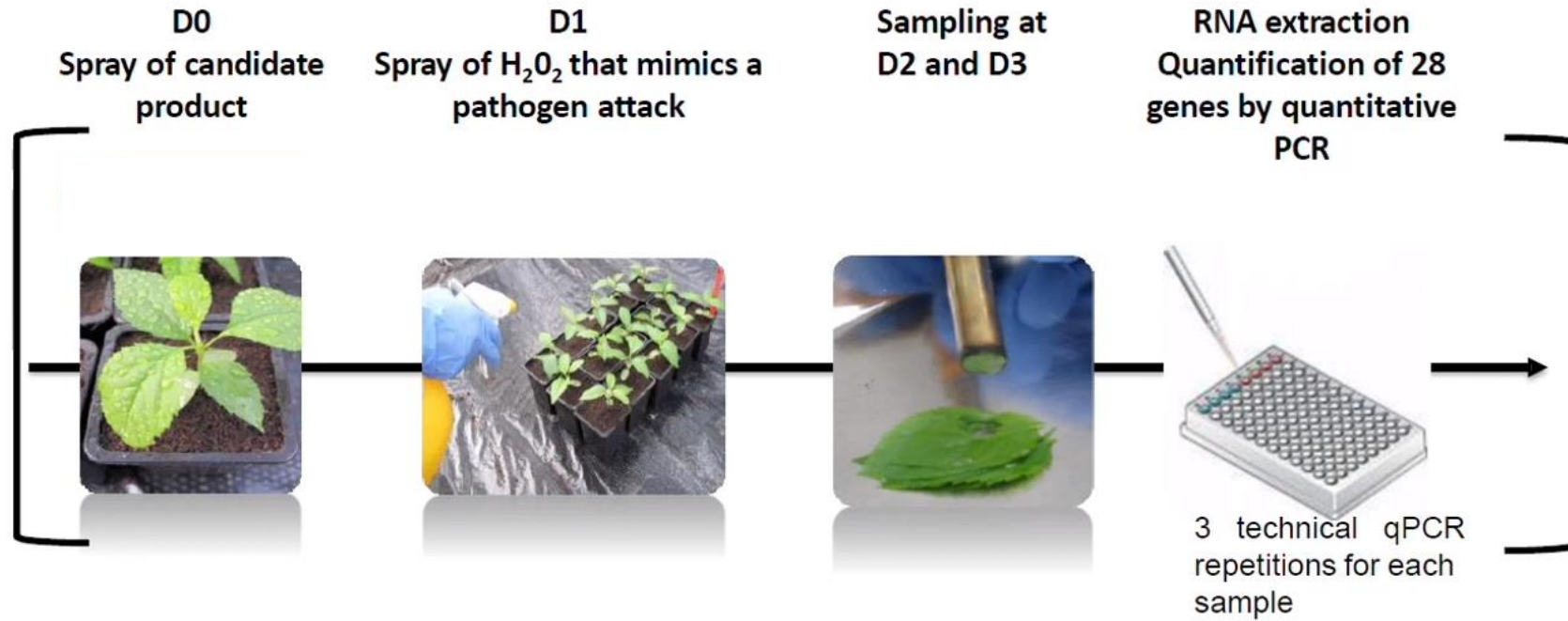
How does Taegro 2 work?



Induces natural resistance



qPFD study (September 2017)*



*3 days after application: Proven overexpression of proteins PR 2 (27 times more than untreated) and PR8 (23 times more), known to be involved in biotic and abiotic resistance.

Mode of Action: Secondary Metabolites

Around 8.5% of the genome of *B. amyloliquefaciens* strain FZB42 appears to be devoted to metabolite production

Bacillomycin D

Fengycin

Surfactin

Bacillibactin
(iron siderophore)

Have direct antifungal activity by inhibiting growth of the pathogen itself

Indirect antifungal action- bacillibactin deprives pathogens of iron, surfactins help with outcompeting pathogens and help induce plant resistance

Antifungal Metabolites



Botrytis cinerea



Phaeosphaeria nodorum

Alternaria solani

Phaeosphaeria nodorum

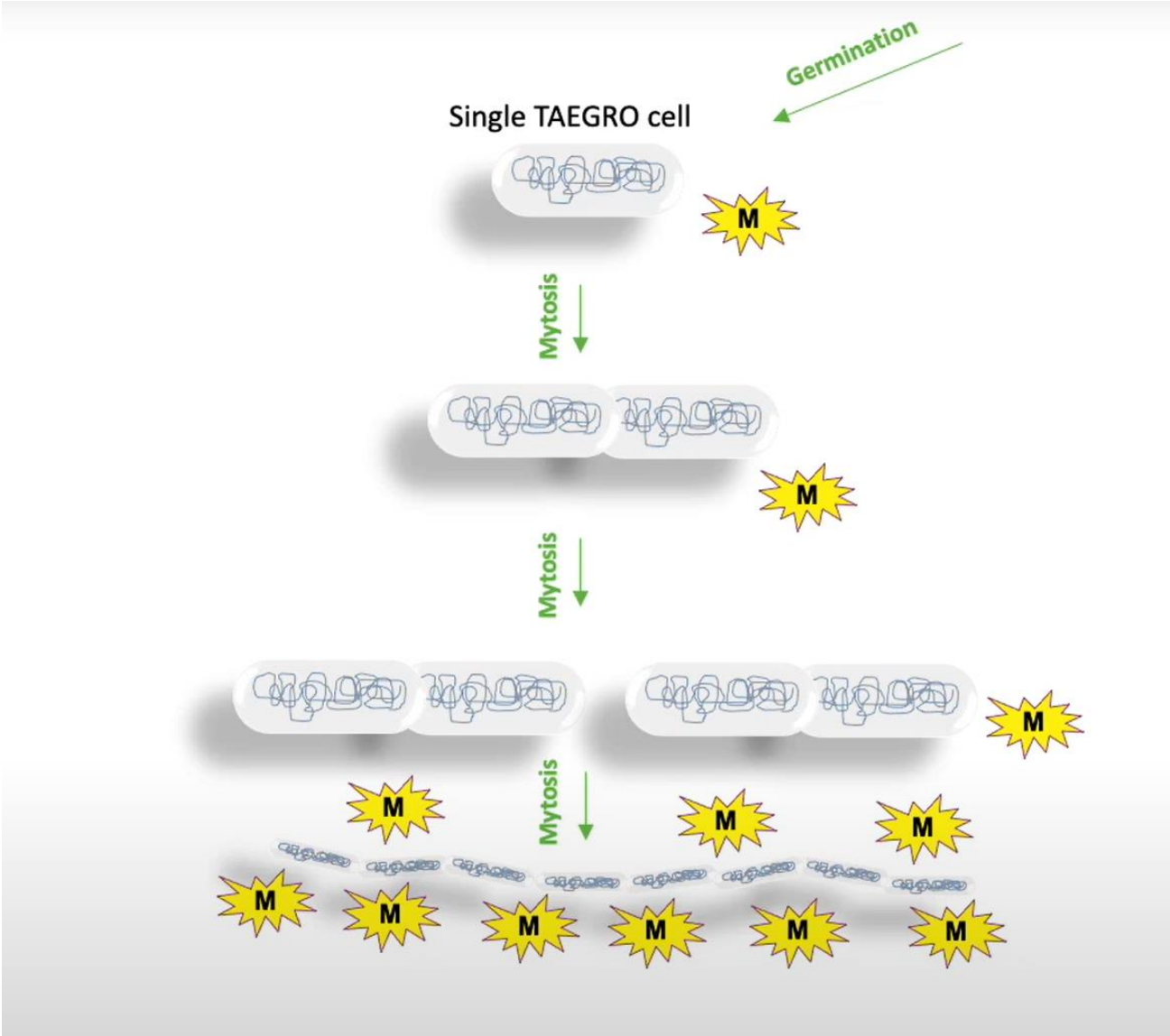
Botrytis cinerea



Taegro 2 Stripe

Alternaria solani

Mode of Action: Metabolite Production

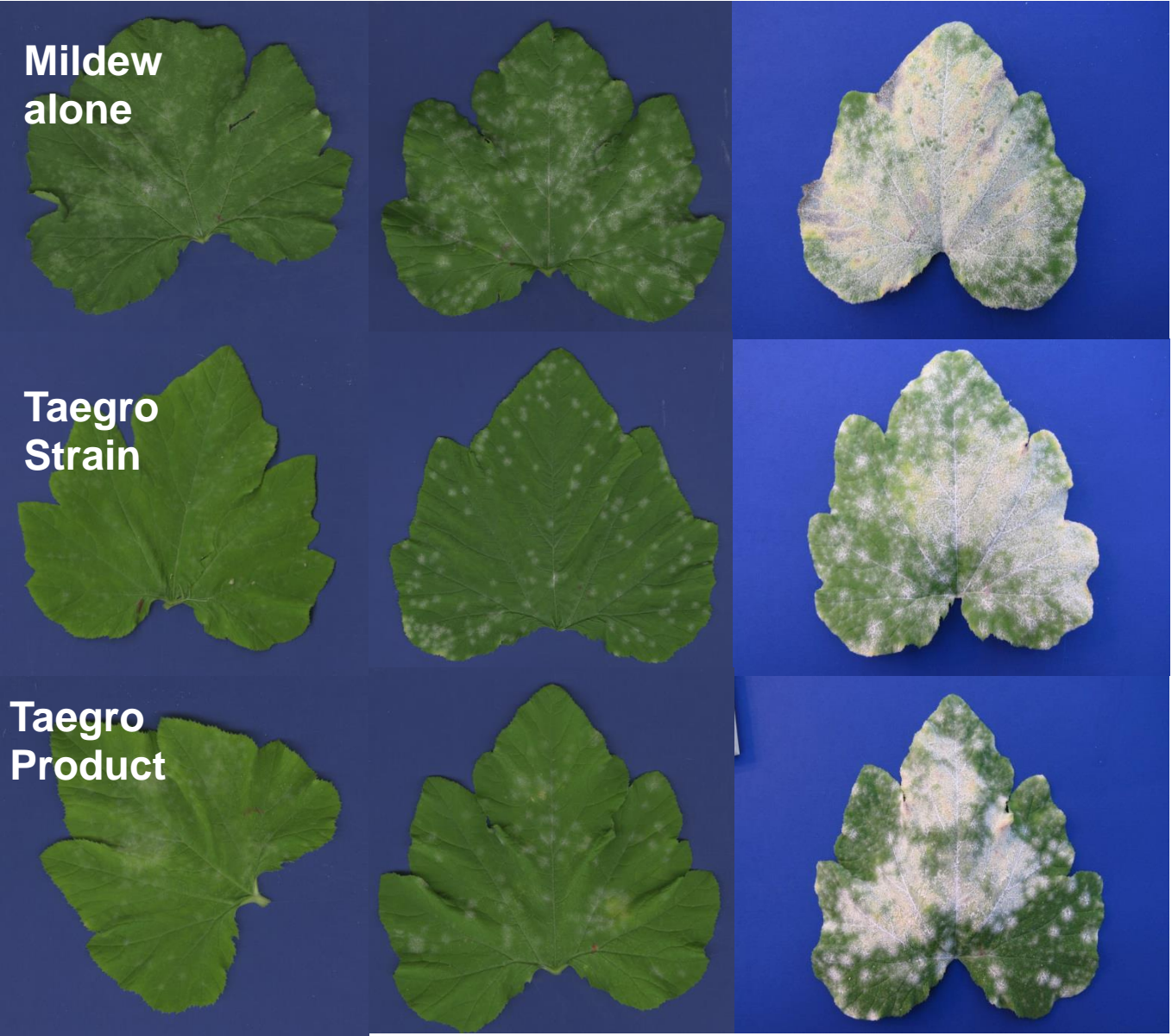


Powdery Mildew (*Podosphaera xanthii*), the Taegro Strain, and the Taegro Product

7 dai

10 dai

14 dai

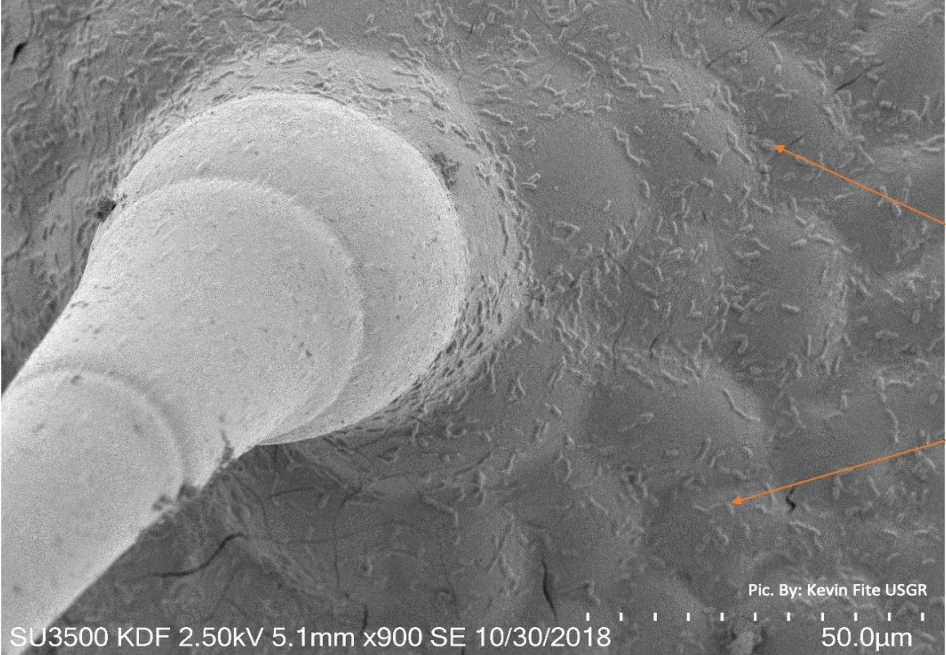


Our Taegro product can show protection with live cells alone, showing efficacy beyond just antibiotic production

Competes with disease for space & nutrients

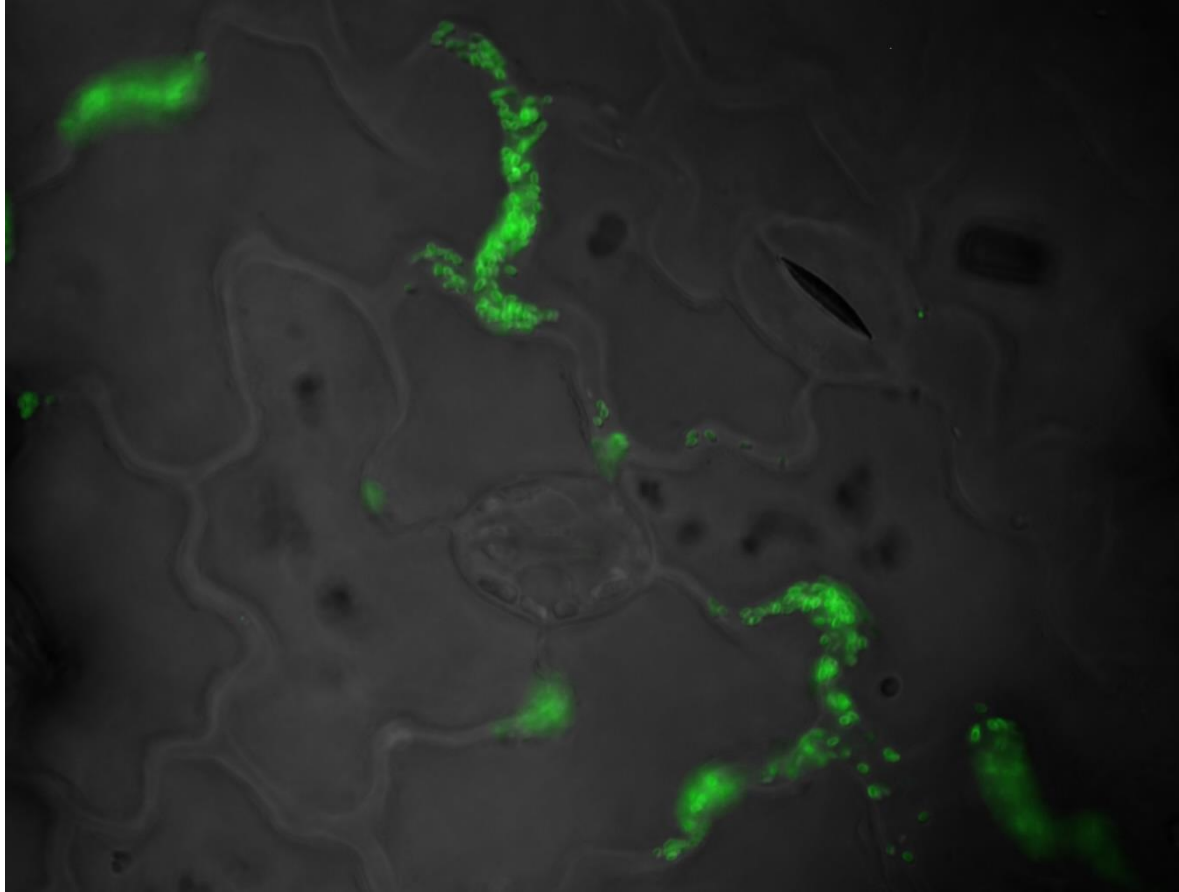


3 days after Taegro application on grape leaf. Stamped on petri dish filled with agar.

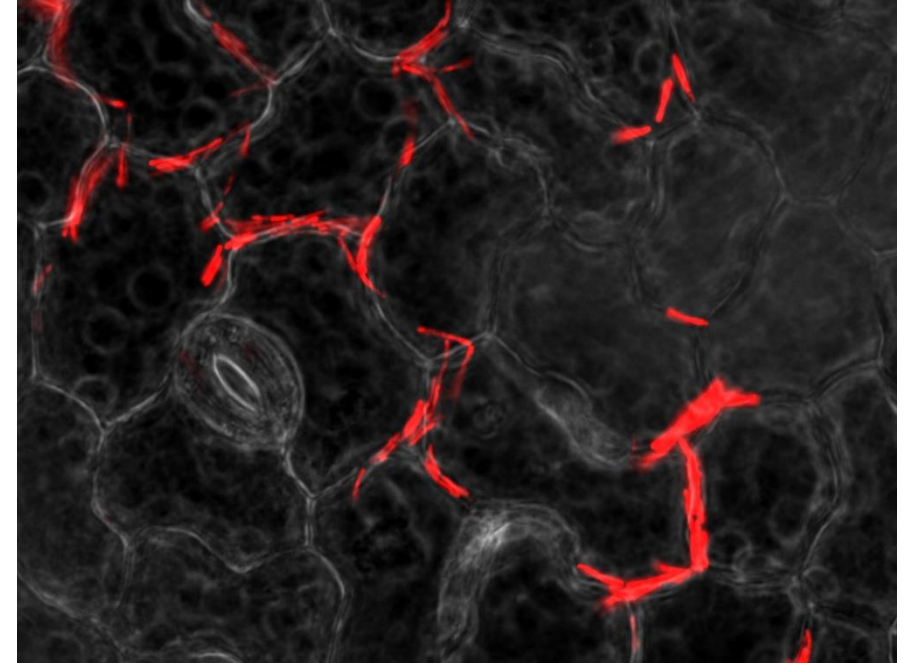


TAEURO cells lying and multiplying on the leaf surface

Following Taegro on soybean leaves



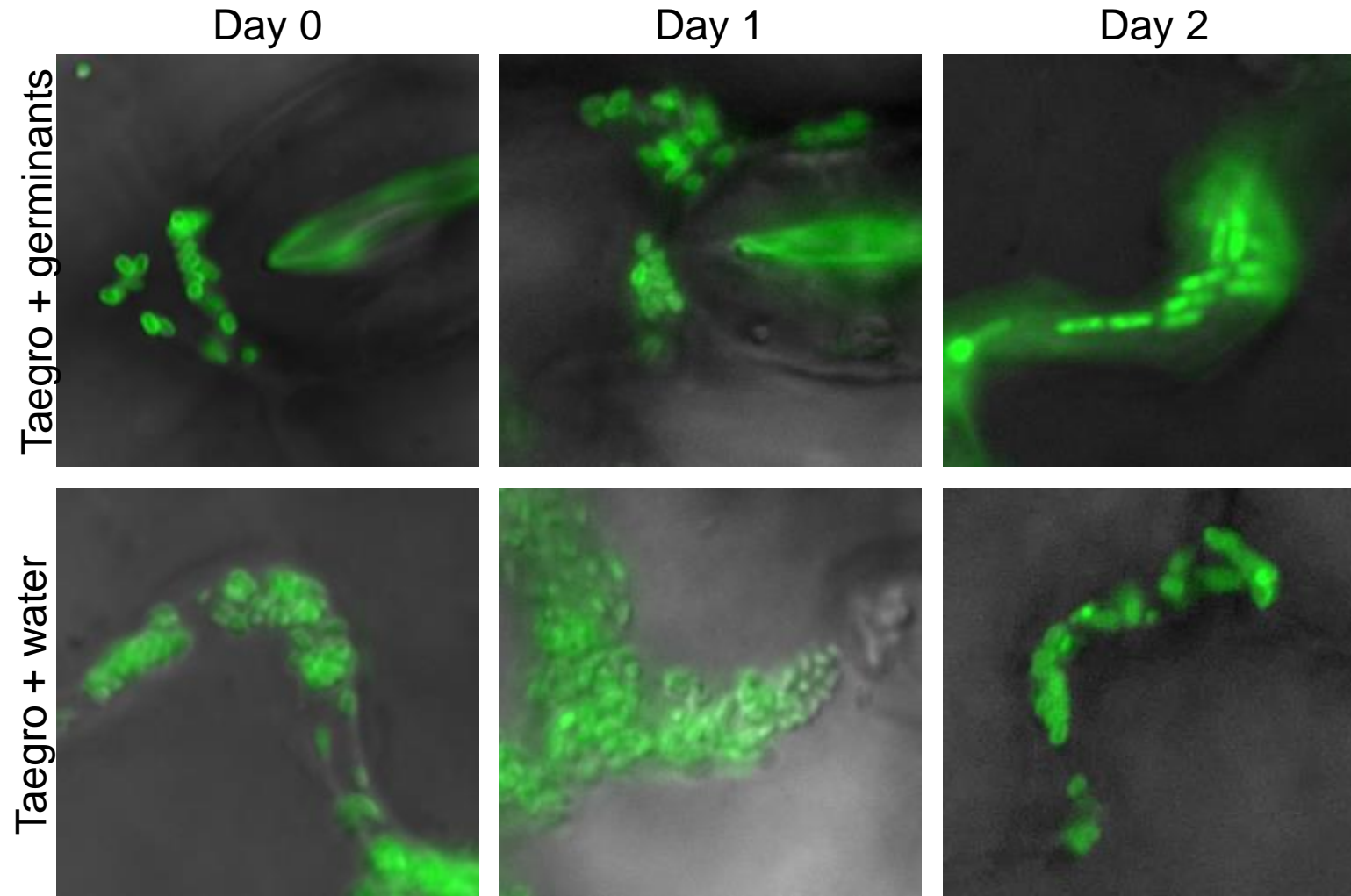
Fluorescent Green Taegro Spores



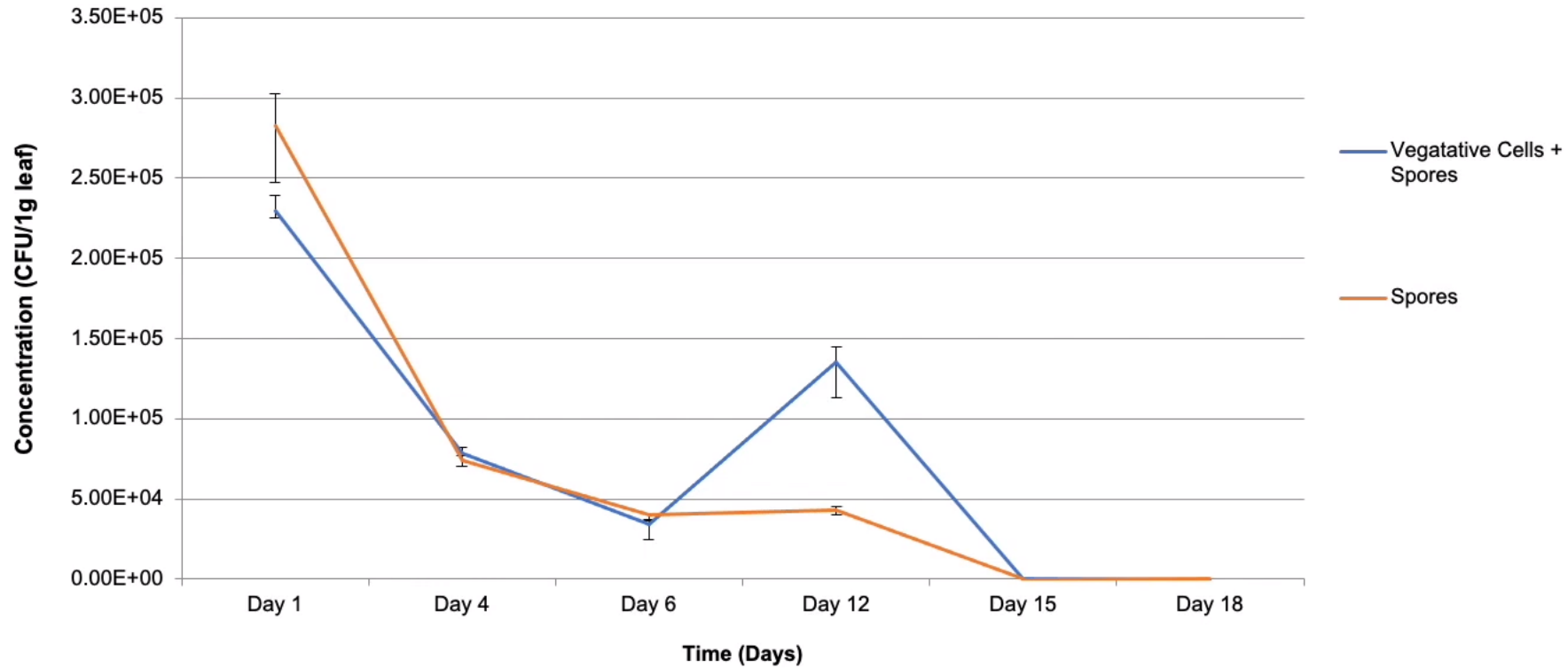
Fluorescent Red Taegro Cells

- Taegro product is made and stored as spores, to increase their shelf life and storage
- Once on a plant leaf, Taegro will slowly germinate, becoming “vegetative” cells and colonizing the leaf

Taegro germination on a tomato leaf

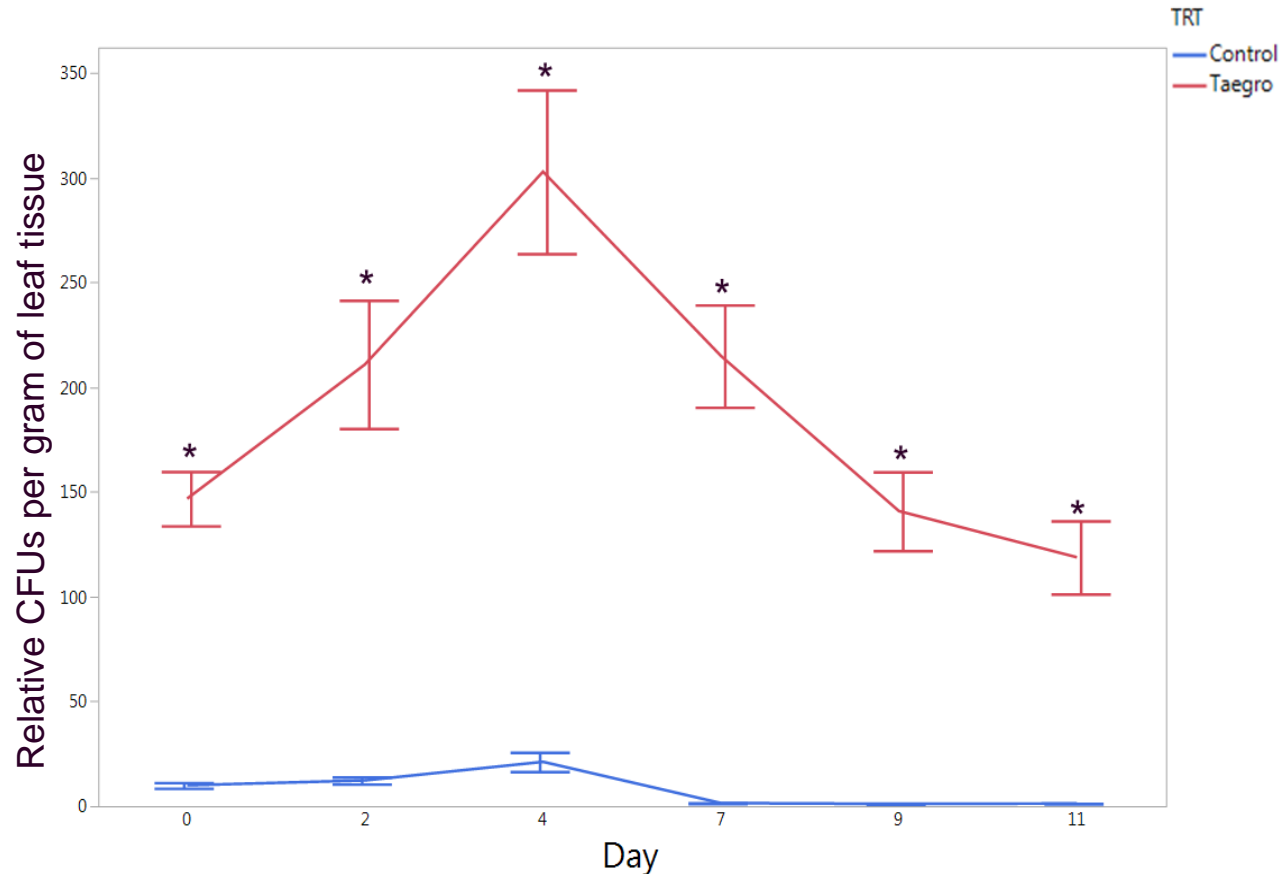


Longevity



Lettuce in greenhouse

Quantifying Taegro persistence on tomatoes

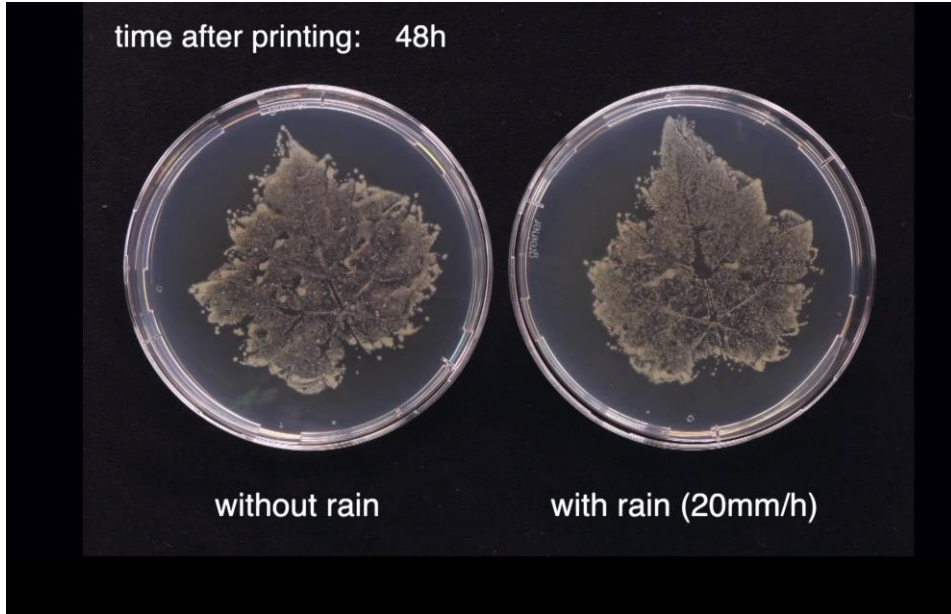


Taegro survived on tomatoes in the field for two weeks

The control fields showed almost no signal, showing no drift

The presence of Taegro was tied to reduced powdery mildew

Durable across weather & pH conditions



pH	4	5	6	7	8	9	10	11	12
	-	+	+	+	+	+	-	-	-

Temperature C (F)	15 (59)	20 (68)	25 (77)	30 (86)	35 (95)	40 (104)	45 (113)	50 (122)	55 (131)
	+	++	++	+++	+++	++	+	-	-

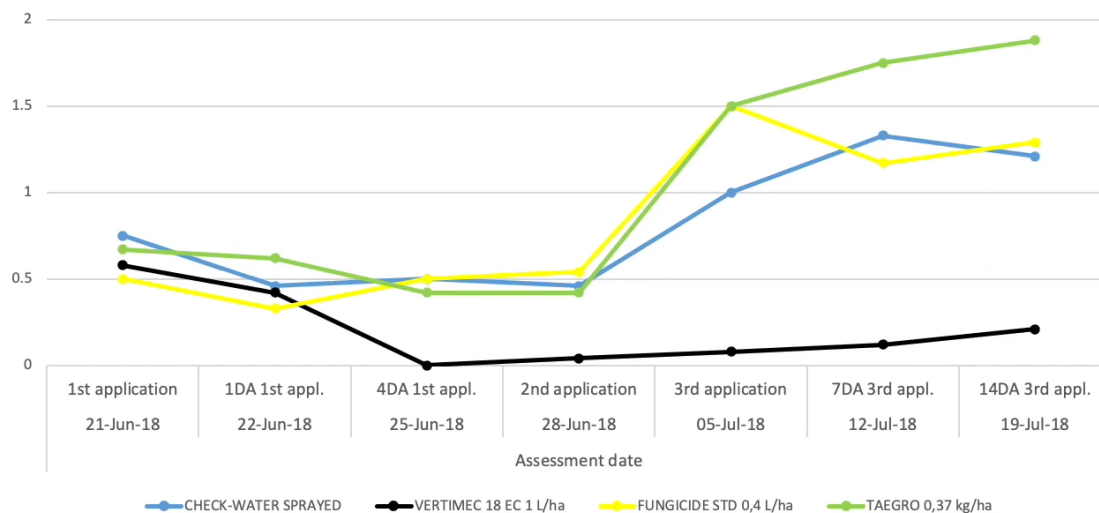
Gentle on beneficials

Comparable to water



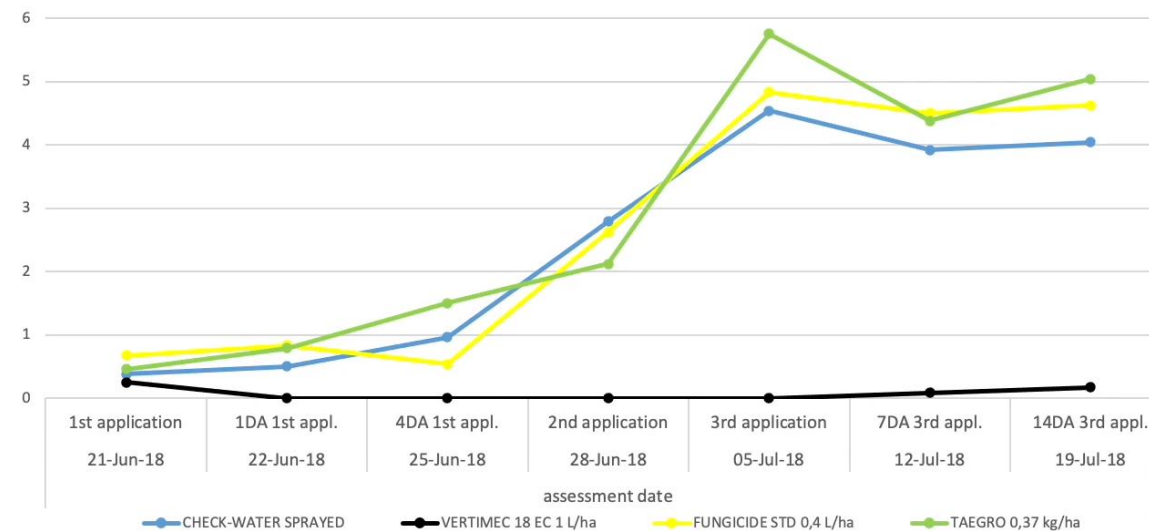
3 applications: 21/6 – 28/6 – 05/07
Water volume: 500 - 600 - 820 L/ha

Adults counting
(6 shoots/plot, avg of 4 replicates)



3 applications: 21/6 – 28/6 – 05/07
Water volume: 500 - 600 - 820 L/ha

Nymphs counting
(6 shoots/plot, avg of 4 replicates)



Compatibility Recommendations – Foliar applied chemicals and Taegro®

Kocide[®]
2000·

 **REGALIA**[®]
BIOFUNGICIDE

 **Cannonball**[®] **WG**

 **Switch**[®]

 **Actigard**[™]

Tanos[™]
FUNGICIDE

 **Quadris**[®]

 **Omega**[®]

 **Inspire**[®]

 **Revus**[®]

Pristine[®]
Fungicide

FireWall[™]
STREPTOMYCIN
17 WP

 **Actara**[®]

 **Vanguard**[®]



*only incompatibility during testing is with lime sulfur

Physical Compatibility

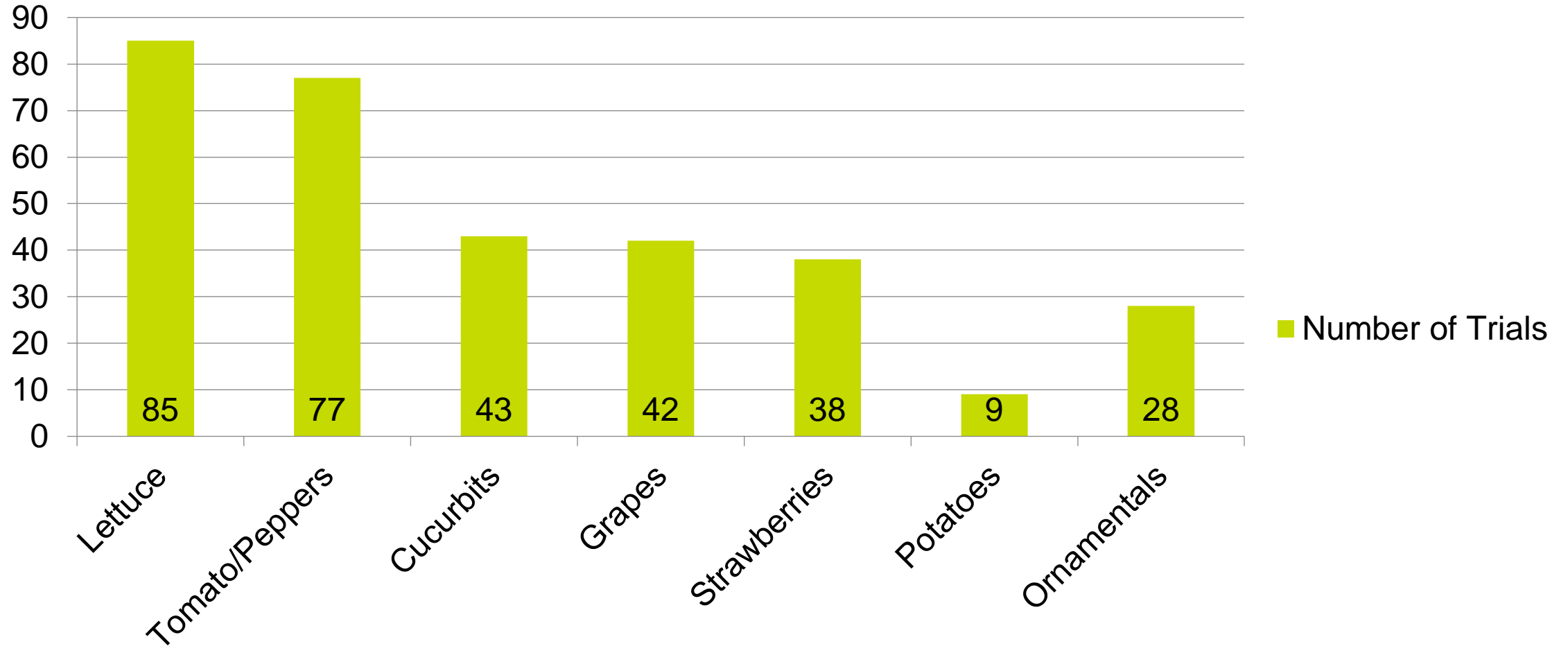
- No foaming was observed in 10 out of 12 tank batches. Minimal (1 mm) foam in the others.
- No Taegro 2 particles were visible on the pump filter screens (50 mesh) or the nozzle filters screens (100 mesh).
- The very small differences found when comparing post-spray nozzle screen weights between mix batches having 1X vs. 4X concentrations (60 vs. 15 GPA) confirmed that Taegro 2 was not collecting on the screens.
- No consistent effects were attributable to water hardness, mix concentration, or production batch.
- With hydraulic agitation suitable for wettable powders this product did not settle out in the tank.
- **Taegro 2 is a viable formulation in the field when applied with commercial equipment and procedures as typically used for wettable powders.**

Figure 1. Surface of liquid after mixing for 5 minutes, showing "worst case" 1 mm foam.



Taegro® 2 Trials by Crop

322 Total Number of Trials



Crops Tested

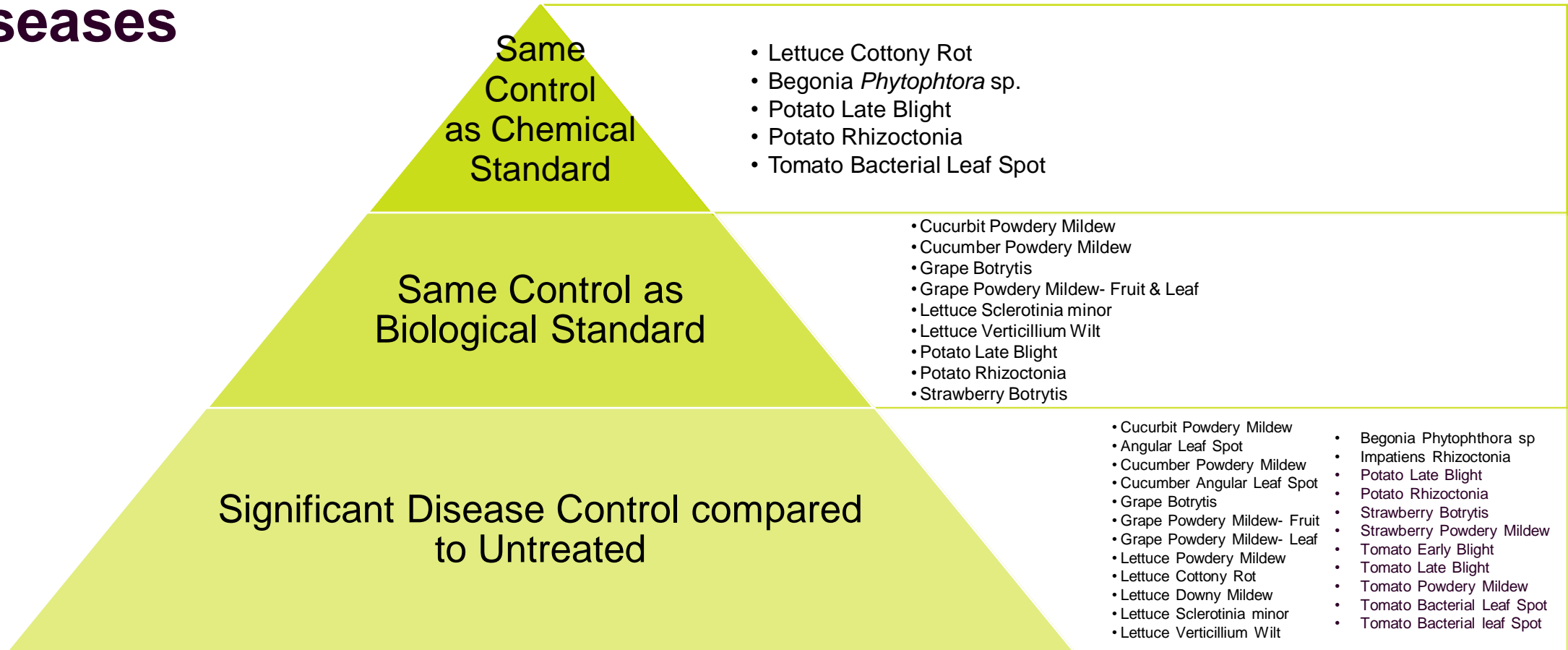
Crop	Years	States/Provinces
Cucurbit	2009-2014	CA, BC, ON, OR, PA, FL, AZ
Cucumber	2009, 2013-2014	CA, BC, ON, OR
Grape	2009, 2011-2013	CA, OR
Lettuce	2011-2013	AZ, BC, CA, IL, ON
Pepper	2009, 2010, 2013	AL, CA, MB, ON
Potato	2013	CA, ID
Strawberry	2009, 2011-2013	AZ, CA, FL
Tomato	2011-2013	BC, CA, FL, GA, MB, ON
Ornamentals	2013	AL, BC, FL



Selection based on high value crops



Taegro has efficacy against a high number of diseases



As part of an IPM management system, Taegro 2 can be used with the standard chemical applications to provide equal or better control of the disease symptoms while lowering MRLs and the number of chemical applications. Taegro also has no resistance or minimal resistance, and can be used to fight resistant pathogens.

What makes Taegro 2 different?

Compatible with wide variety of fertilizers and pesticides

Active in variety of soil temperature and pH conditions



No MRL

Pollinator friendly

Short re-entry and pre-harvest interval



Ideal for use in Integrated Pest Management systems

Reduced chemical usage

Compliance with various food chain requirements

Q&A

On Master

Ornamental
Brassica Vegetables
Bulb Vegetables
Legume Vegetables
Cereals, small grain
Corn
Oil Seed Crops
Edible Fungi
Herbs and Spices
Citrus
Pome Fruit

Tree Nuts
Stone Fruit
Tropical and Subtropical
Fruits
Rice
Specialty Vegetables
Tree, Vine, Bush and
Other Crops
Shrubs
Shade and Forest Trees
Turf

On Commercial

Leafy Vegetables
Fruiting vegetables
Curcurbits
Ornamentals
Root and Tuber Vegetables
Berries and Small Fruit

Product Registrations/Labels: USA and Canada

- Registered in USA with OMRI and EPA (#70127-12)

- Registered in Canada with OMRI and PMRA # 31865



GROUP 44 FUNGICIDE/BACTERICIDE
GROUPE 44 FONGICIDE/BACTÉRICIDE

PROD. #756258-668

COMMERCIAL WETTABLE POWDER

ACTIVE INGREDIENT:
Bacillus subtilis var. *amyloliquifaciens* Strain FZB24
1.0 x 10¹⁰ colony forming units/g
Live organism

Registration No: 31865
PEST CONTROL PRODUCTS ACT

CAUTION SKIN IRRITANT
POTENTIAL SENSITIZER
READ THE LABEL BEFORE USING

COMMERCIALE POUDRE MOUILLABLE

PRINCIPE ACTIF:
Bacillus subtilis var. *amyloliquifaciens* souche FZB24
1.0 x 10¹⁰ unités formant des colonies/g
Organisme vivant

Numéro d'homologation: 31865
LOI SUR LES PRODUITS ANTIPARASITAIRES

ATTENTION IRRITANT POUR LA PEAU
SENSIBILISATEUR POTENTIEL
LIRE L'ÉTIQUETTE AVANT L'UTILISATION

Batch code and expiration date/ Code de lot/Date d'expiration

[]

Net contents / Contenu net:
375 g

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Novozymes BioAg Limited
3935 Thatcher Avenue
Saskatoon, SK Canada S7R 1A3
1-888-744-5662



ACTIVE INGREDIENT
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OTHER INGREDIENTS 87.0%
Total 100.0%

* Contains a minimum of 1.0 x 10¹⁰ colony forming units (CFU)/gram.

KEEP OUT OF REACH OF CHILDREN CAUTION

See inside this booklet for additional Precautionary Statements, First Aid, complete Directions for Use, and Warranty.

Precautionary statements

HAZARDS TO HUMANS AND DOMESTIC ANIMALS

CAUTION - Causes moderate eye irritation. Avoid contact with eyes, skin, or clothing. Wear protective eyewear such as goggles, face shield or shielded safety glasses. Harmful if absorbed through skin, inhaled or swallowed. Avoid breathing dust or spray mist. Wash thoroughly with soap and water after handling and before eating, drinking, and chewing gum, using tobacco or using the toilet. Remove and wash contaminated clothing before reuse.

Batch code and expiration date

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[Batch code and expiration date to be inserted]

Novozymes Biologicals Inc.
5400 Corporate Circle
Salem, VA 24153, USA
1-888-744-5662

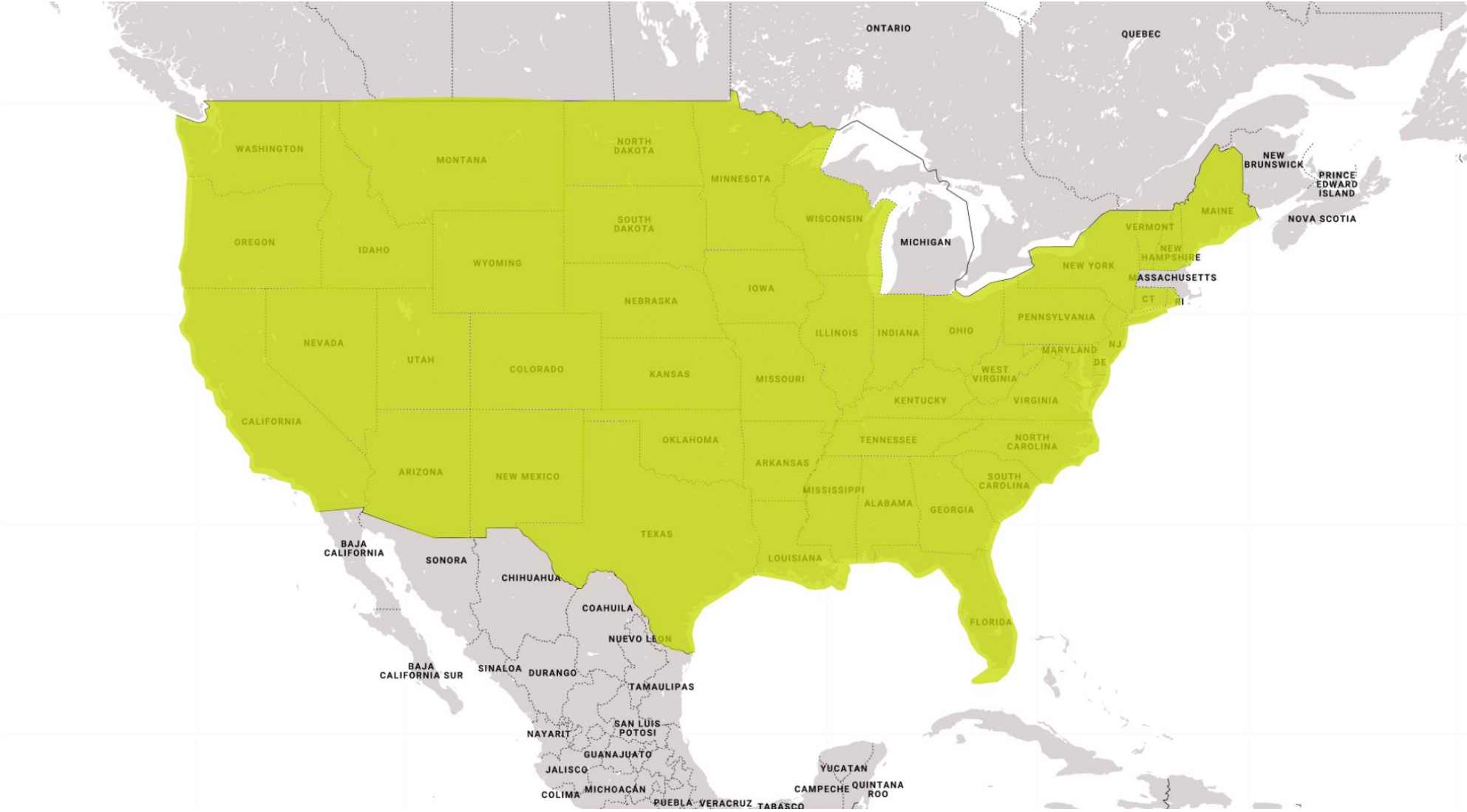
EPA Registration Number: 70127-12
EPA Establishment Number: 33967-NV-1
Made in the USA 16001 10-16 2651-708

Net contents:
13.2 oz (375 g)

novozymes
Rethink Tomorrow

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HOTLINE NUMBER:	Have the product container or label with you when calling a poison control center or doctor, or going for treatment. You may also contact 1-800-222-1222 for emergency medical treatment information.

USA State Registrations * as of 26-Aug-21

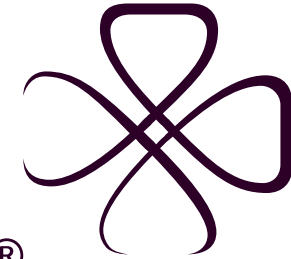


Taegro® 2 for the US | Novozymes



Scan to learn more

novozymes®



Rethink Tomorrow