

Outlook for Powdery and Downy Mildew Control in Vine Crops – Fungicides, Variety Resistance and More!

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Cornell Vegetables

Resources for commercial growers

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Disease factsheets and articles

If you were a big fan of the pioneering [Vegetable MD Online](#) website, much of that content has been moved here. We are in the process of moving over the rest.

- **(LIHREC)** indicates information from the Long Island Horticultural Research and Extension Center Vegetable Pathology website.
- List also **includes some herbs** (parsley, basil) and **abiotic disorder**
- Some content is available as printer-friendly .pdf versions.

- [Diseases and management practices affecting multiple crops](#)
 - [Phytophthora Blight and Its Management in Cucurbit Crops](#)
 - [Other Vegetables](#)
 - [Reduced-tillage for Managing Phytophthora Blight and Other Borne Pathogens](#)
 - [Biofumigation for Managing Phytophthora Blight and Other Borne Pathogens](#)
 - [White Mold and Its Management in Cabbage, Beans, and Other Vegetables](#)
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 - [Virus diseases of snap and dry beans](#)
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 - [Corn \(sweet\)](#)
 - [Sweet corn diseases and control measures](#)
 - [Common corn smut](#) (LIHREC)

- [Crucifers \(aka brassicas and cole crops\)](#)
 - [Alternaria leaf spot of brassicas](#)
 - [Alternaria leaf spot of brassicas](#) (LIHREC)
 - [Bacterial leaf spot on cauliflower](#) (LIHREC)
 - [Black leg on kale](#) (LIHREC)
 - [Black rot on Brussels sprouts](#) (LIHREC)
 - [Black rot on cabbage](#) (LIHREC)
 - [Black rot on ornamental kale and ornamental cabbage](#) (LIHREC)
 - [Cabbage chimera \(genetic disorder\)](#) (LIHREC)
 - [Clubroot of crucifers](#)
 - [Clubroot on bok choy](#) (LIHREC)
 - [Diseases of winter greens: downy mildew, Cladosporium leaf spot, Botrytis crown rot and root rot](#)
 - [Downy mildew on cabbage](#) (LIHREC)
 - [Downy mildew on seedlings](#) (LIHREC)
 - [Fusarium yellows of cabbage & related crops](#)
 - [Head rot \(soft rot\) of broccoli](#) (LIHREC)
 - [Heat stress damage to broccoli heads](#) (LIHREC)
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 - [Table: Fungicides for Cucurbit Crops](#)
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 - [Anthracnose](#) (LIHREC)
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 - [Powdery mildew](#)
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 - [Pythium root rot](#) (LIHREC)
 - [Scab](#)
 - [Sunscald of pumpkin and winter squash](#) (LIHREC)
 - [Virus diseases of cucurbits](#)
 - [White mold on cucurbits](#) (LIHREC)
 - [Xanthomonas leaf spot \(formerly Bacterial leaf spot\)](#)
- [Dill](#)
 - [Cercosporoid leaf blight](#) (LIHREC)

Cucurbits

- [Table: Fungicides for Cucurbit Crops \(.pdf\)](#) ([click here for Excel version](#))
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Cucurbit Powdery Mildew

Updated: June 2022 [Printer-friendly .pdf version of the management information on this page.](#)

See also:

- Newsletter articles:
 - [Why Manage Cucurbit Powdery Mildew?](#)
 - [Managing Cucurbit Powdery Mildew Organically – Key Points for Success](#) [Updated 2022-01-25]
 - [Managing Cucurbit Powdery Mildew Conventionally – Key Points for Success](#) [Updated 2022-01-25]
 - [Conventional Fungicide Recommendations for Cucurbit Powdery Mildew](#)
- [LIHREC Cucurbit powdery mildew photo gallery \(includes diagnostic images\)](#)
- [Research](#) on powdery mildew conducted at LIHREC.
- [Guidelines on managing cucurbit powdery mildew in 2022.](#)
- Podcast: [Avoiding the Powdery Mildew Blues](#) – Meg McGrath, plant pathologist at Cornell's Long Island Horticultural Research and Extension Center, discusses how with other members of the Great Lakes Vegetable Working Group on 24 June 2020. This and other recordings are in the green-bordered box at the bottom of [this page](#).
- Listen to Meg McGrath talk about managing powdery mildew in a teleconference hosted by Steve Bogash of Marrone Bio Innovations on 22 July 2020. Dial 515-604-9875. At prompts enter 832191 for access code and 14 for reference number.
- [Results from research on fungicide resistance in the cucurbit powdery mildew pathogen](#)
- [Targeted Fungicides for Cucurbit Powdery Mildew](#)
- [Table: Fungicides for Cucurbit Crops](#)
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Topics on this page:

- [Impact and causal fungi](#)
- [Symptoms and signs](#)
- [Disease cycle](#)
- [Managing cucurbit powdery mildew – Overview](#)
- [Cultural and biological controls including resistant varieties](#)
- [Chemical control – General information](#)
- [Recommended targeted fungicides](#)
- [Organic fungicides for powdery mildew](#)
- [Summary points about managing powdery mildew successfully](#)

Vegetable Pathology – Long Island Horticultural Research & Extension Center

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- **About** – Research and Extension info.
- **Photo gallery** – Images of and disorders on vegetable, herbs
- **Research** – Annual program s current applied research proj publications, presentation file
- **Extension & Outreach** – Pro proceedings, presentation file
- **Organic** – Info on managing c
- **News** – Recent additions to t

Learn more about the [Long Island Extension Center](#).



Research reports

Organic Disease Management

Biopesticide Evaluations

Fungicide Resistance

Cucurbit Downy Mildew

Cucurbit Powdery Mildew

Phytophthora Blight

Basil Downy Mildew

Late Blight of Tomato

Foliar Diseases of Tomato

Ozone on Long Island and its Impact on Plants

Extension & Outreach

Providing growers with information about diseases of vegetable crops and their management is the goal of my program. I conduct applied (translational) research generating practical results that are relevant for crop production. Gardeners will find some information at this website useful; I also conduct a Master Gardener class on plant diseases focused on vegetables. See [About](#) for additional general information on my program.

- [For gardeners](#)
- [Vegetable and herb disease factsheets and articles](#)
- [Resistant vegetable variety tables](#)
- [Organic management of vegetable disease](#)

[List of Extension presentations made by M. T. McGrath](#)

Some recent presentations

- **[Some Love It Wet, Others Dry: The Many Cucurbit Pathogens and Their Management.](#)** 2023 NYS Vegetable Growers Expo. Cucurbit Session. Syracuse, NY. 2/6/23.
- **[Review of Powdery Mildew Management.](#)** 2023 Mid-Atlantic Fruit and Vegetable Convention. Pumpkin Session. Hershey, PA. 2/2/23.
- **[What was Learned From Over 20 Years of Evaluating Biofungicides.](#)** 2023 Mid-Atlantic Fruit and Vegetable Convention. Biocontrol Session. Hershey, PA. 1/31/23.
- **[Lessons Learned Over a Career About Vegetable Diseases, Management and Fungicide Resistance.](#)** 2023 Mid-Atlantic Fruit and Vegetable Convention. General Vegetable Session. Hershey, PA. 1/31/23.
- **[Greenhouse Vegetable Disease Management.](#)** 2023 Mid-Atlantic Fruit and Vegetable Convention. Greenhouse Vegetable Session. Hershey, PA. 1/30/23.
- **[Effectively Managing Diseases of Vegetables.](#)** Berkshire Grown Workshop Webinar. 1/18/23.
- **[Tips on Managing Vegetable Diseases Organically.](#)** 2023 Long Island Agricultural Forum. Sustainable Session. 1/12/23.
- **[Recommendations for Managing Important Diseases Based on Research.](#)** 2023 Long Island Agricultural Forum. Vegetable Session. 1/11/23.

<https://www.vegetables.cornell.edu/pest-management/disease-factsheets/>



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- [Minimizing Injury from Copper Fungicides](#)



Disease-resistant varieties

Disease Resistant Vegetable Varieties

See also: [Tips on Using Resistant Varieties](#)

Disease resistance reported in these lists is based on information obtained from seed company catalogs.

If you see an error, please contact mtm3@cornell.edu.

- Beans

- Beets

Article: [Evaluations of Beet Varieties Resistant to Cercospora Leaf Spot](#)

- Broccoli

- Brussels Sprouts

- Cabbage

- Carrots

- Corn (sweet)

- Cucurbits (cucumbers, melons, pumpkins, squash)

Cucurbit variety evaluations: [downy mildew](#) (cantaloupe, cucumber LIHREC) | [powdery mildew](#) (cantaloupe, pumpkin, squash LIHREC)

Article: [Cucumber and Cantaloupe Varieties Resistant to Downy Mildew](#)

- Eggplant

- Leeks

- Lettuce

- Onion

- Peas

- Peppers

Article: [Pepper Varieties Resistant to Phytophthora Blight and Bacterial Leaf Spot](#)

- Spinach

- Tomato

Article: [Tomato varieties with multiple disease resistance from Cornell](#)

Article: [Late blight resistant tomato variety evaluations](#)

Prefer to view disease-resistant variety information in spreadsheets? [Download disease-resistant variety spreadsheets from this Box folder](#).

Disease-resistant cucurbit varieties

- Information is from seed catalogs for 2018, 2020, and 2022. Occasionally varieties are listed as resistant without the disease(s) or disorder(s) specified.
- Follow links below to tables with more details about these varieties including seed companies marketing them and whether organic seed is available, as well as variety resistance to disorders.
- Prefer to view disease-resistant variety information in spreadsheets? [Download disease-resistant variety spreadsheets from this Box folder](#)

Cucumbers – Slicers

- **201:** Cucumber Mosaic Virus, Downy [Mildew](#), Powdery [Mildew](#), Papaya Ringspot Virus, Scab, Watermelon Mosaic Virus (Strain 2), Zucchini Yellow Mosaic Virus
- **Alcazar F1:** Cucumber Vine Yellowing Virus, Powdery [Mildew](#), Scab
- **Ashley:** Angular Leaf Spot, Downy [Mildew](#), Powdery [Mildew](#)
- **Bella:** Corynespora Leaf Spot/Blight, Powdery [Mildew](#), Scab, Target Leaf Spot
- **Bragger:** Resistant to disorders
- **Brickyard:** Angular Leaf Spot, Anthracnose, Cucumber Mosaic Virus, Downy [Mildew](#), Powdery [Mildew](#), Papaya Ringspot Virus, Scab, Watermelon Mosaic Virus (Strain 2)
- **Bristol F1:** Angular Leaf Spot, Anthracnose(Co:1; A), Cucumber Mosaic Virus, Downy [Mildew](#), Powdery [Mildew](#), Papaya Ringspot Virus, Scab, Watermelon Mosaic Virus, Zucchini Yellow Mosaic Virus
- **Burpee II:** Cucumber Mosaic Virus, Downy [Mildew](#)
- **Burpless Beauty:** Disease resistance not specified
- **Bush Champion:** Cucumber Mosaic Virus
- **Bush Crop:** Scab
- **Camaro F1:** Powdery [Mildew](#)
- **Centella F1:** Cucumber Mosaic Virus, Downy [Mildew](#), Powdery [Mildew](#), Papaya Ringspot Virus, Scab, Watermelon Mosaic Virus (Strain 2), Zucchini Yellow Mosaic Virus
- **Cobra F1:** Angular Leaf Spot, Anthracnose (Co; A2), Cucumber Mosaic Virus, Downy [Mildew](#), Powdery [Mildew](#), Papaya Ringspot Virus, Scab, Watermelon Mosaic Virus (Strain 2), Zucchini Yellow Mosaic Virus

mildew



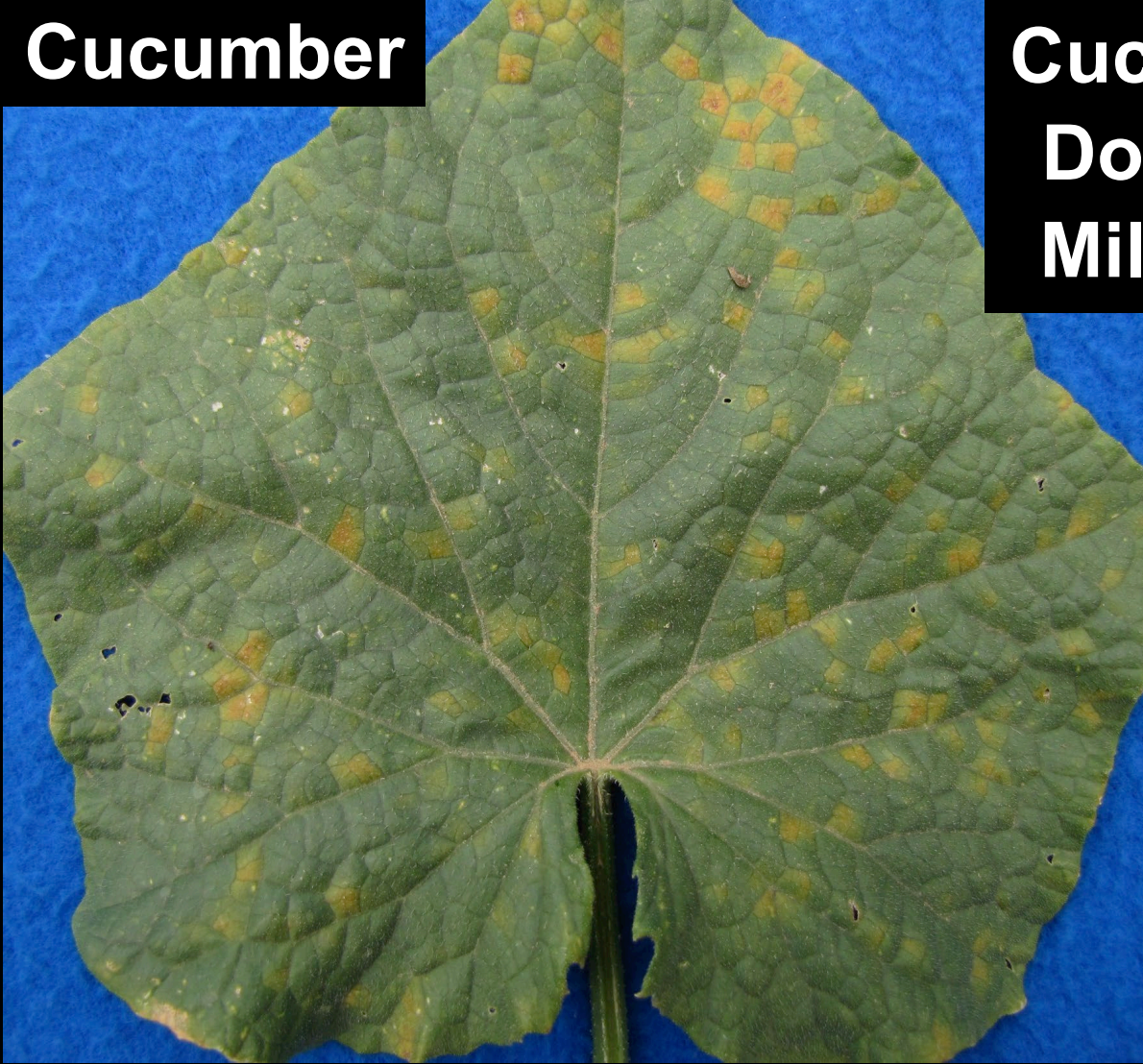
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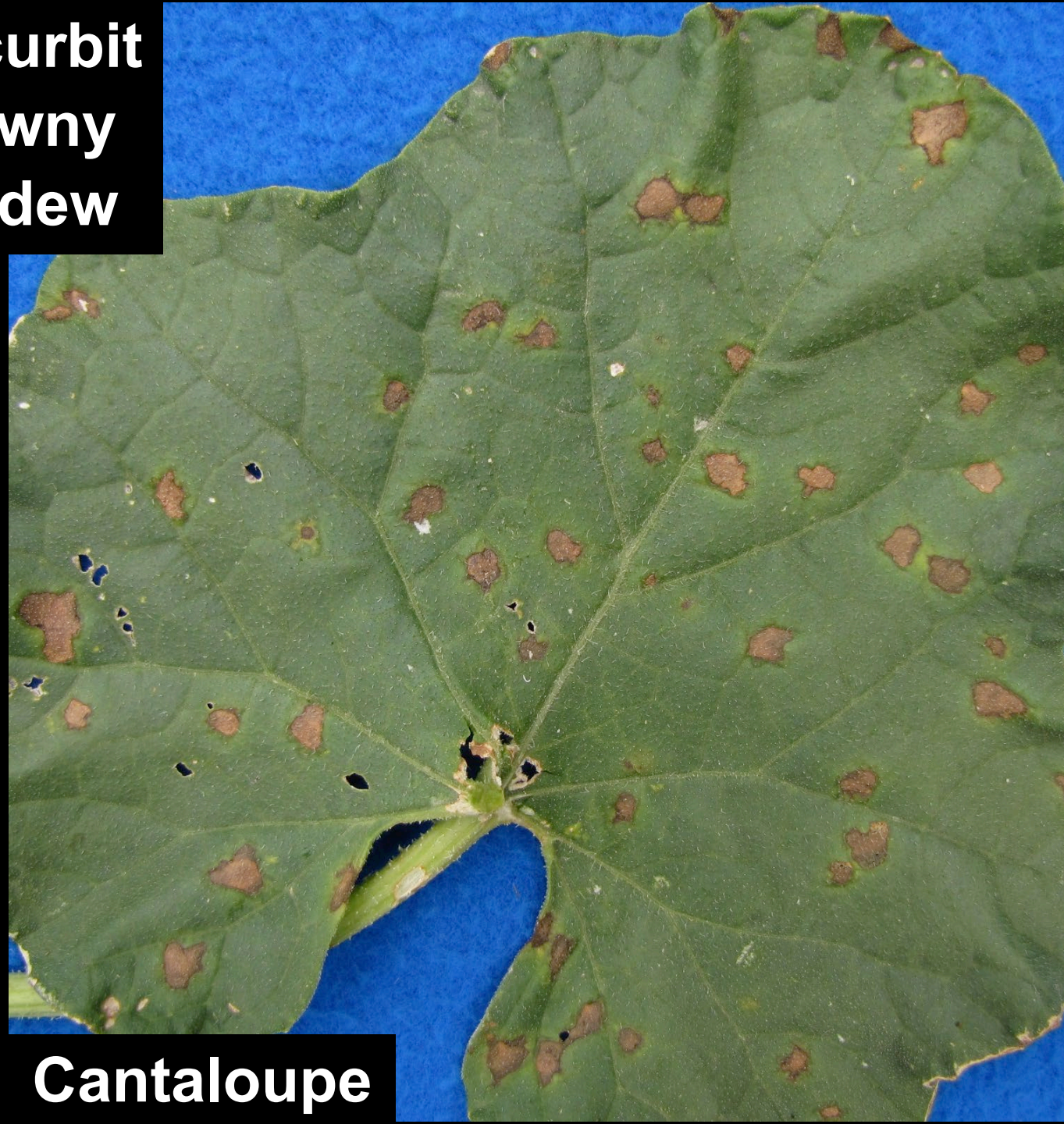
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Cucumber



**Cucurbit
Downy
Mildew**



Cantaloupe



Cucurbit Downy Mildew – important facts

- Pathogen survives overwinter in S Florida, moves northward.
- Occurrence is monitored, but no longer forecasted. Sign up for alerts. <https://cdm.ipmpipe.org/>
- Pathogen is host-specialized. Cucumber + cantaloupe affected first; pathogen Clade 2.
- Squash, pumpkin, and watermelon affected later in season if at all pathogen Clade 1.

Managing Cucurbit Downy Mildew

- **Learn about the disease** at <https://www.vegetables.cornell.edu/pest-management/disease-factsheets/downy-mildew-of-cucurbits/>.
- **Plan fungicide program** based on information at above website about fungicide efficacy, resistance, and label use restrictions.
- **Select resistant varieties.** Cucumber: DMR 401, Brickyard, new Tokita lines. Cantaloupe: Trifecta.
- Sign up to **receive alerts** when downy mildew has been detected nearby at **The Cucurbit Downy Mildew Forecast webpage:** <https://cdm.ipmpipe.org/>.
- **Monitor** <https://cdm.ipmpipe.org/> to know when and where downy mildew is developing in different cucurbit crops.
- Become familiar with **early symptoms**. See <http://blogs.cornell.edu/livepath/gallery/cucurbits/downy-mildew-o-cucurbits-early-symptoms/>
- **Scout** for symptoms at least weekly, especially cucumbers.
- **Report** occurrence to extension specialist or post at <https://cdm.ipmpipe.org/>.
- Start applying **targeted fungicides** as soon as symptoms detected in crop or nearby, ~~or risk high~~. Apply in alternation and with protectant fungicides (chlorothalonil, mancozeb, copper, biopesticides). Protectants alone recommended when preventive application used.
- **Rate success** of management program and identify ways to improve if inadequate.

Management – Downy Mildew – Cantaloupe

Downy Mildew Resistant Varieties

Trifecta Edisto 47 Planter's Jumbo

29% control (AUDPC values); 72% control (defoliation)

Conventional Fungicide Program

Ranman alt. Previcur Flex alt. Orondis Ultra

7-27 started preventive applications.

8-17 started IPM program.

98 – 100% control including on susceptible variety.

Conventional Fungicide Programs + Resistant Varieties

Downy Mildew on Cantaloupe



8-15-22

Ambrosia (nontreated)



Ambrosia (preventive)



Ambrosia (IPM)



Trifecta (nontreated)



9-12-22

Ambrosia (IPM)



Trifecta (IPM)



Edisto 47 (IPM)

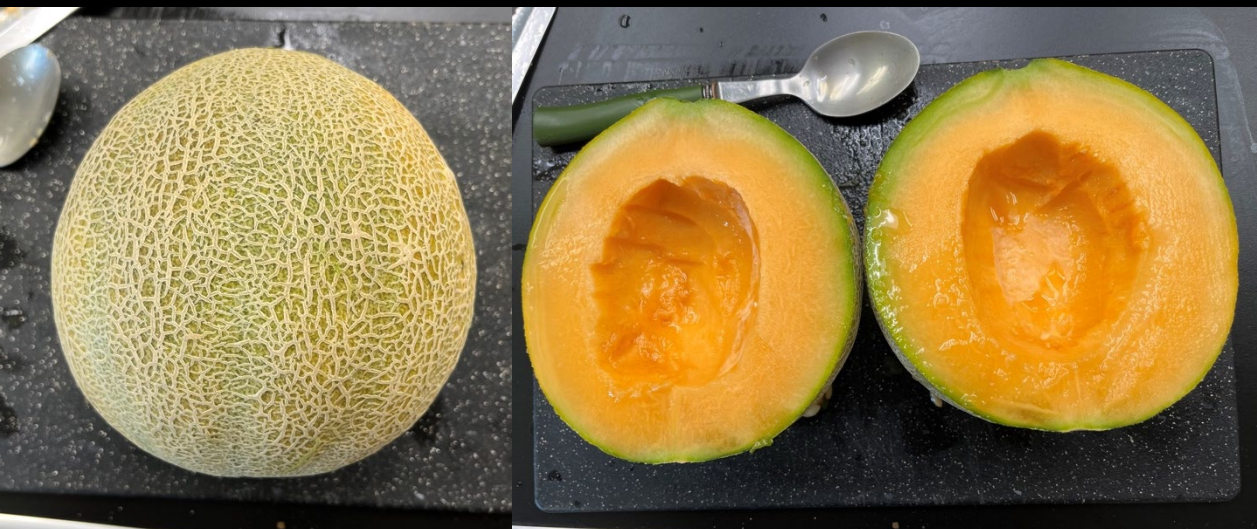


Planter's Jumbo (IPM)



9-12-22

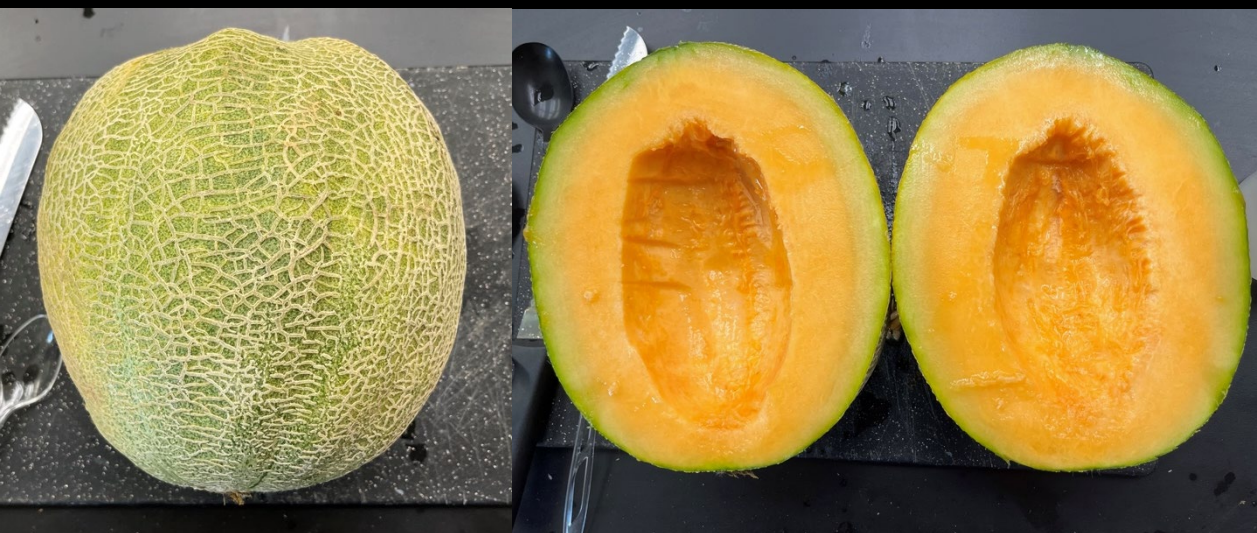
Ambrosia



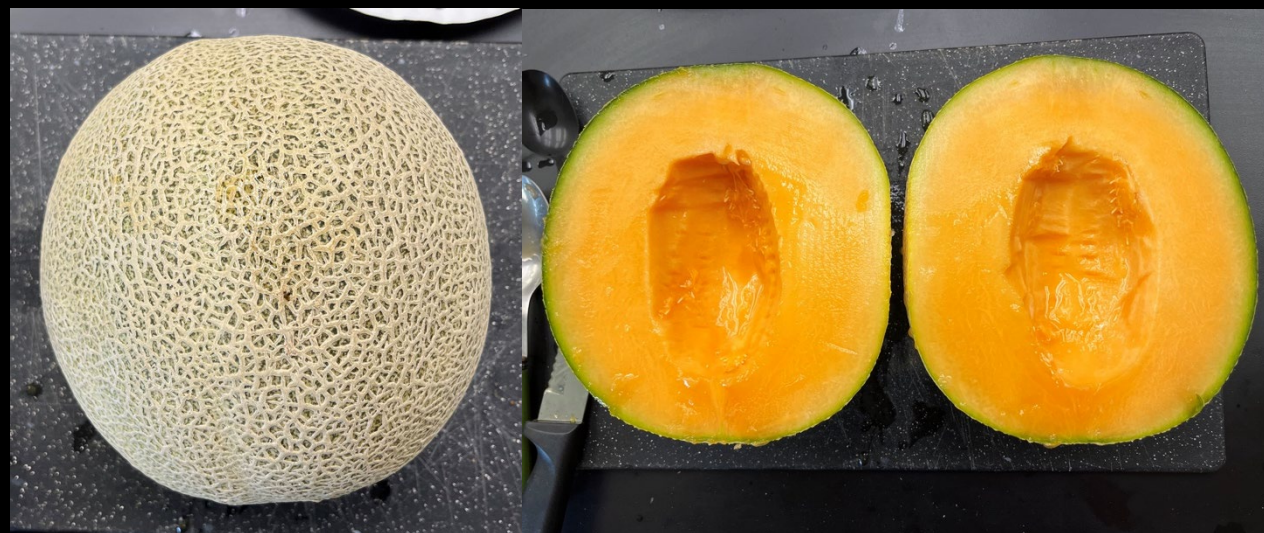
Trifecta



Edisto 47



Planter's Jumbo



Fungicide Efficacy – Downy Mildew – Cucumber

Biopesticides tested in 2022 and copper (Kocide 3000-O) ineffective based on symptom severity and % leaves affected.

Symptoms first seen 16 days after the first application.

Biopesticides tested:

- Serifel (microbial)

- Theia (microbial)

- Trillium (thyme oil)

- Regalia + Stargus (extract giant knotweed + microbial)

Conventional fungicide program very effective (99% control):

- Ranman alt. Orondis Ultra alt. Previcur Flex

Documents CDM is difficult to manage with contact fungicides.



8-29-22. 24 days after first symptoms. 1 day before 7th app.

Seedling Bioassay - Fungicide Resistance



Fungicide Efficacy - Cucumber Bioassay LI

FRAC Code	Fungicide	2021	2019	2018	2017	2016
4	Ridomil	not tested	not tested	not tested	not tested	not tested
11	Quadris	ineffective	ineffective	ineffective	ineffective	Mod. effective
40	Revus	ineffective	ineffective	ineffective	ineffective	Mod. effective
43	Presidio	ineffective	Mod. effective	ineffective	EFFECTIVE	EFFECTIVE
40	Forum	Mod. effective	Mod. effective	EFFECTIVE	ineffective	ineffective
22	Gavel, Zing!	EFFECTIVE	Mod. effective	EFFECTIVE	EFFECTIVE	EFFECTIVE
27	Curzate, Tanos	EFFECTIVE	EFFECTIVE	EFFECTIVE	poor	EFFECTIVE
28	Previcur Flex	EFFECTIVE	EFFECTIVE	EFFECTIVE	poor	EFFECTIVE
21	Ranman	EFFECTIVE	EFFECTIVE	EFFECTIVE	EFFECTIVE	EFFECTIVE
45 + 40	Zampro	not tested	not tested	EFFECTIVE	EFFECTIVE	EFFECTIVE
29	Omega	EFFECTIVE	EFFECTIVE	not tested	not tested	not tested
49	Orondis	EFFECTIVE	EFFECTIVE	EFFECTIVE	not tested	not tested

Fungicide Efficacy - Bioassays - South Carolina

FRAC Code	Fungicide	Cucumber, LI, 2021	Cucumber, Clade 2	Butternut squash, Clade 1	Watermelon, Clade 1
11	Quadris	ineffective	ineffective *	ineffective *	ineffective *
40	Revus	ineffective	ineffective *	EFFECTIVE	EFFECTIVE
43	Presidio	ineffective	EFFECTIVE	EFFECTIVE	EFFECTIVE
40	Forum	Mod. effective	ineffective *	ineffective *	ineffective *
22	Gavel, Zing!	EFFECTIVE	not tested	not tested	not tested
27	Curzate, Tanos	EFFECTIVE	ineffective *	ineffective *	ineffective *
28	Previcur Flex	EFFECTIVE	EFFECTIVE	ineffective *	ineffective *
21	Ranman	EFFECTIVE	EFFECTIVE	EFFECTIVE	EFFECTIVE
45 + 40	Zampro	EFFECTIVE when tested: 2016-18	not tested	not tested	not tested
29	Omega	EFFECTIVE	EFFECTIVE	EFFECTIVE	EFFECTIVE
49	Orondis	EFFECTIVE	not tested	not tested	not tested

*** Ineffective in some bioassays, 2018 – 2020.**

Fungicides – Phytophthora Blight

FRAC Code	Fungicide	Active Ingredient	Registered	Resistance	Downy Mildew
4	Ridomil	mefenoxam	mid-1990s	Common	Resistance common
33	multiple	phosphorous acid			Not effective
43	Presidio	fluopicolide	2008 (spring)	Common, southeast	Resistance – Clade 2?
21	Ranman	cyazofamid	2004	Detected, southeast	EFFECTIVE
22	Gavel	zoxamide	2002 (Feb)	lab	EFFECTIVE
49	Orondis	oxathiapiprolin	2016	lab	EFFECTIVE
40	Forum	dimethomorph	2002 (Nov)		Resistance – all
40	Revus	mandipropamid	2008		Resistance – Clade 2
27	Tanos	cymoxanil	2005		Resistance – Clade 1
45 + 40	Zampro	armetoctradin + dimethomorph	2012 (June)		EFFECTIVE
29	Omega	fluazinam	2012 / 2016		EFFECTIVE

Fungicides – Phytophthora + Downy Mildew

Cucumber and Cantaloupe (downy mildew pathogen clade 2):

Omega early. PHI is 30 days.

Zampro, Orondis, Gavel. Tanos?

Ranman if not used a lot for Phytophthora in past on farm.

Squash, Pumpkin and Watermelon (downy mildew pathogen clade 1; concern late summer - fall):

Revus or Forum, Tanos early when downy mildew not a concern.

Revus, Zampro, Omega (7 d PHI), Orondis, Gavel.

Ranman and Presidio if not used a lot for Phytophthora.

Cucurbit Powdery Mildew



Integrated Disease Management

Cucurbit Powdery Mildew

- Resistant varieties provide limited (pumpkin, squash) to excellent (cucumber, cantaloupe) suppression.
- Onset coincides with start of fruiting.
- Many biopesticides and protectant fungicides (sulfur, chlorothalonil) effective on upper leaf surfaces.
- Targeted fungicides can be excellent.

Effective on lower leaf surface.

Resistance is major issue.

Isolates with multi-fungicide resistance.

Inherent differences in efficacy including within FRAC group

Betternut 1744



Copyright © Rupp Seeds

Powdery mildew tolerant. Developed by Rupp breeders. Slightly larger than Betternut 900 for farm markets and roadside stands.

Taybelle PM



Copyright © Seminis

A direct conversion from Taybelle to include intermediate resistance to powdery mildew.



HARRIS
EST SEEDS 1879

Pumpkin Gladiator

Our #1 variety! Its improved disease protection and grower-preferred fruit size have made Gladiator the number one variety of growers across the country. Raised next to other varieties in field comparisons, Gladiator shows improved homozygous intermediate resistance to powdery mildew. The round, deep orange fruit have moderate ribbing and measure 13" wide x 12" high. Gladiator's long handles are thick and firmly rooted to the 20 to 25 lb. fruit. Vigorous, semi-vine plants produce good yields of these classic, attractive pumpkins that are uniform for size and shape. US Patent 7,166,772.

Squashes and Pumpkins
Intermediate resistance
Powdery mildew tolerant
Homozygous best
control improved with fungicides

Cantaloupe: **Race specific resistance.** Excellent but specific

Arangina



Copyright © Seminis

Arangina is a delicious mid-season ESL Italian melon. Strong plant vigor with good and uniform fruit setting. The fruit is blocky shaped, hard course netting, deep green sutures, dark orange flesh with great firmness and small cavity. Outstanding eating quality. Harvest indicator is when rind changes colors.

Disease Resistance

Fusarium Wilt (0,1,2)

Powdery Mildew (1,2)

Disease Resistance

Fusarium Wilt 0,1,2

Powdery Mildew 1,2,3,5

Athena



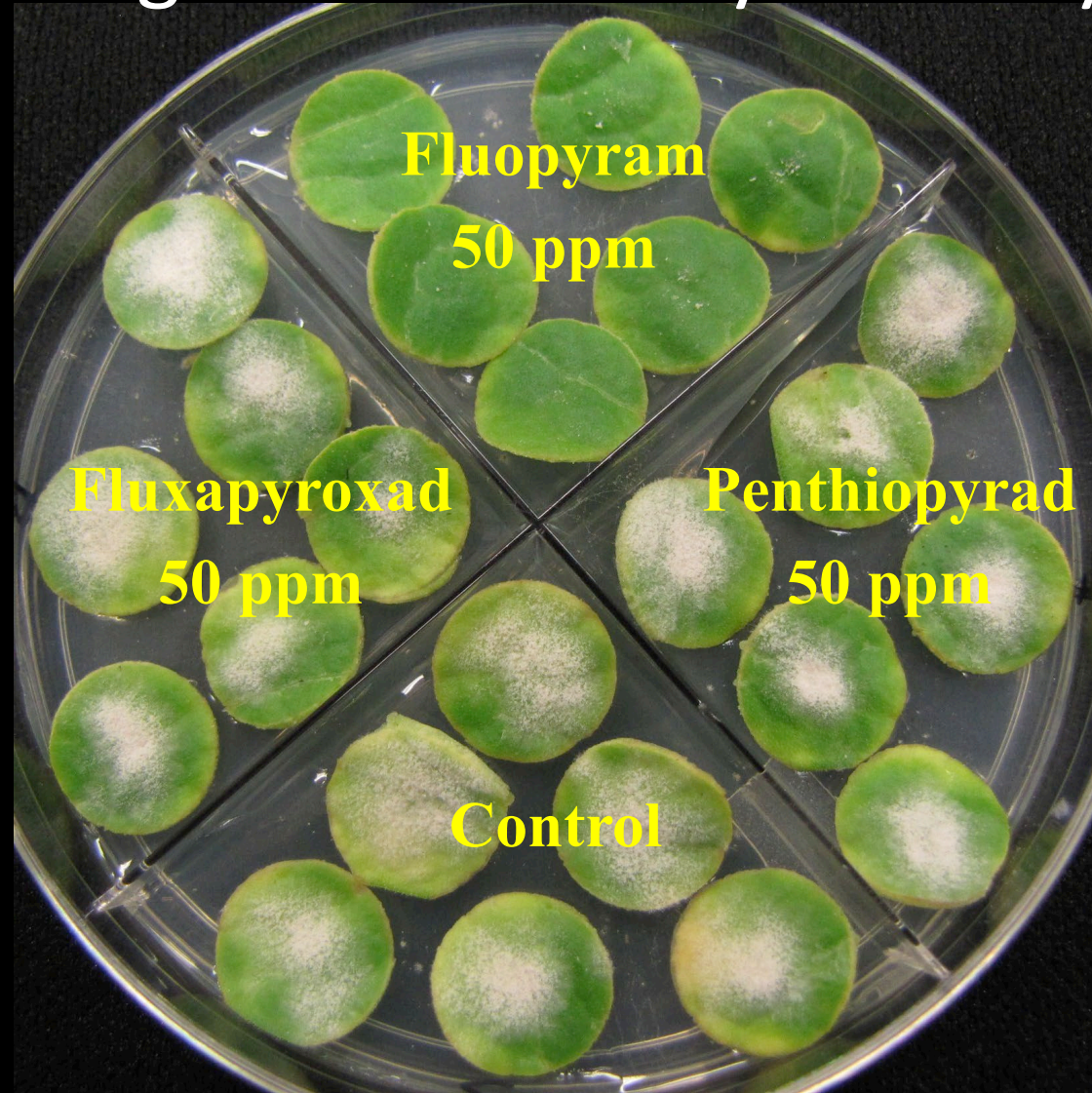
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Firm flesh, harvest closer to slip than Super Star. Resembles Saticoy. Excellent disease tolerance.

Fungicide Evaluation - Pumpkin



Fungicide Sensitivity Bioassay



Powdery Mildew Isolate Bioassays – Fungicides

Endura (7)	500 ppm (= field rate)	Resistant
Torino (U6)	50 ppm (= field rate)	
Quintec (13)	200 ppm (= field rate)	
Rally (3)	40, 80 ppm (field rate = 300 ppm)	Reduced Sensitivity
Vivando (50)	50, 150 ppm (field rate = 600 ppm)	
Luna Privilege (7)	50, 150 ppm (field rate = 390 ppm)	

Field rate = highest label rate applied at 50 gpa.

Luna Privilege used instead of Luna fungicides labeled for this use because Luna Experience and Luna Sensation have another AI.

Fungicide resistance is result of change in single or multiple genes.

Quintec

**Sensitive
Isolate**

Luna Privilege

Torino

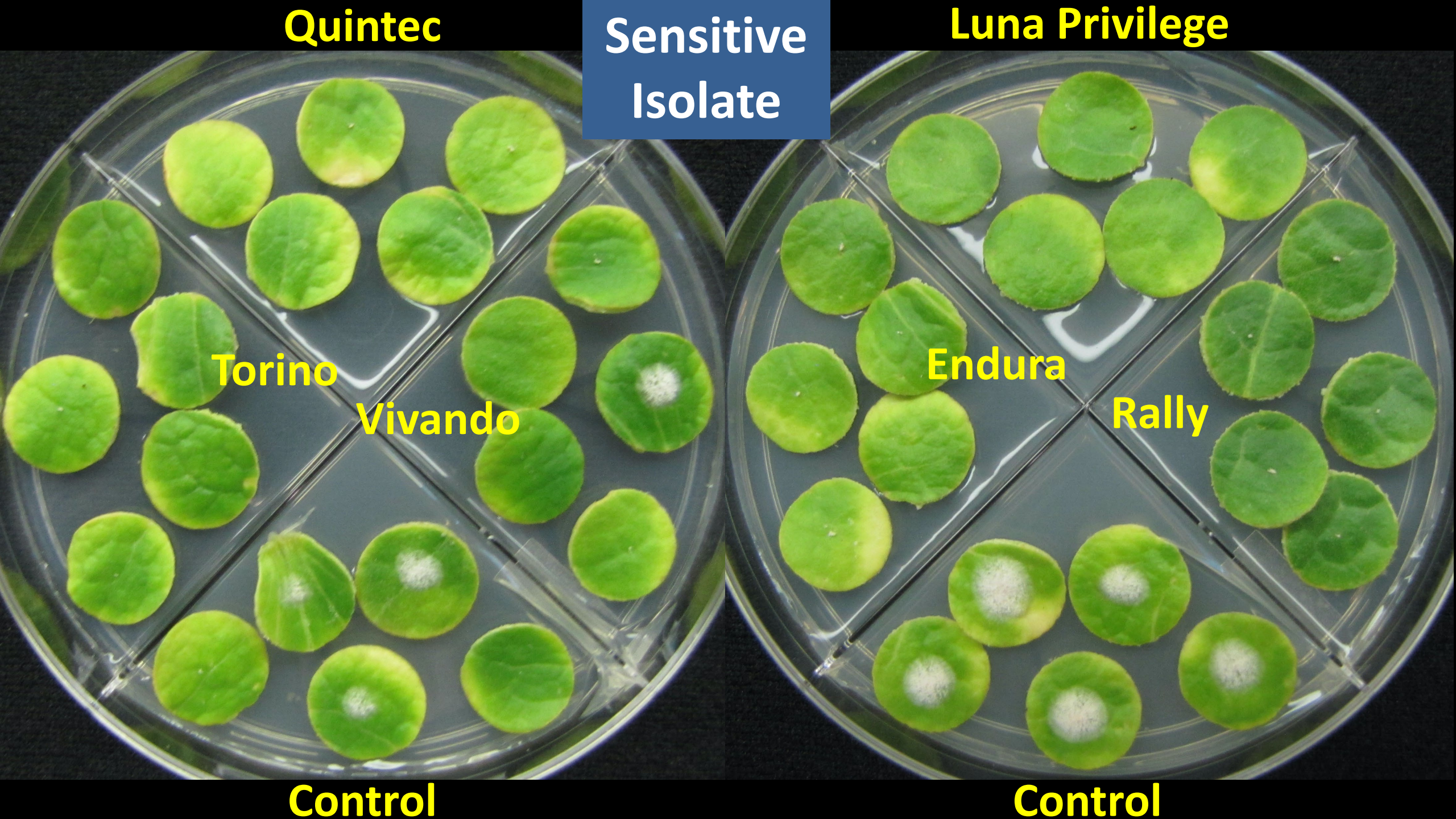
Vivando

Endura

Rally

Control

Control



Quintec

**Resistant
Isolate**

Luna Privilege

Torino

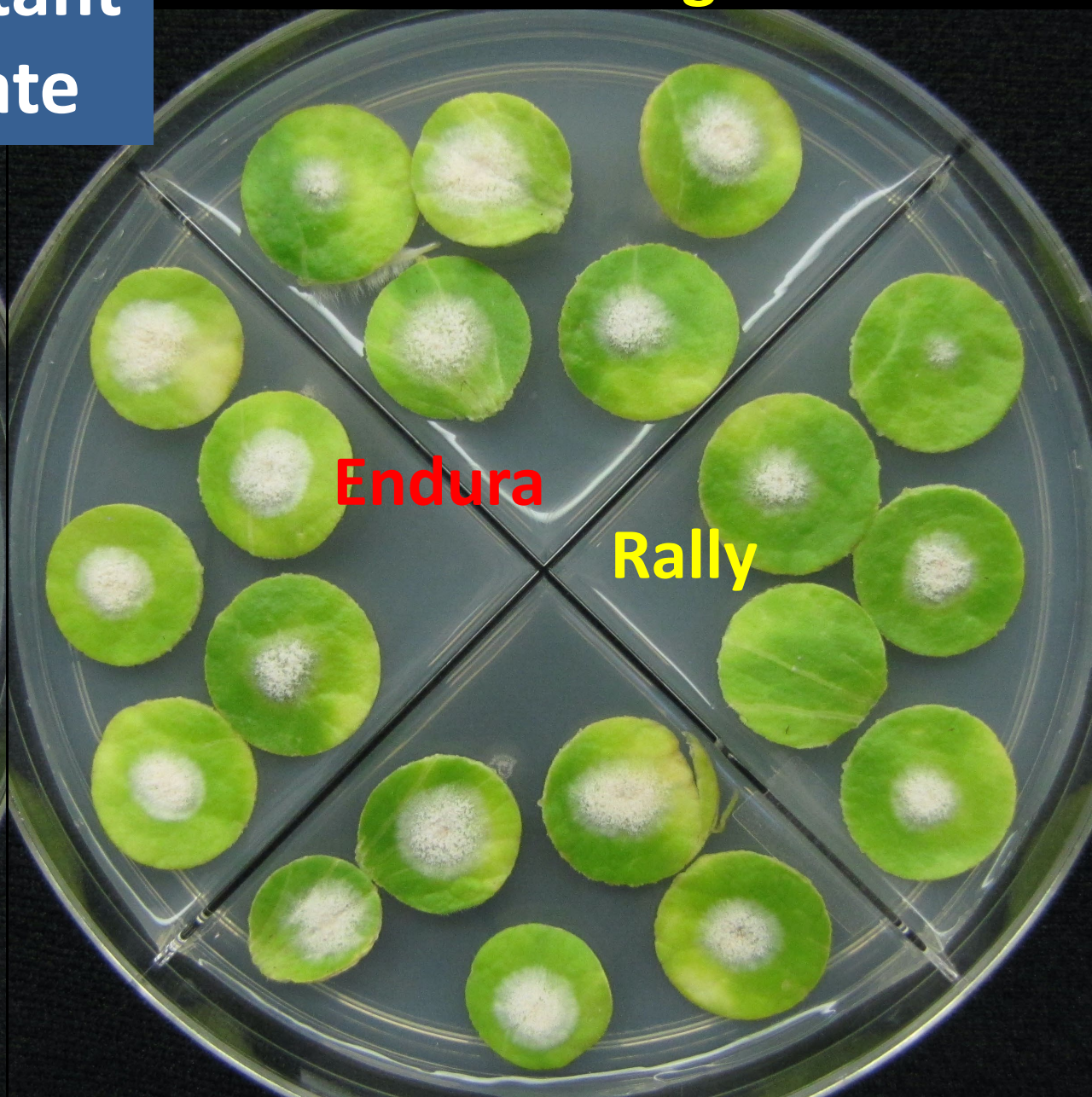
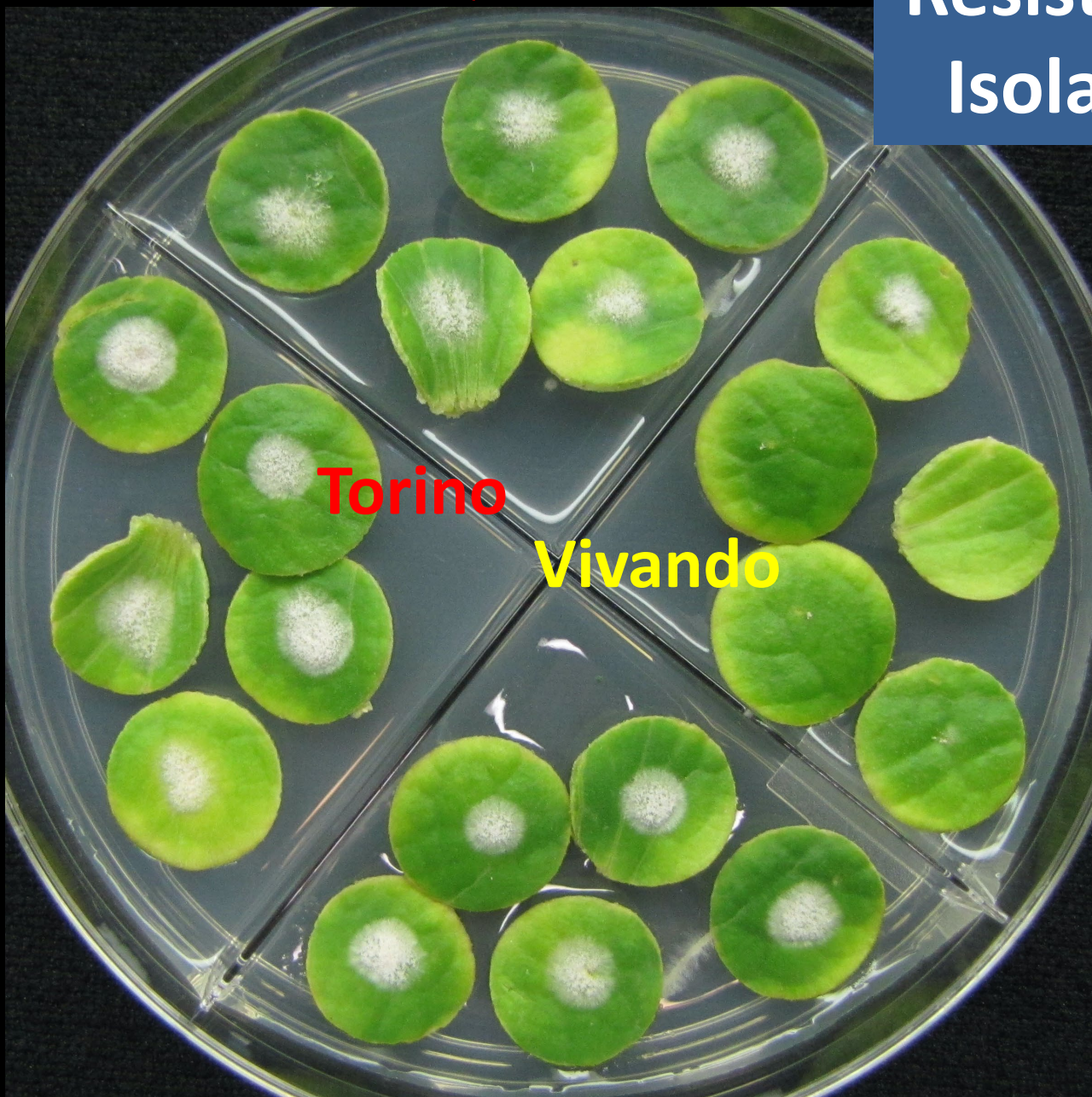
Vivando

Endura

Rally

Control

Control



Fungicide Resistance – TORINO – Cucurbit Powdery Mildew

2012. Registered for this use in USA.

Label restrictions stronger than any other at-risk fungicide:
no consecutive applications allowed; maximum 2 applications.

Other at-risk fungicides not yet impacted by resistance available
to use in a sound resistance management program:
Quintec and DMIs plus Vivando 2 years later.

2017. Fully resistant isolates detected.

Resistance detected to Qols after 3 yrs, Endura after 6 yrs, and
Quintec after 8 yrs.

Fungicide Resistance Occurrence in Powdery Mildew Isolates from Cucurbit Crops, Eastern NY, 2021

Powdery Mildew Fungicides used	Percent Resistant Isolates		
	Torino	Quintec	Endura
Just protectants (copper, chlorothalonil)	0	0	14

Fungicide Resistance Occurrence in Powdery Mildew Isolates from Cucurbit Crops, Eastern NY, 2021

Powdery Mildew Fungicides used	Percent Resistant Isolates		
	Torino	Quintec	Endura
Just protectants (copper, chlorothalonil)	0	0	14
Quintec, Vivando, Vivando (all applied with protectants)	0	0	56

Fungicide Resistance – Powdery Mildew - Eastern NY, 2021

Powdery Mildew Fungicides used	Resistant Isolates (%)		
	Torino	Quintec	Endura
Just protectants (copper, chlorothalonil) **	0	0	14
Quintec, Vivando, Vivando *	0	0	56
Vivando, Quintec, Rhyme, Vivando, Quintec *	0	67	67
Quintec, Vivando, Quintec + Vivando *	67	100	100
Quintec, Rhyme, Prolivo, Gatten, Prolivo, Quintec, Prolivo, Gatten * **	71	71	86

* all applied with protectants

** Fields about 2 miles apart

Fungicide Resistance – Powdery Mildew - Eastern NY, 2021

Powdery Mildew Fungicides used	Resistant Isolates (%)		
	Torino	Quintec	Endura
Just protectants (copper, chlorothalonil)	0	0	0
Quintec, Vivando, Vivando *	0	0	14
Vivando, Quintec, Rhyme, Vivando, Quintec *	0	67	67
Quintec, Vivando, Quintec + Vivando *	50	100	100
Quintec, Rhyme, Prolivo, Gatten, Prolivo, Quintec, Prolivo, Gatten *	71	71	86
Gatten, Vivando, Gatten *	11	11	44

* all applied with protectants

Fungicide Resistance - Cucurbit Powdery Mildew

Resistant isolates are fit. Found in plantings not treated.

Frequency of resistance in a planting can change with fungicide use during a season.

Applying a fungicide ineffective due to resistance may not be evident when other fungicides used are effective.

Pathogen isolates with resistance to multiple fungicide chemistry groups have been found increasingly.

All 2020 isolates found to be resistant to Quintec were also resistant to Torino, Endura, and QoI fungicides.

Change in 2022 reflecting fungicide use.

Expect resistance to develop to additional fungicides.

Fungicide Resistance - Cucurbit Powdery Mildew

2022 Preliminary Results:

76 isolates tested. 37 resistant to Endura.

6 resistant to Torino. 8 resistant to Quintec.

JUST ONE MULTI-FUNGICIDE RESISTANT ISOLATE SO FAR!!

Fungicides used: Quintec applied once in 1 crop.

Vivando or Prolivo. Rhyme, Inspire Super. Miravis Prime

Fungicide Programs - Cucurbit Powdery Mildew

Proline, Vivando, Proline, Vivando, Procure, Vivando

Vivando, Vivando, Aprovia Top, Aprovia Top, Vivando

FRAC: 50 3 3 + 7 7

Others: Prolivo Rhyme Luna Experience Miravis Prime

leftover Quintec or Torino 1 application

Gatten has not been as effective in efficacy trials.

**Start preventive (start of fruit formation) or
at threshold (1 of 50 older leaves)**

Apply with protectant:

sulfur, mineral oil, chlorothalonil, biopesticide

Fungicide Resistance - Cucurbit Powdery Mildew

Luna Experience – sensitivity to fluopyram (FRAC 7)

Most 2022 isolates tolerate 50 ppm. Few tolerate 150 ppm.

Luna Experience 6 fl oz/A applied at 50 gpa = 165 ppm.

Luna Experience 17 fl oz/A applied at 50 gpa = 468 ppm.

Higher gallonage, lower concentration.

Cucurbits


- 
- [Table: Fungicides for Cucurbit Crops \(.pdf\) \(click here for Excel version\)](#)
 - [Table: Mobile Fungicides for Managing Three Major Cucurbit Diseases: Powdery Mildew, Downy Mildew, and Phytophthora Blight](#)
 - [Alternaria](#) (LIHREC)
 - [Angular leaf spot](#) (LIHREC)
 - [Anthracnose](#)
 - [Anthracnose](#) (LIHREC)
 - [Bacterial leaf spot \(renamed Xanthomonas leaf spot\)](#) (LIHREC)
 - [Choanephora fruit rot](#) (LIHREC)
 - [Downy mildew](#)
 - [Fusarium crown rot and fruit rot of pumpkin](#) (LIHREC)
 - [Fusarium fruit rot of other cucurbits](#) (LIHREC)
 - [Gummy stem blight and black rot](#) (LIHREC)
 - [Ozone injury](#) (LIHREC)
 - [Phytophthora blight](#)

Table contains many conventional fungicides labeled for diseases of cucurbit crops, approximate cost per acre of an application, number of acres that can be treated with the package size available, and diseases labeled. Most products listed have mobility and/or targeted activity. The last nine are contact protectant fungicides.																														
Product *	FRAC	Max # consecutive applications	Maximum # applications to a crop	Pre-harvest Interval (PHI) days	Restricted Entry Interval (REI) hours	Labeled for use in greenhouse	Classified Restricted Use in NY	Not for use on Long Island	Price	Unit	Pkg Size	Rate/A	Unit	Cost/A	A/treated	Alternaria blight	Alternaria leaf spot	anthracnose	angular leaf spot	bacterial leaf spot	downy mildew	Fusarium blight aka Fusarium crown rot and fruit rot	gummy stem blight	Phytophthora blight	Plectosporium blight	powdery mildew	scab			
Actigard	P01	-	4-8	REI	12				\$59.00	oz	8 oz	0.5-1	oz	\$30-59	8-16				R	R	L					L	L			
Aprovia Top 1.62 EC	3 + 7	2	4	REI	12	Max # consecutive applications										12.2	R	R	R							R		R		R
Cabrio EG	11	1	4-8	REI	12											5-10	R		R			nr				R?		R	nr	
Cevya	3	-	3-5	REI	12											33.3	R										R			nr
Curzate 60 DF	27	-	6	3	12	Maximum # applications to a crop										3-20								R?						
Endura	7	1	4	REI	12											16	R										nr			nr
Flint Extra	11	1	4	7	12											4-16									nr			R	nr	
Forum 4.17 SC	40	2	5	REI	12	Pre-harvest Interval (PHI) days										21.3									nr			R		
Gatten	U13	-	5	REI	12											-5.3													R	
Gavel 75 DF	22 + M3	-	8	5	48											5-20									R			R		
Inspire Super 2.82 EW	3 + 9	2	4-5	7	12											4-8	R	R	R								R		R	nr
Luna Experience 3.34 SC	7 + 3	2	2-5	7	12	Restricted Entry Interval (REI) hours										-5.3		R	R								R			R
Luna Sensation	7 + 11	2	4	REI	12											4-16		R	R								R			nr
Mettle 125 ME	3	2	5	REI	12											16	R	R									R			R
Miravis Prime 3.34 SC	12 + 7	2	2	1	12	Labeled for use in greenhouse										34.8	R	R								R			R	R
Omega	29	-	6	30	12											26.7		R								R	R			
Orondis Gold	49 + 4	2	6	5	48											22.9												R		
Orondis Opti	49 + M5	2	4	REI	12	Classified Restricted Use in NY										11.4														
Orondis Ultra	49 + 40	2	4	REI	4											23.3											R			
Fungi-Phite (phosphorus acid)	33	-	6	REI	4	Not for use on Long Island										5-10	L-S	L-S	L-S				nr			L-S	R	L-S	L-S	
Presidio 4 SC	43	1	2	2	12											10.7												R		
Previcur Flex 6F	28	2	2	2	12											16.7														

Product *	Alternaria blight	Alternaria leaf spot	anthracnose	angular leaf spot	bacterial leaf spot	downy mildew	Fusarium blight aka Fusarium crown rot and fruit rot	gummy stem blight	Phytophthora blight	Plectosporium blight	powdery mildew	scab
Actigard				R	R	L					L	L
Aprovia Top 1.62 EC	R	R	R					R		R		R
Cabrio EG	R		R			nr		R?		R	nr	
Cevya	R							R			nr	
Curzate 60 DF						R?						
Endura	R							nr			nr	
Flint Extra						nr				R	nr	
Forum 4.17 SC						nr			R			
Gatten											R	
Gavel 75 DF						R			R			

Fungicides – Cucurbit Powdery Mildew – Cost + Acreage

Microthiol Disperss	\$10 - 40/A (low rate effective)	
Bravo Weather Stik	\$8 - 15/A	
Proline (3)	\$32	56 A (2.5 gal)
Procure (3)	\$16 - 33/A	4 - 8 A
Rhyme (3)	\$24 - 33/A	7 - 10 A
Inspire Super (3 + 9)	\$32 - 40/A	6 - 8 A
Aprovia Top (3 + 7)	\$32 - 41/A	10 - 12 A
Luna Experience (3 + 7)	\$34 - 96/A	2 - 5 A
Miravis Prime (7 + 12)	\$37 - 45/A	28 - 35 A (2.5 gal)
Vivando (50)	\$35/A	7 - 10 A
Prolivo (50)	\$19 - 23/A	2 - 3 A

organic Biopesticides

Cucurbit Mildews + Other Diseases

Double Nickel. *Bacillus amyloliquefaciens* strain D747

Taegro 2. *Bacillus amyloliquefaciens* strain FZB24

Serifel. *Bacillus amyloliquefaciens* strain MBI 600

LifeGard. *Bacillus mycoides* isolate J

Sonata. *Bacillus pumilus* strain QST 2808

Aviv. *Bacillus subtilis* strain IAB/BS03

Companion. *Bacillus subtilis* strain GB03

Serenade. *Bacillus subtilis* strain QST 713

LALSTOP G46 / Prestop. *Gliocladium catenulatum* J1446

Romeo. cerevisane (cell walls of *Saccharomyces cerevisiae*)

Howler. *Pseudomonas chlororaphis* strain AFS009

Carb-O-Nator. potassium bicarbonate

Kaligreen. potassium bicarbonate

MilStop. potassium bicarbonate

Regalia. extract of giant knotweed.

EcoSwing. extract of *Swinglea glutinosa*.

Problad Verde. Banda de *Lupinus albus* doce.

ECOWORKS. cold pressed neem oil.

Rango. cold pressed neem oil.

TerraNeem. cold pressed neem oil.

Trilogy. extract of neem oil.

Timorex Act. tea tree oil.

Thymox Control. thyme oil.

GreenFurrow BacStop. several botanical oils.

GreenFurrow EF400. several botanical oils.

Mildew Cure. several botanical oils.

Sporan EC². several botanical oils.

Sil-MATRIX. potassium silicate

OSO. polyoxin D zinc salt

PerCarb. sodium carbonate peroxyhydrate

Seican. cinnamaldehyde

Role of Biopesticides in Cucurbit Disease MGT

Organic production.

Good coverage important because of contact activity.

Conventional production:

In place of contact fungicides (chlorothalonil, copper)
tank mixed with targeted fungicides.

Applied in place of targeted fungicides.

Preventive and late season best.

Biopesticides & Conventional Fungicides

Powdery Mildew on Pumpkin



8-5-22

Biopesticide Efficacy – Powdery Mildew - Pumpkin

% Control based on AUDPC on both leaf surfaces 2022

Fungicide (7-day)	Upper		Lower	
Serifel	69	b	27	a bc
Stargus + Regalia	71	bc	17	a b
Trillium	73	bc	24	a bc
Theia	76	bc	24	a bc
Microthiol Disperss (sulfur)	99	d	33	bc
Stargus + Regalia alt. sulfur	96	d	35	bc
Theia alt. sulfur	96	d	37	bc

Trial conducted on powdery mildew intermediate resistant 'Bayhorse Gold'.

First application 21 July before powdery mildew seen.

Values in column with same letter not statistically different. **a=ineffective**.



9-7-22

Stargus + Regalia



Trillium



Serifel



Theia



9-7-22

Microthiol Disperss (sulfur)



Stargus + Regalia alt. sulfur



Theia alt. sulfur



Serifel, Proline, Vivando



9-7-22

Biopesticide Efficacy – Powdery Mildew - Pumpkin

% Control based on AUDPC on both leaf surfaces 2022

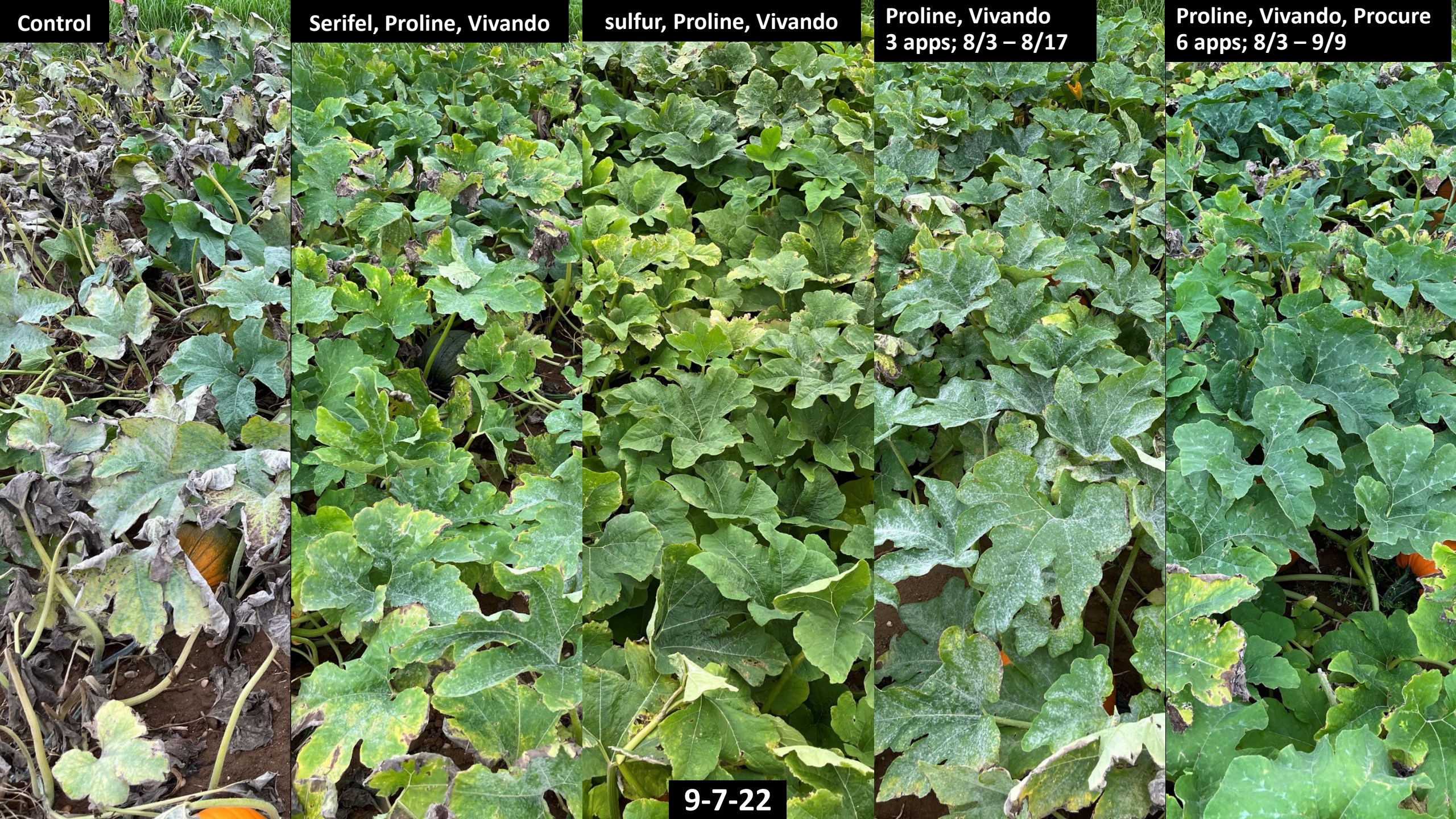
Fungicide (7-day)	Upper		Lower	
Theia (2), Proline alt Vivando (3), Theia (2)	95	c	83	b
Serifel (2), Proline alt Vivando (3), Serifel (2)	93	bc	87	b
TACT (2), Proline alt Vivando (3), TACT (2)	91	bc	84	b
Proline alt Vivando (3)	68	b	83	b
Proline alt Vivando alt Procure (5)	99	c	90	b

Trial conducted on powdery mildew susceptible 'Gold Challenger'.

First application 21 July before powdery mildew seen.

TACT = Timorex ACT

Values in column with same letter not statistically different. **a=ineffective**.



Control

Serifel, Proline, Vivando

sulfur, Proline, Vivando

Proline, Vivando
3 apps; 8/3 – 8/17

Proline, Vivando, Procure
6 apps; 8/3 – 9/9

9-7-22



Fungicides – Cucurbit Powdery Mildew – Other Diseases

Microthiol Disperss	\$10 - 40/A	
Bravo Weather Stik	\$8 - 15/A	Alternaria, Anthracnose, DM, GSB, Scab
Proline (3)	\$32	Fusarium, Gummy Stem Blight (GSB)
Procure (3)	\$16 - 33/A	
Rhyme (3)	\$24 - 33/A	Gummy Stem Blight
Inspire Super (3 + 9)	\$32 - 40/A	Alternaria, Anthracnose, GSB, Plectosporium
Aprovia Top (3 + 7)	\$32 - 41/A	Alternaria, Anthracnose, GSB, Plecto, Scab
Luna Experience (3 + 7)	\$34 - 96/A	Alternaria, Anthracnose, GSB
Miravis Prime (7 + 12)	\$37 - 45/A	Alternaria, Gummy Stem Blight, Scab
Vivando (50)	\$35/A	
Prolivo (50)	\$19 - 23/A	

A close-up photograph of a green leaf, likely from a plant, showing signs of powdery mildew. The leaf has a prominent network of veins. Several irregular, white, powdery patches are visible on the leaf's surface, particularly along the veins and near the edges. The background is dark and out of focus.

Questions?

Thank You!

