

## Characterization and Management of Cucurbit Downy Mildew, GR007-077

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### Accomplishments:

**1. Establish and monitor sentinel plots for downy mildew.** Spore traps were placed in five Michigan counties across the state and Essex County in Ontario, where they continuously sampled the air and impacted all airborne particles onto cellophane tape. A microscope was used to identify any downy mildew spores present on the tapes. The spore traps helped to alert us to any influx of spores into those production regions, but were not used to time fungicide sprays.

**2. Identify effective downy mildew fungicides and resistant cucumber cultivars.** This downy mildew pathogen is resistant to commonly used fungicides (Ridomil Gold-based products and the strobilurin fungicides, i.e., Cabrio, Quadris, and Flint). Chemical control must be focused on using and alternating effective products, and applying fungicides at short intervals. Results from our 2005-07 replicated field trials recommend Previcur Flex (propamocarb) plus chlorothalonil alternated with Tanos 50DF (cymoxanil/famoxadone) plus mancozeb applied every 5-7 days when the weather favors disease. Presidio (fluopicolide) is a new product that is highly effective against downy mildew and will be registered in 2008 (see table, below). All fungicides should be used in a tank mix with another fungicide effective against downy mildew.

Treatment and rate/A ( <i>applied at 5-7 day intervals</i> )	Infection (%) <sup>*</sup>	5 Sep f <sup>**</sup>
Untreated .....	98.8	f <sup>**</sup>
Previcur Flex 6SC 1.2 pt + Bravo Weather Stik 6SC 2 pt -alternate- Tanos 50WG 8 oz + Manzate 75DF 3 lb .....	11.3	a
Previcur Flex 6SC 1.2 pt + Bravo Weather Stik 6SC 2 pt ( <i>app. 1,4,7</i> ) Ranman 3.6SC 2.7 fl oz + Manzate 75DF 3 lb ( <i>app. 2-3,5-6,8-9</i> ) .....	13.8	a
Presidio 4FL 2.9 fl oz + Manzate 75DF 3 lb.....	16.3	ab
Tanos 50DF 8 oz + Manzate 75DF 3 lb -alternate- Curzate 60DF 5 oz + Manzate 75DF 3 lb .....	22.5	ab
Revus 2.09SC 8 fl oz + Dithane Rainshield 4SC 4 pt + NIS 8.33EC 8 fl oz -alternate- Previcur Flex 6SC 1.2 pt + Dithane Rainshield 4SC 4 pt.....	26.3	a-c
Revus 2.09SC 8 fl oz + Dithane Rainshield 4SC 4 pt + NIS 8.33EC 8 fl oz -alternate- Quadris Opti 5.5SC 3.2 pt.....	27.5	a-d
Curzate 60DF 3.2 oz + Manzate 75DF 3 lb .....	31.3	a-d
Curzate 60DF 5 oz + Manzate 75DF 3 lb .....	31.3	a-d
Revus Opti 3.67SC 3 pt + NIS 8.33EC 8 fl oz -alternate- Previcur Flex 6SC 1.2 pt + Dithane Rainshield 4SC 4 pt.....	33.8	a-d
Tanos 50DF 8 oz + Manzate 75DF 3 lb -alternate- Curzate 60DF 3.2 oz + Manzate 75DF 3 lb .....	33.8	a-d
Bravo Weather Stik 6SC 3 pt.....	46.3	b-e
Ridomil Gold Bravo 3.67SC 2.5 pt ( <i>app. 1</i> ); Revus 2.09SC 8 fl oz + NIS 8.33EC 8 fl oz ( <i>app. 2,4,6</i> ); Quadris Opti 5.5SC 3.2 pt ( <i>app. 3,5,7</i> ) .....	57.5	de
Manzate 75DF 3 lb.....	72.5	ef
Ridomil Gold MZ 76WP 2.5 lb.....	75.0	ef

<sup>\*</sup>Based on a visual estimation of percentage of plant affected.

<sup>\*\*</sup>Column means with a letter in common are not significantly different (Fisher LSD Method;  $P=0.05$ ).

Commercially available pickling cucumber cultivars were tested for downy mildew resistance in conjunction with Dr. Todd Wehner, North Carolina State University (NCSU). The 76 cultivars were planted at the MSU Muck Farm according to procedures developed at NCSU to ensure a uniform, high level of disease pressure. Infection on the cultivars was 100% and very severe. Cotyledons developed severe symptoms and eventual necrosis; as plants grew, newer leaves showed reduced disease development. Comparisons of ratings between MSU and NCSU did not show a significant correlation between the locations (see table, below). A small number of cultivars showed tolerance (rated 4-6) to downy mildew in both locations. It is recommended to use a combination of tolerant cultivars and fungicides to reduce losses due to downy mildew.

Cultivar	Seed source	Disease severity rating*		
		Average NCSU	Maximum NCSU	Average MSU
LJ90430	USDA, LaJolla	2.6	5.3	5.6
Picklet	Seminis	3.4	5.5	6.0
NC Davie	Zeramin Gedera	3.6	6.0	6.3
Navigator	Seminis	4.2	5.8	6.4
Fancipak	Seminis	4.2	6.0	5.9
Excel	Seminis	4.3	5.8	6.4
Vlaspik	Seminis	4.6	6.0	6.1

\*Rated on a scale of 1 to 9 on three youngest, fully expanded leaves where 1=symptom free, 9=dead (1-3 considered resistant, 4-6 intermediately resistant/tolerant, 7-9 susceptible).

**3. Establish a molecular-genetic baseline for further characterization of the *P. cubensis*-cucurbit interaction.** Techniques were developed for establishing axenic cultures of *P. cubensis*, a process complicated by the fact that it is an obligate parasite and will only grow on living cucumber tissue. RNA has been isolated from infected and uninfected cucumbers.

**Projected Activities:** Objectives 1 and 2 will be repeated in 2008. Objective 3: RNA from *P. cubensis* spores will be isolated. RNAs will be used to synthesize three cDNA libraries in Jan-Feb 2008 which will be used to extract expressed sequence data for functional genomic and biochemical analyses and as a basis for examining induced/repressed expression of defense genes in cucumber and pathogenesis-related genes in *P. cubensis*. This data will be used to develop and track isolates of *P. cubensis* in the field. Gene expression, genetic composition and host specificity will be related to population dynamics and distribution in the field.

**Impacts:** Research was presented at and published online for the Great Lakes Vegetable, Fruit and Farm Market Expo. Growers were kept posted on presence of downy mildew in Michigan counties in 2007 via a website. New grower recommendations have been developed. Effective registered and unregistered fungicides have been identified. Application intervals have been determined based on type of crop whether downy mildew has been detected. Gavel and Presidio (label due in 2008) have been identified as dual purpose fungicides for both downy mildew and Phytophthora management. Evaluating cultivars for downy mildew infection will assist growers in choosing appropriate varieties and crop protection strategies. A genetic/genomic blueprint of the downy mildew/cucumber association will be developed, and will provide gene expression tools for continuing studies of the host-pathogen interaction and will aid in understanding the population dynamics and evolution of the downy mildew pathogen.