

Great Lakes Fruit, Vegetable & Farm Market EXPO

December 9-11, 2008

DeVo Place Convention Center, Grand Rapids, MI



Celery

Wednesday afternoon 2:00 pm

Where: Gallery Overlook (upper level) Room C

Recertification credits: 1 (1B, PRIV CORE)

CCA Credits: SW(0.5) PM(1.5)

Moderator: Bill Steenwyk, District Vegetable Educator, MSU Extension

- 2:00 p.m. Controlling Insect Pests in Celery
- Beth Bishop, Entomology Dept., MSU
- 2:20 p.m. Black Streak Update
- Mathieu Ngouajio, Horticulture Dept., MSU
- 2:40 p.m. Celery Disease Management
- Mary Hausbeck, Plant Pathology Dept., MSU
- 3:00 p.m. Celery Weed Control Update
- Bernard Zandstra, Horticulture Dept., MSU
- 3:20 p.m. Managing Muck Soils After Flooding
- Darryl Warncke, Crop & Soil Sciences Dept., MSU
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CELERY DISEASE MANAGEMENT

Dr. M.K. Hausbeck, Professor and Extension Specialist
Michigan State University, Department of Plant Pathology (517-355-4534)

Damping-off (caused by *Pythium* spp., *Phytophthora* spp. and *Rhizoctonia* sp.) affects all vegetable seedlings and is also common among flowering bedding plants. Damping-off results in collapse of the plant at the soil surface. Avoid overwatering because some damping-off fungi prefer wet conditions.

Good sanitation is the key and ensures that root rot problems from one crop are not carried over to another crop. Root rot pathogens survive in the greenhouse in soil particles or plant parts clinging to containers, benches, walkways, and equipment. If root rot occurs, remove and destroy the diseased plants. Also, remove healthy-appearing plants that are immediately adjacent to the dead plants because the disease may have already spread to them although they may not be showing symptoms yet. Plug sheets containing diseased transplants should not be reused.

Foliar blights must be managed in field situations. Early blight (caused by *Cercospora apii*) and late blight (caused by *Septoria apiicola*) are major problems every season. Yield losses occur as a result of defoliation and stunting of the plants and petiole blighting. Resistant cultivars and disease-free seed are important, as both pathogens can be seedborne. Symptoms of *Cercospora* early blight include yellow to tan, circular-shaped lesions on the upper and lower surface of leaves and elongated lesions on petioles. *Septoria* late blight is the most common disease of celery in Michigan, and spreads quickly. Symptoms of *Septoria* late blight include yellow to brown, irregularly shaped lesions on the leaves and petioles. Embedded in these lesions are small, black pycnidia, which are the reproductive structures of the fungus. Both *Cercospora* and *Septoria* leaf blights can be controlled with registered fungicides such as chlorothalonil (Bravo), propiconazole (Tilt), and strobilurins (Quadris, Flint). These materials are best when used in rotation with one another and all can be tankmixed with copper fungicides for dual control of both fungal and bacterial diseases. When making fungicide applications to celery a grower needs to ensure that they achieve proper coverage of all foliage and stalks of the plants. This is especially important when plants are large enough to form a thick canopy that can limit coverage to the lower portions of the plants. For bacterial blight in the field, a grower should make applications of copper-based fungicides frequently. These frequent applications will help keep the bacterial populations to a level where disease outbreaks in the field can be limited.

Greenhouse fungicide trials for root rots of celery seedlings.

These studies were conducted in the research greenhouses at Michigan State University. Celery 'Dutchess' seeds were sown into 288-cell flats containing a soilless medium (Baccto Professional Planting Mix, Michigan Peat Company, Houston TX). Inoculum was prepared by growing mefenoxam-resistant isolates of *Pythium* spp. on dilute V8 agar or *Rhizoctonia solani* on potato dextrose agar for three weeks. Flasks filled with two parts millet seed and one part water were sterilized. Four 1.5-inch plugs of agar infested with *Pythium* or *Rhizoctonia* were placed into the flasks. The infested millet was allowed to grow for three weeks before being mixed (8 oz/1 ft³) into a soilless medium. Seedlings were transplanted from the cell flat into 3-inch cells containing the infested media. Eight single plant replicates per

treatment were arranged in a completely randomized design. Two (*Pythium* trial #2) or three (*Pythium* trial #1, *Rhizoctonia* trial) applications of fungicides (Table 1) were applied as a drench to the cells immediately after transplanting and at 7-day intervals. Plants were watered as needed and fertilized once weekly with 200 ppm of Peter's 20-20-20 water soluble fertilizer (The Scotts Company, Marysville, OH). Data on plant health and death were analyzed.

Table 1. Products included in the celery greenhouse seedling fungicide trials.

Product	Active ingredient	Labeled
Aliette 80WDG	aluminum-tris	yes
Banol EC.....	propamocarb	no
Banrot 40WP.....	etrifiazole/thiophanate-methyl	no
Chipco 26019 50WP.....	iprodione	no
Endorse 11.3DF	polyoxin D zinc salt	no
Kocide 2000 DF.....	copper hydroxide	yes
Moncut 75DF	flutolanil	no
Phostrol	phosphorous acid	yes
Presidio 4SC.....	fluopicolide	no
Previcur Flex.....	propamocarb	no
Quadris SC.....	azoxystrobin	no
Ranman 400F.....	cyazofamid	no
Reason 500SC.....	fenamidone	no
Revus 250SC.....	mandipropamid	not on label
Scholar 50WP	fludioxonil	no
Subdue MAXX EC	mefenoxam	no
Terraclor 75WP.....	pentachloronitrobenzene	yes
ZeroTol	hydrogen dioxide	no

Evaluation of fungicides for control of *Pythium* spp.

Disease pressure in trial #1 was significant as the inoculated control had moderate plant stunting and up to 25% plant death (Table 2). The untreated control was the only treatment in which plant death (25%) occurred. Treatments of Aliette, Banrot, Phostrol and Presidio + Previcur provided significant control of *Pythium* spp. and were similar to the untreated uninoculated. Minor phytotoxicity symptoms were observed in the Banrot treatment, including plant stunting and leaf cupping.

A fifteen treatment study, trial #2, was conducted to evaluate the control of *Pythium* root rot of celery seedlings with fungicide drenches. Disease pressure in this trial was moderate (Table 3). The untreated uninoculated plants were among the healthiest of all treatments. Treatments of Aliette, Phostrol and Presidio + Previcur Flex provided control against *Pythium* and were among the healthiest and tallest of all plants.

Table 2. Results of celery greenhouse seedling *Pythium* fungicide trial #1.

Treatment rate/100 gal	Plant health*			Plant death (%)	
	9 Jan	16 Jan	23 Jan	16 Jan	23 Jan
Untreated uninoculated.....	1.0 a**	1.0 a	1.0 a	0.0 a	0.0 a
Untreated inoculated.....	1.8 b	2.4 d	3.1 f	25.0 b	25.0 b
Aliette 80WDG 4 lb.....	1.0 a	1.1 ab	1.4 ab	0.0 a	0.0 a
Banrot 40WP 12 oz	1.0 a	1.0 a	1.5 abc	0.0 a	0.0 a
Kocide 2000 DF 1.5 lb	1.0 a	1.0 a	2.0 bcd	0.0 a	0.0 a
Phostrol 2.5 pt.....	1.0 a	1.0 a	1.4 ab	0.0 a	0.0 a
Presidio 4SC 4 fl oz.....	1.0 a	1.3 ab	1.8 bcd	0.0 a	0.0 a
Presidio 4SC 4 fl oz + Previcur Flex 1.2 pt	1.0 a	1.0 a	1.4 ab	0.0 a	0.0 a
Quadris SC 9 fl oz	1.3 ab	2.0 cd	3.0 f	0.0 a	0.0 a
Ranman 400F 2.75 fl oz	1.0 a	1.4 abc	2.1 cd	0.0 a	0.0 a
Reason 500SC 8.2 fl oz	1.4 ab	1.6 abc	2.1 cd	0.0 a	0.0 a
Revus 250SC 8.2 fl oz.....	1.5 ab	1.8 bcd	2.3 de	0.0 a	0.0 a
Subdue MAXX EC 1 fl oz	1.4 ab	1.8 bcd	2.9 ef	0.0 a	0.0 a

*Plant health rating is 1 to 5; 1=healthy, 2=minor wilting or chlorosis, 3=moderate wilting or chlorosis, 4=severe wilting or chlorosis, 5=plant death.

** Column means with a letter in common are not significantly different (Fisher's Protected LSD; $P=0.05$).

Table 3. Results of celery greenhouse seedling *Pythium* fungicide trial #2.

Treatment rate/ 100 gal	Plant health*				Height (in)
	21 Oct	28 Oct	4 Nov	11 Nov	11 Nov
Untreated uninoculated.....	1.0 a**	1.0 a	1.0 a	1.0 a	2.6 a
Untreated inoculated.....	2.8 cd	4.7 e	5.3 d	5.5 e	1.3 e
Aliette 4 lb.....	1.8 abcd	1.7 ab	1.2 ab	1.8 ab	2.5 abc
Banol EC 3 fl oz	2.3 bcd	4.2 de	5.2 d	5.0 de	1.6 e
Banrot 40WP 12 oz	2.3 bcd	3.0 bcde	5.5 d	5.3 e	1.9 bcde
Kocide 2000 54DF 1.5 lb	2.0 abcd	3.2 bcde	5.5 d	5.7 e	1.5 e
Phostrol 2.5 pt	2.0 abcd	2.0 abc	2.3 abc	2.3 abcd	2.4 abcd
Presidio 4FL 4 fl oz.....	1.7 abc	3.5 cde	3.8 bcd	4.2 bcde	1.8 cde
Presidio 4FL 4 fl oz + Previcur Flex 1.2 pt..	1.5 ab	2.2 abc	2.2 abc	2.2 abc	2.7 a
Quadris 9 fl oz	2.3 bcd	2.8 bcd	3.8 bcd	4.5 bcde	1.7 cde
Ranman 400F 2.75 fl oz	1.5 ab	3.2 bcde	4.8 cd	4.5 bcde	1.8 cde
Reason 5090SC 8.2 fl oz	1.2 ab	2.8 bcd	4.5 cd	4.8 cde	1.9 abcde
Revus 250SC 8.2 fl oz.....	2.2 abcd	3.7 cde	6.0 d	6.0 e	1.4 e
Subdue MAXX EC 1 fl oz	2.2 abcd	3.3 bcde	6.2 d	6.5 e	1.7 de
ZeroTol 100 fl oz.....	3.0 d	4.0 de	5.2 d	5.2 e	1.6 e

*Plant health rating is 1 to 10; 1=healthy, 2=minor chlorosis/minor stunting, 3=severe chlorosis/moderate stunting, 4=severe stunting, 5=minor wilting, 6=moderate wilting, 7=severe wilting, 8=minor necrosis, 9=moderate necrosis, 10=plant death.

** Column means with a letter in common are not significantly different (Fisher's Protected LSD; $P=0.05$).

Evaluation of fungicides for control of *Rhizoctonia solani*.

A ten treatment study was conducted to evaluate the efficacy of fungicide drenches for control of *Rhizoctonia solani*. Disease pressure in this trial was significant, as all untreated inoculated plants were dead by 9 Jan (Table 4). Treatments that prevented plant death and significantly limited infection of *R. solani* compared to the untreated inoculated control included Quadris, Endorse, Moncut, Scholar and Terraclor. Banrot, Chipco and Kocide provided marginal control; however, they were not as effective as the previous mentioned treatments. Phytotoxicity was observed in the Chipco and Banrot treatments; Chipco produced severe wilting and chlorosis of plant leaves while Banrot symptoms included minor wilting and chlorosis of leaves.

Table 4. Results of celery greenhouse seedling *Rhizoctonia* fungicide trial.

Treatment rate/100 gal	Plant health*			Plant death (%)		
	2 Jan	9 Jan	16 Jan	2 Jan	9 Jan	16 Jan
Untreated uninoculated.....	1.0 a**	1.0 a	1.0 a	0.0 a	0.0 a	0.0 a
Untreated inoculated	4.0 c	5.0 c	5.0 d	75.0 b	100.0 b	100.0 d
Quadris SC 9 fl oz	1.1 a	1.2 a	1.9 a	0.0 a	0.0 a	0.0 a
Banrot 40WP 12 oz	1.8 ab	2.4 b	2.5 bc	0.0 a	12.5 a	12.5 ab
Chipco 26019 50WP 2 lb	1.0 a	1.3 a	2.8 bc	0.0 a	0.0 a	25.0 bc
Endorse 11.3DF 6 oz.....	1.0 a	1.0 a	1.1 a	0.0 a	0.0 a	0.0 a
Kocide 2000 DF 1.5 lb.....	2.3 b	2.9 b	3.3 c	12.5 a	12.5 a	37.5 c
Moncut 75DF 1.1 lb	1.3 a	1.1 a	1.4 a	0.0 a	0.0 a	0.0 a
Scholar 50WP 4 oz	1.0 a	1.0 a	1.3 a	0.0 a	0.0 a	0.0 a
Terraclor 75WP 1 lb	1.1 a	1.0 a	1.5 a	0.0 a	0.0 a	0.0 a

*Plant health rating is 1 to 5; 1=healthy, 2=minor wilting or chlorosis, 3=moderate wilting or chlorosis, 4=severe wilting or chlorosis, 5=plant death.

**Column means with a letter in common are not significantly different (Fisher's Protected LSD; $P=0.05$).