

Great Lakes Fruit, Vegetable & Farm Market EXPO

December 4-6, 2007

DeVo Place Convention Center, Grand Rapids, MI



Vine Crops

Wednesday morning 9:00 am

Where: Ballroom D

Recertification credits: 1 (1B, PRIV CORE)

CCA Credits: PM(2.0)

Moderator: Phil Tocco, Agriculture & Natural Resources Educator, Jackson Co. MSU Extension

9:00 a.m. Weed Control in the Age of Neighbors

- Mark Van Gessel, Plant Science Dept., Univ. of Delaware

9:30 a.m. Aphid Vected Viruses in Cucurbits

- Emily Mueller, Entomology Dept., Univ. of Wisconsin-Madison

10:00 a.m. Practices That Encourage Native Bees in Vine Crops

- Tai Roulston, Entomology Dept., Univ. of Virginia

10:30 a.m. Phytophthora and Downy Mildew Update

- Mary Hausbeck, Plant Pathology Dept., MSU

***Phytophthora* and Downy Mildew Update**

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Downy mildew on vine crops

Downy mildew causes symptoms on the leaves of vine crops (such as cucumber, squash, and melon) similar to a mosaic or angular leaf spot. The tell-tale symptom of downy mildew is the purplish/gray fuzz on the underside of the leaf that gives a somewhat “dirty” or “velvet” appearance. This fuzz is made up of thousands of spores and may be most evident in the morning. Downy mildew is well-known for causing catastrophic losses in a brief period of time. When the conditions are favorable, unprotected foliage can become completely infected and appear to be frosted within 10 days of initial infection. Downy mildew is not known to produce over-wintering spores and will not persist in soil and field debris in Michigan from year to year. Downy mildew was first reported in Michigan in August 2005 and appeared again in June 2006 and 2007. As of September 11, 2007, 24 Michigan counties had confirmed reports of downy mildew. Downy mildew primarily caused disease on cucumber, however, there were also reports on cantaloupe, gourd and zucchini.

Currently, there are few cultivars with adequate resistance to downy mildew and chemical control is the most effective tool. Products should be used in alternation with each other and applied at short intervals. Results from our downy mildew research indicated that the most effective spray programs, when applied before disease, were: Gavel 75WG (2 lb), Previcur Flex 6SC (1.2 pt), Ranman 3.6SC (2.8 fl oz), and Tanos 50WG (8 oz), each tank mixed with either Dithane DF Rainshield (3 lb) or Bravo Weather Stik 6SC (1.5 pt). After disease is identified in the field, the most effective products were: Previcur Flex 6SC (1.2 pt), Ranman 3.6SC (2.8 fl oz), and Tanos 50WG (8 oz), each tank mixed with either Dithane DF Rainshield (3 lb) or Bravo Weather Stik 6SC (1.5 pt). A new fungicide called Presidio will be available soon and has performed very well in our downy mildew trials.

In addition to fungicides, it is recommended that any infected vines remaining after harvest be killed with a contact herbicide or plowed under immediately so that they do not serve as a source of downy mildew for nearby crops.

Table 1. Recommended products for managing downy mildew on vine crops.

APPLIED BEFORE DISEASE (7-day intervals)	APPLIED AFTER DISEASE (5-day intervals)
<ul style="list-style-type: none">• Gavel 75WG (5 day PHI)• Previcur Flex 6SC (2 day PHI)• Ranman 3.6SC (0 day PHI)• Tanos 50WG (3 day PHI)	<ul style="list-style-type: none">• Previcur Flex 6SC (2 day PHI)• Ranman 3.6SC (0 day PHI)• Tanos 50WG (3 day PHI)
Alternate products and mix each with either: <ul style="list-style-type: none">• Dithane (mancozeb) 3 lb or• Bravo (chlorothalonil) 1.5 pt	Alternate products and mix each with either: <ul style="list-style-type: none">• Dithane (mancozeb) 3 lb or• Bravo (chlorothalonil) 2 pt

Please note: Gavel 75WG and Dithane are not registered on some vine crops.

***Phytophthora capsici* on vine crops**

Michigan growers producing vine crops have reported significant losses due to *Phytophthora* blight in recent years. The pathogen responsible is *Phytophthora capsici*. Recognizing disease due to *P. capsici* is not always easy as the disease often occurs in the low areas of a field where water accumulates. Many growers assume that when plant stunting occurs in these sites, it is due to the ‘water logging’ of the roots, but infection by *P. capsici* may be to blame. Under conditions of standing water, *P. capsici* produces swimming spores (zoospores) which can move about in water and cause infection of nearby plants. Squash and pumpkin plants often have obvious symptoms of plants wilting or collapsing prior to dying. Such plants often have brown to black discolored roots and crowns. The disease is easily seen on infected fruit, initially as dark, water-soaked lesions which then develop a distinctive white ‘powdered sugar’ layer of spores on the surface of the fruit. Fruit infection is especially troublesome because the infection may occur days before the symptoms become visible. As a result, healthy-appearing fruit may be harvested and then shipped. Fruit then break down during transit or on grocers’ shelves resulting in disposal cost.

To control *P. capsici* several control measures need to be implemented. Good drainage is important in managing this disease. However, even plants growing on well-drained fields on raised beds may have severe disease if rainfall is heavy. Crop rotation may reduce the number of *P. capsici* spores remaining in a field. A minimum of 3 years crop rotation to hosts other than those listed in Table 1 is recommended to avoid build-up of *P. capsici*. Growers should avoid relying on a single fungicide for disease control in order to delay development of fungicide resistance with *P. capsici*. There are many fields in Michigan where the *P. capsici* has become resistant to the commonly used fungicide, Ridomil Gold (mefenoxam). Fungicide programs including the following may provide disease management: Acrobat 50WP (6.4 oz), Gavel 75DF 1.5-2.0 lb, Tanos 50WG (8-10 oz). Fields heavily infested with *P. capsici* may require the use of pre-plant fumigation for disease control. Fumigants that are most effective include: Telone C35, Vapam HL, and Sectagon 42. Trial results from a new fungicide, Presidio (fluopicolide), appears promising and may complement a spray program that includes other *Phytophthora* fungicides.

Control of *Phytophthora* is complicated by its broad host range, long-term persistence in agricultural soils, presence in irrigation water sources, and ability to develop resistance to fungicides. An integrated production system that combines cultural methods and tolerant cultivars, effective fungicides and use of uncontaminated irrigation sources.

Table 1. Common vegetable hosts affected by *Phytophthora capsici*.

cucumber	summer squash	zucchini	hot pepper	snap beans
gourd	watermelon	eggplant	tomato	yellow wax beans
pumpkin	winter squash	bell pepper	lima beans	

Table 2. Products tested in *Phytophthora* trials.

Product	Active ingredient	Labeled
Captan 80WDG	captan	no
Forum 4.16SC.....	dimethomorph	yes
Gavel 75DF.....	zoxamide/mancozeb	yes
Presidio 4FL.....	fluopicolide	registration pending
Previcur Flex 6EC.....	propamocarb	yes
ProPhyt 4.2EC	phosphorous acid salts	yes
Ranman 3.6SC	cyazofamid	yes
Reason 4.13SC.....	fenamidone	yes
Revus 2.08SC	mandipropamid	no
Ridomil Gold MZ 76.5WP	mefenoxam/mancozeb	yes
Tanos 50WG.....	famoxadone/cymoxanil	yes

Evaluation of fungicides for control of crown, root, and fruit rot of yellow squash in fumigated beds

The trial was conducted on a commercial farm in Cass County, MI with a history of *Phytophthora capsici*. Beds were fumigated with Telone C-35 at 35 GPA on 31 May, and covered in black plastic mulch with drip irrigation. Yellow squash seeds, commercially treated with Thiram, were planted 2 ft apart in 20-ft-long rows on beds 2-ft-wide on 22 Jun. The plots were arranged in a randomized complete block design. In Aug, the Southwest Michigan Research and Extension Center at Benton Harbor, located 15 miles away from the commercial field, received a total of 11.62 in. of rainfall. All treatments were applied with a CO₂ backpack sprayer and a 3-nozzle swivel boom with 50 mesh screens and 8003XR nozzles, calibrated to deliver 50 GPA. The outer two swivel nozzles were aligned at 45° angles towards the squash crown, and the middle stationary nozzle was positioned directly over top of the plant crown. The applications were initiated when the plants had developed one true leaf and continued until harvest concluded. Eleven chemical treatments were applied every 5-7 days. In the event of rainfall > ½ in. in a 1 hour period, additional treatments were applied outside of the regular spray schedule to prevent increased infection from the rain splash. Treatments were applied on 6, 13, 20, 27 Jul, 3, 8, 15, 21, 24, 31 Aug and 7 Sep. Fruits were harvested from the entire row and evaluated for *P. capsici* infection on 8, 14, 17, 21, 24, 31 Aug, 7 and 14 Sep. The healthy fruits were stored for 4-5 days in ambient conditions and evaluated again for disease.

Heavy rainfall occurred in the first two weeks of Sep with a total of 6 in. documented. In the untreated plots, 87.5% of the plants were wilted and/or dead. Although applications of Mandipropamid 2.08SC, Captan 80WDG, Gavel 75DF, Previcur Flex 6EC, Ridomil Gold MZ 76.5WP, Tanos 50WG, and Presidio 4FL produced significantly healthier plants than the untreated control (14 Sep), plant wilting and death was still relatively high (up to 55.4%) among these treatments. Plots treated with Captan 80WDG and Gavel 75DF had <13% plants wilted and dead (14 Sep) and were significantly better than several of the other treatments. The percentage of fruit infected at harvest was low across all treatments. However, postharvest disease exceeded 10% for all treatments. Ridomil Gold MZ produced significantly higher yields than the untreated check. ProPhyt treatments reduced yield significantly from the untreated control because phytotoxicity caused stunting and yellowing of the foliage earlier in the growing season.

Treatment and rate/A, applied at 5-7 day intervals	Plants/20 ft of row* 9/14		Infected yield (lb/20 ft of row)	
	Dead (%)	Wilted and dead (%)	At harvest (%)	Post-harvest (%)
Untreated.....	80.0 e**	87.5 e	2.4	18.0
Gavel 75DF 2 lb.....	7.5 a	10.0 a	1.5	18.3
Captan 80WDG 6 lb.....	4.8 a	12.6 a	0.8	17.9
Ridomil Gold MZ 76.5WP 2 lb .	20.5 ab	27.5 ab	0.8	18.7
Presidio 4FL 0.18 pt.....	29.6 a-c	32.1 a-c	0.7	12.2
Revus 2.08SC 0.5 pt.....	23.4 ab	33.0 a-c	1.6	14.0
Tanos 50WG 0.5 lb.....	41.1 b-d	53.0 b-d	1.7	11.8
Previcur Flex 6EC 1.2 pt.....	42.9 b-d	55.4 b-d	2.1	23.2
Reason 4.13SC 0.34 pt.....	54.6 c-e	59.3 c-e	1.9	10.4
Ranman 3.6SC 0.18 pt.....	48.9 b-d	63.4 de	2.7	21.1
Forum 4.16SC 0.4 pt.....	59.3 de	68.6 de	2.7	16.4
ProPhyt 4.2EC 4 pt.....	63.5 de	75.3 de	0.6	12.8

*Total numbers of emerged plants were statistically similar between all plots.

**Column means with a letter in common or with no letter are not significantly different (Fisher LSD Method; $P=0.05$).

Evaluation of fungicides for control of crown, root, and fruit rot of yellow squash in nonfumigated beds

The experiment was conducted in a commercial vegetable grower's field in Cass County, MI that had hosted a crop exhibiting symptoms of severe *Phytophthora capsici* infection the previous year. Summer squash seeds, commercially treated with Thiram, were planted 2 ft apart on 3-ft-wide raised beds

covered with black plastic mulch with drip irrigation on 22 Jun. The plots were 20 ft long and replicated four times in a complete block randomization. Treatments were applied using a compressed CO₂ backpack sprayer and a 3-nozzle boom with 50 mesh screens and 8003XR nozzles, calibrated at 50 GPA. The outer two nozzles were aligned at 45° angles towards the squash crown, and the middle nozzle was directed straight over top. Treatments were initiated when the crop had developed one true leaf and continued until harvest concluded. Eleven chemical treatments were applied every 5-7 days. In the event of rainfall > ½ in. in a 1 hour period, additional treatments were applied outside of the regular spray schedule to prevent increased infection from the rain splash. Applications were made on 6, 13, 20, 27 Jul, 3, 8, 15, 21 and 24 Aug. Plants with symptoms of *P. capsici* including irreversible wilting, crown rot, and plant death were counted weekly and sampled to confirm infection until Sep. Fruits were harvested from the entire row, weighed and sorted for *P. capsici* infection on 8, 14, 17, 21 and 24 Aug. Healthy fruits were stored for 4-5 days at ambient conditions and evaluated for infection postharvest.

In Aug, there were several periods of heavy rainfall and conditions were favorable for disease development. All plants in untreated plots died. Applications of Mandipropamid 2.08SC, Captan 80WDG, Gavel 75DF, Ranman 3.6SC, Ridomil Gold MZ 76.5WP and Presidio FL produced significantly healthier plants than the untreated control; Mandipropamid, Captan and Gavel limited wilted and dead plants to <25%. All of the products provided adequate fruit protection at harvest; however, only Presidio and Captan provided >90% control after storage. Presidio had the highest yield with the cleanest fruit (*data not shown*), despite the higher incidence of plant death. ProPhyt treatments caused severe stunting of the plants and yellowing of the foliage earlier in the season, resulting in a significantly lower yield.

Treatment and rate/A, applied at 7 day intervals	Plants/20 ft of row (%) *30 Aug		Infected yield, lb/20 ft of row (%)	
	Dead (%)	Healthy (%)	At harvest (%)	Post-harvest (%)
Untreated.....	100.0 c**	0.0 e	6.9 c	27.0
Captan 80WDG 6 lb.....	12.5 a	80.0 a	0.2 a	9.9
Revus 2.08SC 0.5 pt.....	21.7 ab	65.8 ab	1.3 ab	16.3
Gavel 75DF 2 lb.....	23.1 ab	61.1 ab	1.3 ab	20.2
Ranman 3.6SC 0.18 pt.....	40.6 b	46.9 bc	0.6 a	10.7
Presidio 4FL 0.18 pt.....	38.9 ab	45.8 bc	2.7 ab	8.3
Ridomil Gold MZ 76.5WP 2 lb .	33.3 ab	33.3 cd	1.3 ab	12.0
ProPhyt 4.2EC 4 pt.....	75.0 c	15.0 de	0.9 ab	20.0
Forum 4.16SC 0.4 pt.....	86.3 c	11.3 de	1.9 ab	14.0
Previcur Flex 6EC 1.2 pt.....	73.9 c	7.5 e	3.4 b	35.7
Reason 4.13SC 0.34 pt.....	80.0 c	7.5 e	2.8 ab	17.5
Tanos 50WG 0.5 lb.....	89.7 c	0.0 e	2.3 ab	19.1

*Total numbers of emerged plants were statistically similar between all plots.

** Column means with a letter in common or with no letter are not significantly different (Fisher LSD Method; *P*=0.05).

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