



Managing the Uncertainties in Growing and Marketing Fruits and Vegetables

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Avoiding an Invasion of the Rots and Blights

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Phytophthora Blight

Michigan growers producing squash and pumpkins have reported significant losses due to *Phytophthora* blight in recent years. In most cases, the fungus *Phytophthora capsici* is responsible. Recognizing disease due to *P. capsici* is not always easy. Because the disease often occurs in the low areas of a field where water accumulates, many growers assume that when plant stunting occurs, it is due to the 'water logging' of the roots, but infection by *P. capsici* may be to blame. Squash and pumpkin plants often have more obvious symptoms, with 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 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 the fruit breaking down during transit or on grocers' shelves.

To control *P. capsici*, several control measures need to be used in a management program to reduce losses from this disease. 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*. There are many fields in Michigan where the *P. capsici* has become resistant to the commonly used fungicide, Ridomil Gold. Other registered fungicides have been tested on zucchini fruit and include Acrobat 50WP and Gavel 75DF. Both Acrobat 50WP and Gavel 75DF help to limit *P. capsici* even when the pathogen is resistant to Ridomil Gold (Table 2). Mixing copper hydroxide with Acrobat 50WP and Gavel 75DF may be helpful. Fungicides perform best when used early and frequently. Good coverage of the fruit with the fungicide is essential. Fungicides cannot be relied upon alone to prevent disease, but they can provide an extra degree of protection when used in combination with other management practices, such as crop rotation, raised beds, and water management.

Good drainage is important in managing this disease. Susceptible crops should be planted on well-drained sites and in raised beds. However, even plants growing on well-drained fields on raised beds may have severe disease if rainfall is heavy. Growers should avoid relying on a single fungicide, to delay development of fungicide resistance with *P. capsici*. Crop rotation may help to lower *Phytophthora* levels in a field, but planting any of the susceptible vegetable crops into a field with a history of *P. capsici* is risky.

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

Cucumber	Bell pepper	Pumpkin
Hot pepper	Summer squash	Tomato
Winter squash	Gourds	Eggplant
Zucchini	Watermelon	

Preplant Control Strategies

- Consider a pre-plant banded fungicide application for fields with known problems with *P. capsici*.
- Plant susceptible crops in well drained fields.
- Utilize raised beds (6" minimum) whenever possible.
- Do not plant in low-lying areas of the field.
- Do not irrigate a field with water that contains runoff from fields with a history of *P. capsici* disease.

Production Control Strategies

- Monitor fields for disease, including damping off, plant stunting, root and crown rot.
- Irrigate conservatively and, if possible, do not irrigate prior to harvest.
- Plow under portions of the field with diseased plants, including healthy plants that border diseased areas.
- Remove diseased fruit from the field.
- Never dump culls or diseased fruit from other fields or farms into production fields. Once *Phytophthora capsici* is introduced, it may remain indefinitely.
- Apply fungicide preventively, especially for known problem fields.
- Rotate the types of fungicides used.

Postharvest Control Strategies

- Harvest fruit as soon as possible from problem fields.
- Keep harvested fruit dry and cool.

Table 2. Evaluation of fungicides for managing *Phytophthora* blight of zucchini fruits (trial 1).

Trial 1 Treatment and rate/A	Lesion diameter (cm) from <i>Phytophthora</i> isolate sensitive to Ridomil Gold	Lesion diameter (cm) from <i>Phytophthora</i> isolate resistant to Ridomil Gold
Untreated control	5	5.7
Kocide 2000 54WG 1.5 lb	4.7	4.1
Acrobat 50WP 6.4 oz	0	0
Acrobat 50WP 6.4 oz + Kocide 2000 54WG 1.5 lb	0	0
Ridomil Gold 4EC 8.0 fl oz	0	3.8

Ridomil Gold Bravo 76.5WP 2.0 lb	0	2.7
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Table 2. Evaluation of fungicides for managing Phytophthora blight of zucchini fruits (trial 2).

Trial 2		
Untreated control	2.9	5.1
Kocide 2000 54WG 1.5 lb	1	2.7
Gavel 80DF 3.0 lb	0	0.9
Ridomil Gold Copper 76.5WP 2.0 lb	0	1.9
Acrobat 50WG 6.4 oz + Kocide 2000 53.8DF 1.5 lb	0.5	0
Gavel 80DF 3.0 lb + Kocide 2000 53.8DF 1.5 lb	1.1	1.7

Powdery Mildew

Powdery mildew is perhaps one of the easiest diseases to identify because of the whitish, talcum-like, powdery growth that develops on both leaf surfaces, petioles, and stems. Infected leaves usually wither and die. Premature loss of foliage often reduces the size or number of fruit and the length of the harvest period. In addition, powdery mildew infection predisposes plants to other diseases such as gummy stem blight. Powdery mildew occurs each year, although the time of disease appearance is unpredictable. Propagules responsible for infection (conidia or spores) may be transported rapidly over long distances by air currents. Therefore, the disease may become established in a clean field from conidia blowing in from a field affected by the fungus. It is also possible that this disease may overwinter in a black, bead-like, weather resistant form. Although this has not been verified for Michigan, overwintering of the fungus responsible for powdery mildew has been documented in nearby states.

Once powdery mildew is present, the disease may increase rapidly. The fungus can multiply and spread quickly under favorable conditions because the length of time between infection and symptom appearance is usually only three to seven days. Also, a large number of conidia that can infect healthy tissue can be produced in a short time, and contribute to spread of the disease within a field.

Currently, fungicides are the primary control practice for this disease. Resistant cultivars are becoming more available. Many products were tested in 2002 for their ability to control powdery mildew (see table, below). To avoid the development of fungicide resistance, fungicides should be used in alternation. Since Flint, Quadris, and Cabrio affect the powdery mildew similarly, they should not be used in alternation with each other. Rather, they could be used in a program with Bravo or Nova. It is critical that a field be monitored closely for the first appearance of the disease. To monitor effectively, a grower must walk through a field once or twice a week to look for powdery mildew, especially on the older, shaded leaves. Do not forget to look at the underside of the leaves! It is apparent from field observations that early control of powdery mildew is the most effective.

Table 3. Evaluation of fungicides for managing powdery mildew of pumpkin.

Treatment and rate/A, applied at 7-day intervals	Currently registered	Foliar powdery mildew ¹ (%) 8/19	Handle rating ² 10/1
Untreated	~	8	h ³ 6
Flint 50WG 2.0 oz alternated Bravo Weather Stik 6SC 2.0 pt	yes	3.5 abcd	2.3
Flint 50WG 2.0 oz	yes	3.3 abcd	4.8
Cabrio 20WG 1.0 lb	yes	3.3 abcd	2.3
BAS 510 70WG 4.0 oz	no	3 abcd	1.8
Cabrio 20WG 1.0 lb + BAS 510 70WG 4 oz	yes no	1.8 a	3
Cinnamite 2.5SC 6.0 pt alternated Flint 50WG 2.0 oz	yes yes	2.8 abc	5
Nova 40WP 5.0 oz	yes	4.8 def	2
Bravo WeatherStik 6SC 2.0 pt	yes	3.3 abcd	2.8
Quadris 2.08SC 15.4 fl oz alternated Nova 40WP 5 oz	yes yes	4.3 cde	3.3

¹ Based on a rating of 1 to 10 where 1=0% to trace of disease to 10=complete defoliation and death.

² Rated on a scale of 1 to 10, where 1=healthy to 10=rotted.

³ Column means with a letter in common or with no letter are not significantly different (Fisher LSD; P=0.05).

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