DIAGNOSING AND MANAGING PHYTOPHTHORA ON SQUASH

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Vegetables that are susceptible to *Phytophthora capsici* include cucumber, zucchini, summer and winter squash, watermelon, cantaloupe, pumpkin, pepper, eggplant, tomato, and succulent bean. The pathogen may overwinter in the soil and persist for >10 years. *Phytophthora* is favored by rain and warm temperatures and spreads readily via runoff or infested surface water used for irrigation.

Recognizing *Phytophthora* on SQUASH

- Crown rot at the soil line, wilted vines and plant death
- Dark, water-soaked lesions on fruit and leaves
- White spores on the surface of the fruit that look similar to powdered sugar

The roots, crowns, stems, leaves, and fruits of winter squash and pumpkin are susceptible to *Phytophthora*. Root and crown rot symptoms include browning of tissue and rot. Lesions may appear on the foliage during periods of excessive rain. Acorn and 'Golden Delicious' processing squash are highly susceptible to root and crown rot. Spaghetti and butternut squash and some pumpkin cultivars are less susceptible to root and crown rot.

Fruit rot symptoms may appear as white spores that look similar to powdered sugar. Infected fruit eventually rot. It is possible to harvest healthy-appearing fruit, but rot develops days later while the crop is in transit or on grocer's shelves. Squash and pumpkin cultivar types that become more resistant to rot as the fruits mature include butternut and acorn squash and jack-o-lantern pumpkin. Some cultivars that remain susceptible through fruit maturity include 'Lumina' pumpkin, 'Hubba Hubba' hubbard squash and 'Golden Delicious' processing squash.

If you do not have *Phytophthora* in your fields, do everything you can to prevent it from occurring. If there is a history of *Phytophthora* in a field, take preventive measures. Do not plant susceptible crops in the field. Fields must be well-drained and leave low-lying areas of the field unplanted. Irrigate overhead sparsely; drip irrigation is recommended. If *Phytophthora* is recognized in the field, remove the infected plants and surrounding healthy-looking border plants. Clean all equipment used in the field to prevent spread to other areas. Discard culls in an area where crops are not grown.

White "powdered sugar" *Phytophthora* spores and lesions on fruits of acorn squash (top left), processing squash 'Golden Delicious' (top right) and butternut squash (bottom).

Phytophthora may form many sporangia (spores) on the surface of the host plant following infection. If these sporangia come into contact with water, each sporangium will develop into 20 to 40 swimming zoospores. These zoospores may swim through saturated soil or may be carried in flowing water, including irrigation water. Swimming zoospores use electrical and chemical signals to find plant roots. Zoospores in water can survive and cause infection for days, even after they have ceased to swim. *Phytophthora* can thus be spread field-to-field via irrigation water and initiate epidemics on susceptible vegetables even in fields lacking a previous history of *Phytophthora*.

Management Strategies

- Plant into well-drained, tiled fields
- Use raised beds and drip irrigation
- Avoid using surface water for irrigation
- Irrigate sparingly from a well
- Rotate crops
- Scout fields regularly for *Phytophthora*
- Remove any diseased plants and adjacent healthy plants
- Apply fungicides preventively and at short intervals when needed
- Remove fruits from field as quickly as possible and store in a warm, dry place
- Powerwash equipment after it has been in infested fields
- Do not dump diseased culls in production fields

Wilted vines and sporulating winter squash fruits.

Preferred *Phytophthora* Fungicides for SQUASH			
Product	**A.I.**	**FRAC***	**Comment**
Elumin	ethaboxam	22	Rotate between applications. Apply as a soil or foliar spray or via drip.
Orondis Gold 200	oxathiapiprolin	49	Apply at-plant in-furrow or via drip (after plant emergence if direct-seeded).
Orondis Ultra	oxathiapiprolin / mandipropamid	49/40	Rotate to a fungicide with a different FRAC after 2 sequential applications. Use either soil or foliar applications of oxathiapiprolin products, but not both for disease control.
Presidio 4SC	fluopicolide	43	Use in a fungicide tank mix. Apply via drip or as a foliar spray.
Revus 2.08SC	mandipropamid	40	Include surfactant.
**Apron XL	mefenoxam	4	Seed treatment. Wait 6 weeks after transplant to apply mefenoxam products.
**Ridomil Gold	mefenoxam	4	Apply as a preplant-incorporated, at-plant soil spray or via drip.
***Phytophthora* 'B' Team for SQUASH**			
Forum 4.18SC	dimethomorph	40	Use in a fungicide tank mix.
Gavel 75DF	mancozeb/ zoxamide	M03/22	Relatively long PHI.
Ranman 400SC	cyazofamid	21	See label about surfactant.
Zampro 4.4SC	ametoctradin/ dimethomorph	45/40	Apply via drip or as a foliar spray.

***The FRAC code is an alphanumeric code assigned by the Fungicide Resistance Action Committee and is based on the mode of action of the active ingredient.**

****While mefenoxam is not labeled for *Phytophthora*, it is labeled for control of *Pythium*. Fungicide resistance has been detected in *Phytophthora* where mefenoxam has been used frequently.**

It was discovered that the amount of infection observed depended on the numbers of zoospores in the water, and more fruits were infected at higher zoospore numbers. Zoospores were able to infect fruit even after being in water for 5 days, especially if high numbers of zoospores were present. Thus, zoospores can survive in water for days and still cause infection of susceptible hosts. Well water or water from well-fed ponds should be used to irrigate susceptible crops since *Phytophthora* can travel in surface runoff from infested fields into rivers, creeks, ponds, ditches and culverts.

Heavy rains caused flooding in a *Phytophthora*-infested squash field, which released swimming zoospores that infected the plants, causing death despite the use of raised beds with black plastic.

Spread of *Phytophthora capsici* in water. When immersed in water, the contents of undifferentiated sporangia (U) form swimming spores (zoospores, Z) inside the sporangia (S). The zoospores are released (R) into the water, leaving empty sporangia (E).

An example of a surface water source that was found to have *Phytophthora*.

Remember that the pesticide label is the legal document on pesticide use. Read the label and follow all instructions. The use of a pesticide in a manner not consistent with the label can lead to the injury of crops, humans, animals, and the environment, and can also lead to civil or criminal fines and/or condemnation of the crop. Pesticides are good management tools for the control of pests on crops, but only when they are used in a safe, effective and prudent manner according to the label.

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