Managing Cucurbit Powdery Mildew Successfully in 2013 in the Northeast Region of the US

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Effectively managing powdery mildew is essential for producing a high-quality cucurbit crop. This foliar, fungal disease is common in the northeast because the pathogen produces an abundance of asexual spores easily dispersed by wind, thus it can spread widely, and the pathogen can produce a sexual spore in fall that enables it to survive over winter. Leaves affected by powdery mildew die prematurely which results in fewer fruit and/or fruit of low quality (poor flavor, sunscald, poor storability).

Powdery mildew is managed with resistant varieties and fungicides. An integrated program with both management tools is needed to achieve effective control because the pathogen is adept at evolving new strains resistant to individual tools that thus are not controlled as well by the tool. It is more difficult for new pathogen strains to develop when an integrated program is used, and effective control is more likely.

Resistant varieties are now available in most crop groups with new varieties released most years. Select melons with resistance to pathogen races 1 and 2. They provided good suppression in 2012. There are many types of resistant melons now. Select squash and pumpkins with resistance from both parents (homozygous resistance) when possible. This term is used in a few catalogues (for example Outstanding Seeds) whereas others use terms like ‘high resistance’ and ‘intermediate resistance’ to generally refer to homozygous and heterozygous resistance, respectively. Degree of disease suppression obtained with a variety also depends on modifying genes present. Resistant squash and pumpkin varieties have not provided as effective control in recent years as before. But they remain an important tool. Plant breeders are actively searching for new sources of resistance to powdery mildew.

Fungicide program. The most important component of an effective management program is an effective fungicide program. And the key to that is using mobile fungicides targeted to powdery mildew. Mobile fungicides are needed for control on the underside of leaves. Because these fungicides have targeted activity, additional fungicides must be added to the program when there is a need to manage other diseases such as downy mildew and Phytophthora blight.

Alternate among targeted, mobile fungicides and apply with protectant fungicide to manage resistance development and avoid control failure if resistance occurs, and also to comply with label use restrictions. The powdery mildew pathogen has a long history of developing resistance to fungicides (it was the first occurrence of resistance in the USA), thus a diversified fungicide program applied to resistant varieties when possible is critical for success. Always implement a resistance management program. The goal is to delay development of resistance, not manage resistant strains afterwards.

When to apply fungicides. The action threshold for starting applications is one leaf with symptoms out of 50 older leaves examined. Examine both surfaces of leaves. Starting treatment after this point will compromise control and promotes resistance development. If the threshold is inadvertently missed, to minimize the reduction in control that will occur, consider starting the program with a DMI fungicide or Torino; do not use Quintec in this situation. Powdery mildew usually begins to develop around the start of fruit production. Protectant fungicides applied
before detection will slow initial development. After detection, continue applying fungicides weekly. Conditions are favorable for powdery mildew throughout the growing season.

**Recommended targeted fungicides.** Alternate among targeted, mobile fungicides in the following 4 chemical groups, and apply with protectant fungicide to manage resistance development and avoid control failure if resistance occurs, and also to comply with label use restrictions. See the tables that are in separate pdf files for more information about these fungicides, in particular their resistance risk, expected efficacy, and key use directions.

Torino (FRAC Code U6) is a new fungicide with a new mode of action. It has exhibited excellent control in fungicide evaluations conducted recently. Activity is limited to powdery mildew. It can only be applied twice to a field in a 12-mo period. Consecutive applications are not recommended. REI is 4 hr and PHI is 0 days. Torino is not registered yet in NY.

Quintec (FRAC Code 13) has been consistently effective in fungicide evaluations. Activity is limited to powdery mildew. Labeled crops are pumpkin, winter squash, gourd, and melon. The crop rotational restriction is 12 months. Recent crop additions to the Quintec label have increased the options of what can be planted within 12 months of the last application. The Quintec label specifies no more than two consecutive applications plus a crop maximum of four applications. It is the only fungicide in this chemical group available in the USA. REI is 12 hr. PHI is 3 days.

**DMI fungicides** (FRAC Code 3) include Procure, Rally, Tebuzol, Folicur, and Inspire Super. Resistance is quantitative. Highest label rate is recommended because the pathogen has become less sensitive to this chemistry. Efficacy has varied in fungicide evaluations. Procure applied at its highest label rate provides a higher dose of active ingredient than the other Code 3 fungicides. Five applications can be made at this rate. REI is 12 hr. PHI is 0 days. Powdery mildew is the only labeled cucurbit disease for these fungicides, except for Inspire Super, which contains another active ingredient (Code 9) and is labeled for additional diseases. PHI is 7 days.

**Carboxamide fungicides** (FRAC Code 7) currently registered are Pristine, Fontelis, and Luna fungicides (labeled for use only on watermelon so far; there are 4 Luna formulations). Fontelis and Luna fungicides are not registered yet in NY. Strains of the powdery mildew pathogen resistant to boscalid, the Code 7 active ingredient in Pristine, have been detected and likely are the reason its efficacy has varied. Strains resistant to boscalid were determinant through laboratory assays to be highly cross resistant to other fungicides in this chemical group, thus these other fungicides would also not be effective on boscalid-resistant strains, with the exception of Luna fungicides, which have an active ingredient that is sufficiently different chemically.

In a fungicide evaluation conducted in 2012 in NY, Quintec was very effective, Procure was moderately effective, while Pristine and Fontelis were ineffective when tested alone (this is neither a labeled nor recommended commercial use pattern for these fungicides; it is done in efficacy evaluations to determine if resistance affects control). Very good to excellent control was achieved with Quintec applied 3 times alternated with Procure and Pristine or twice alternated with Torino and Luna Sensation for a total of 5 applications.

No longer recommended. Resistant pathogen strains are sufficiently common to render the following fungicides ineffective: Topsin M (FRAC code 1; MBC fungicide) and QoI fungicides (Code 11), which include Quadris, Cabrio and Flint. Resistant strains continue to be detected commonly every year in NY where monitoring is being conducted.
**Recommended protectant fungicides.** Chlorothalonil, sulfur, copper, oils (mineral and botanical), potassium bicarbonate, and biologicals. Melons are sensitive to sulfur especially when hot; there are tolerant varieties. There are many fungicides with contact activity for powdery mildew. Mancozeb is an exception.

In summary, to manage powdery mildew effectively in cucurbit crops: 1) select resistant varieties, 2) inspect crops routinely for symptoms beginning at the start of fruit development, and 3) apply targeted fungicides weekly with protectant fungicides and alternate amongst available chemistry based on FRAC code, starting at the action threshold of 1 affected leaf out of 50 older leaves. Add new fungicides to the program when they become available; substitute new for older product if they are in the same FRAC group.

**Please Note:** The specific directions on fungicide labels must be adhered to -- they supersede these recommendations, if there is a conflict. Note that some products mentioned are not yet registered for use on cucurbits. Check labels for use restrictions. Any reference to commercial products, trade or brand names is for information only; no endorsement is intended.