

Get a Handle on Managing Powdery Mildew and Plectosporium

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Powdery mildew is best managed with an integrated program including both management tools (resistant varieties and fungicides) that is based on efficacy results from research. The pathogen has demonstrated ability to evolve and become less effectively controlled by both tools, but especially targeted fungicides. An integrated program maximizes likelihood of effective control.

Resistant varieties are now available in most crop groups with new varieties released most years. Resistance in cucumber is standard in modern varieties and is so strong it is easy to forget this cucurbit type is susceptible until an Heirloom type is grown. Cantaloupe with resistance to pathogen races 1 and 2 have exhibited excellent suppression. Resistance in other cucurbit crop types is not adequate used alone (without fungicide treatment) to prevent impact of powdery mildew on yield and fruit quality.

Fungicides with targeted activity for powdery mildew have proven very important because they are able to move through leaves to the underside where the pathogen develops best, but because of their targeted mode of action they have medium to high risk for resistance to develop in the pathogen. It is very difficult to deliver fungicide directly to the underside of large cucurbit leaves even with air assist sprayers. Consequently, contact fungicides (chlorothalonil, biopesticides) provide good control on the upper but not the lower leaf surface, and thus do not prevent premature leaf death due to powdery mildew. Fungicides recommended for powdery mildew routinely change as new products are registered and the pathogen develops resistance to fungicides that have been in use for several years. Targeted fungicides need to be used in alternation to delay development of resistance, avoid control failure when resistance develops, and comply with label use restrictions. Some targeted fungicides have narrow activity necessitating applying multiple products when other diseases are occurring.

Fungicide recommendations are based on results from university research assessing product efficacy, which varies due to inherent differences in fungicide activity and can be reduced when the pathogen develops resistance, and resistance occurrence in the pathogen. This research is conducted every year at LIHREC with seedling bioassays and isolate testing done to assess resistance. Fungicide resistance has been confirmed in NY to FRAC 1, 7 (boscalid), 11, 13, and U6 fungicides. Resistance likely has or could develop elsewhere. Bioassays conducted in OH in 2020 (PDMR 15:V076) revealed resistance to FRAC 7 (Pristine, Fontelis and Merivon) and U6 (Torino); Rally (3) was also ineffective. Quintec (13) was moderately effective suggesting some resistant isolates present. Vivando (50), Gatten (U13), and Procure (3) were most effective.

Alternate among targeted, mobile fungicides in the 4 chemical groups below (first 2 most important), and apply with contact, protectant fungicide to manage resistance development. Begin very early in disease development (one older leaf out of 50 with symptoms).

Vivando or Prolivo (FRAC 50). Activity is limited to powdery mildew. They can be applied 3 times (4 for Prolivo at low label rate which is not recommended) with no more than 2 consecutive applications. REI is 12 and 4 hr, respectively. PHI is 0 days. Do not mix Vivando with horticultural oils. Less sensitive isolates have recently been detected. Prolivo was not as effective as Vivando in an evaluation conducted in OH in 2021 (PDMR 16:V079).

DMI fungicides (FRAC 3) include Proline, Procure, and Rhyme (these considered most effective) plus Aprovia Top, Folicur, Inspire Super, Mettle, Rally, Tebuzol, and TopGuard (also has FRAC 11 ingredient). Efficacy varies from moderate to excellent (Proline) in fungicide evaluations. Cevya is not as effective for powdery mildew on lower leaf surface as most others. Resistance is quantitative. Highest label rate is recommended because the pathogen has become less sensitive to this chemistry. Procure applied at its highest label rate provides a higher dose of active ingredient than the other FRAC 3 fungicides. Five

applications can be made at this rate. REI is 12 hr for these fungicides. PHI is 0 to 7 days. Powdery mildew is the only labeled cucurbit disease for some of these.

Carboxamide fungicides (FRAC 7) include Luna fungicides (Luna Experience recommended), Miravis Prime (also has FRAC 12 ingredient which targets other diseases), Fontelis, Endura, Pristine and Merivon. Powdery mildew pathogen strains resistant to boscalid, active ingredient in Endura and Pristine, have been detected since 2009 on Long Island and likely are the reason for poor efficacy in some fungicide evaluations. In laboratory assays boscalid-resistant strains exhibited sufficient cross resistance with Fontelis and Merivon that these are expected to be ineffective as well, but not with Luna fungicides. However, Luna Sensation failed in experiment at LIHREC in 2017. REI is 12 hr. PHI is 7. Maximum number of applications is 2-5, depending on rate used. Low rate is not recommended. Luna Experience also contains tebuconazole (FRAC 3), which needs to be considered when developing an alternation program. Luna Sensation is not recommended because it also contains trifloxystrobin (FRAC 11); resistance to this chemistry is very common. Limit use of Luna Experience as less sensitive isolates have been detected recently.

Gatten (FRAC U13) was not as effective as Vivando when tested at LIHREC in 2018 and in OH in 2021 (PDMR 16:V079).

Switch (FRAC 9+12) ingredient with activity for powdery mildew (9) has greater activity for other labeled diseases and is recommended for powdery mildew when needed for others.

Resistance is a major issue. Recent testing of isolates from commercial crops in NY revealed a high percentage of isolates (67-100%) being resistant to Quintec from crops treated twice with Quintec even though a good fungicide program was used. Many isolates were also resistant to Torino (FRAC U6) and Endura (7) although these or related fungicides were not applied. Almost all isolates tested were resistant to MBC fungicides (FRAC 1; Topsin M), although now in limited use, and QoI fungicides (FRAC 11; Quadris, Cabrio and Flint). Therefore, none of these are recommended. Occurrence of multi-fungicide resistant isolates is a concern.

Plectosporium blight: This fungal disease, which primarily affects pumpkin and zucchini, has been increasing in importance. It is a relatively new disease first seen in the U.S. in the 1980s. Then it was called *Microdochium* blight. Characteristic symptoms are small, white, elliptical to diamond-shaped spots. They form on stems, petioles, fruit stems, fruit, and most distinctively on leaf veins, especially evident on the leaf underside. This disease can be easily missed until it becomes severe because symptoms do not develop on the blade portion of the leaf, and the symptoms can be mistaken for physical damage or feeding injury from cucumber beetles. Rainy weather provides ideal conditions for development of this disease, thus important to apply fungicide beforehand where this disease is a concern and look for symptoms 7-10 days afterwards. The pathogen produces spores dispersed by wind and splashing water. It can survive on crop debris in soil. Labeled fungicides include Bravo, Inspire Super (FRAC 3 + 9), and the QoI fungicides (11): Cabrio, Flint Extra, Quadris, Quadris Top (3 + 11), and Merivon (7 + 11). Merivon and Inspire Super were the most effective products, providing 96% and 68% control, respectively, based on % fruit with symptoms on handles, in an experiment evaluating fungicides for *Plectosporium* blight and powdery mildew in pumpkin conducted in OH in 2021 (PDMR 16:V079). Other products tested are labeled for powdery mildew not *Plectosporium* blight, thus not surprising that they were not effective. QoI fungicides were shown effective for *Plectosporium* blight in previous experiments. Label restrictions necessitate rotating among targeted fungicides based on FRAC code, thus the program with targeted fungicides is Inspire Super alternated with a QoI, but not Quadris Top as it has same FRAC 3 fungicide. Tank mixing these with Bravo is recommended for resistance management. Consecutive applications are not allowed with QoIs. Inspire Super can be applied 5 times to a crop with no more than 2 consecutive applications. Merivon can be applied 3 times; label states not to tank mix it with any other agricultural product. Note that none of these are the best choices for powdery mildew. In the OH trial, control of powdery mildew on lower leaf surfaces based on AUDPC was 75% for Inspire Super, 86% for Merivon, and 97% for Procure (3).

Additional information about these and other cucurbit diseases, plus photographs and research results, are posted at <https://www.vegetables.cornell.edu/pest-management/disease-factsheets/>.