



# Downy Mildew of Cucurbits

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## Introduction

Downy mildew causes a severe foliar disease of all cucurbit crops, which include cucumber, gourd, cantaloupe, squash, watermelon, and zucchini. However, in Indiana, downy mildew does not occur consistently every year. This bulletin describes the biology, symptoms, and management of downy mildew of cucurbits—including why this disease is not a regular visitor to Indiana.

Before discussing the cycle of the pathogen that causes downy mildew, a bit about the name of the disease. Downy mildew can affect many different crops; however, the pathogen that causes downy mildew of cucurbits is *specific* to cucurbits. The microbe that causes downy mildew of cucurbits will not affect soybean and spinach, for example. Likewise, the pathogens that cause downy mildew in *other* plant families do not cause disease in cucurbits. Finally, powdery mildew of cucurbits is a different disease, caused by an unrelated pathogen with a distinct disease cycle and management options that differ in important ways from downy mildew.

## Disease Cycle and Symptoms

In Indiana, downy mildew may not be observed until August or September. This late timing is due to downy mildew's disease cycle. The fungus-like organism that causes downy mildew, *Pseudoperonospora cubensis*, does not survive Indiana winters because it requires green, living plant tissues. That means the fungus only overwinters in south Florida or in greenhouses in the northern U.S. and Canada.

The wind carries downy mildew spores to new, living hosts; depending on conditions, it can be quite late in the growing season before spores reach Indiana. Downy mildew of cucurbits may occur as early as mid-July or not show up in Indiana at all during a particular growing season. Because pumpkins are grown until relatively late in the growing season, this crop is often affected more than other cucurbits.

Each week, you can check <http://cdm.ipmpipe.org/> for current information on occurrence and predicted pathogen movement in the eastern half of the United States.

On pumpkin and cucumber, downy mildew causes angular yellow lesions on leaves (Figure 1). Lesions on cantaloupe and watermelon tend to be diffuse and amorphous (Figure 2). On any host, the lesions may coalesce, producing large areas of diseased tissue that may turn brown (Figure 3). On wet mornings or after a rain, downy mildew lesions on the undersides of leaves may be covered with a dark “fuzz”—the result of spore production (Figure 4). Downy mildew does not cause lesions on stems or fruit.

Wind can easily spread downy mildew spores to other leaves, nearby plants, and more distant fields. The fungus-like organism can rapidly multiply and affect large areas of a field when conditions are favorable—100 percent humidity for at least six hours, with temperatures between 59°F and 68°F.



**Figure 1.** Lesions of downy mildew of cucumber (left) and pumpkin (right) are often angular in shape.



**Figure 2.** Lesions of downy mildew on watermelon (left) and cantaloupe (right) tend to lack distinct borders and do not have a specific shape.



**Figure 3.** Large areas of brown tissue on this cucumber leaf have resulted from coalesced lesions of downy mildew.



**Figure 4.** Under conditions of high leaf moisture, such as after a rain or an early-morning dew, a dark, downy growth may appear on the underside of lesions resulting from spore production of the fungus-like organism that causes downy mildew.

Cucumber varieties resistant to downy mildew are available and should be used where possible to reduce reliance upon fungicide applications.

Once downy mildew has been locally detected, apply appropriate fungicides as soon as possible. Contact fungicides effective against downy mildew include formulations of chlorothalonil (Bravo<sup>®</sup>, Echo<sup>®</sup>, Equus<sup>®</sup>) and mancozeb (Dithane, Manzate<sup>®</sup>, Penncozeb<sup>®</sup>).

Systemic fungicides effective against downy mildew include ethaboxam (Elumin<sup>®</sup>), dimethomorph (Forum<sup>®</sup>), chlorothalonil/zoxamide (Zing!<sup>®</sup>), mancozeb/zoxamide (Gavel<sup>®</sup>), cyazofamid (Ranman<sup>®</sup>), and oxathiapiprolin (various formulations of Orondis<sup>®</sup>). These fungicides are more effective than contact fungicides but are specialized and will not be effective against other pumpkin diseases—with the exception of Phytophthora blight, which is caused by a related organism.

Because systemic fungicides are expensive and the presence of downy mildew uncertain, some growers may prefer to apply contact fungicides weekly starting in the first week of August. Always read and follow labels carefully.

Cucurbit growers who want to manage downy mildew of cucurbits with certified organic methods may want to apply products with the active ingredient copper, such as copper hydroxide or copper sulfate. If used in between applications of copper, products with the active ingredient hydrogen dioxide will disinfect the leaf and may help to lessen downy mildew severity.

Fungicide recommendations change when new products are registered or the pathogen develops resistance to a fungicide in response to its use, thereby reducing its efficacy.

Fungicides no longer recommended to address downy mildew because of resistance include mandipropamid (Revus<sup>®</sup>) and propamocarb (Previcur Flex<sup>®</sup>).

## Learn More

For more information on products, fungicide resistance strategies, rates, and cautions, see Purdue Extension publication ID-56, the *Midwest Vegetable Production Guide for Commercial Growers*, available at <https://mwvegguide.org> or by visiting the Purdue Extension Education Store at <https://edustore.purdue.edu>.

The *Vegetable Crops Hotline* is a biweekly newsletter available to growers throughout the growing season — available for free online and at a nominal cost for a hard copy. For more information, email [egel@purdue.edu](mailto:egel@purdue.edu) or go to <https://vegcropshotline.org>.