



## **Downy Mildew on Basil in the Greenhouse**

### **Introduction**

Downy mildew on basil was first reported in the US in 2007 in Florida. In 2008, it was widespread in the Northeast. Since then it has been found both in the greenhouse and in Connecticut gardens and farmers' fields. Downy mildew on basil is seed borne, so infections can begin in the greenhouse. It is also readily spread by air blown spores.

### **Symptoms**

Symptoms are often confused with a nutritional problem because you may first see mottling and yellowing of the foliage. On young seedlings, you may see mild yellowing and leaf cupping. During conditions of high humidity, (greater than 85%), you will see the dark purplish-brown to gray fungal-like sporulation on the underside of the leaves giving the leaves a “dirty appearance.”



*Figure 1 & 2: Yellowing of basil leaves resembling a nutrient deficiency (on left) and gray sporulation on underside of leaves. Photos by L. Pundt*

### **Conditions Favoring Downy Mildew on Basil**

Downy mildew on basil is especially severe when foliage stays wet for extended periods after inoculation (arrival of the pathogen on its host plant). The downy mildew pathogen needs at least 4 hours of leaf wetness for infection and more than 7.5 hours of high humidity (greater than 95%) at night for sporulation. Optimum temperature for basil downy mildew to develop is 68° F, with no basil downy mildew growth below 53° F or above 77 °F.

### **Causal Organism and Host Range**

Basil downy mildew is caused by the host specific fungus-like organism *Peronospora belbahrii*. Like other downy mildews, it is an obligate parasite and needs a living host to live and reproduce. Unfortunately, the popular Genovese type sweet basil (*Ocimum basilicum*) are very susceptible, whereas the citrus, spice and ornamental basil varieties tend to be less susceptible. Tolerant and resistant varieties of sweet basil are now currently available.

### **Monitoring**

Scout crops regularly and promptly remove and destroy infected plants.



*Figure 3: Sporulation on leaf underside and leaf cupping. Photo by L. Pundt*

### **Management**

- Start with disease free seed. Ask if your supplier is steam treating their basil seed. (Basil seed produces a gelatinous exudate, so it is difficult for the seed companies to use hot water seed treatments.)
- Buy seed from a trusted source. Talk to your supplier about how the seed was produced, and if it has been tested. The pathogen may be seed borne, but the mechanisms involved are not well known and testing is difficult.
- Purchase basil downy mildew resistant varieties. Disease resistance is rarely immunity, so some symptoms may occur. Rutgers Obsession DMR for both field and potted plant production, Rutgers Devotion DMR for potted plant production and Rutgers Thunderstruck DM for field production are resistant varieties released from the Rutgers breeding program and sold by VDF Specialty Seeds. Prospera is an organic basil

seed from Johnny's Selected Seeds. Proven Winners has developed the downy mildew resistant variety, Amazel, sold as cuttings for the seed is sterile. None of these varieties are fully resistant but will develop the disease more slowly than fully susceptible varieties.

- If you purchase plugs or transplants, inspect them carefully upon arrival.
- Monitor plants at least once a week. Inspect plants in areas where air movement is the lowest, such in the middle of benches.
- It is vital to reduce humidity and leaf wetness duration to prevent spore germination.
- In the greenhouse, use a combination of heating and venting to reduce humidity and condensation, especially at night. See [Reduce Greenhouse Humidity](#) factsheet.
- Reduce leaf wetness periods by proper plant spacing, improving air circulation, use of open wire benches and watering when plants will dry quickly.
- If possible, avoid overhead watering and use drip irrigation.
- **Promptly** destroy any infected plants and carefully remove from the greenhouse by placing in plastic bags that are tightly closed.
- Thoroughly clean and sanitize the greenhouse after plant removal. Use of a contact spray with hydrogen peroxide and peroxyacetic acid (ZeroTol 2.0) to help kill any spores that may have spread.
- Once plants become infected, the disease is inside the plant tissues and fungicides will not be effective in stopping the downy mildew within the infected basil plants.
  
- The following fungicides are labeled for use against basil downy mildew in the greenhouse: azoxystrobin (Heritage) (FRAC Group 11), cyazofamid (Ranman), (FRAC Group 21), fluopicolide (Adorn) Group 43 (see supplemental label and resistance management guidelines on tank-mixing), mandipropamid (Micora) for greenhouses with permanent flooring (FRAC Group 40), oxathiapiprolin (Segovis) Group U15 with supplemental label for retail sale to residential consumers, potassium salts of phosphorous acid (Fosphite), (Alude), (FRAC Group 33), phosphorous acid and hydrogen peroxide (OxiPhos).
  
- **Organic Products** include *Bacillus amyloliquefaciens* D747 (Double Nickel, Triathlon BA) (FRAC Group 44), potassium bicarbonate (Milstop), hydrogen dioxide & peroxyacetic acid (Oxidate 2.0), neem oil (Triact 70), *Reynoutria sachalinensis* extract (Regalia GC) (FRAC Group P5), *Streptomyces lydicus* (Actinovate AG). However, there is not strong efficacy data for these organic materials. Thorough coverage to the underside of leaves can also be difficult with these contact materials.

Researchers are investigating the use of night lighting to inhibit spore production. This method works best on young seedlings, for if basil leaves overlap, the spores develop. In Israel, where basil is grown in shade or net-houses, they found that nocturnal fanning from 8 pm to 8 am suppressed downy mildew development. The fans helped keep the relative humidity levels at lower levels within the plant canopy suppressing sporulation.

### **Advice for Retailers Selling to Home Gardens**

When you are selling basil plants to retail customers, encourage home gardeners to plant and harvest basil early! Basil downy mildew does not overwinter in Connecticut, but the windblown spores move in from the South and infections often begin around mid-July. Keep track of where the disease is being found via the [basil downy mildew monitoring program](#) that Dr. McGrath at Cornell University has put together and maintains.

Dr. McGrath, from Cornell University also suggests encouraging home gardeners to grow some plants in containers that can be brought inside when humidity outside is high (on overnight and on rainy days). The pathogen needs at least 85% humidity for sporulation to occur.

Basil downy mildew is not soil-borne, so it will not stay in the soil. Advise home gardeners to plant in well-drained sites with good air circulation; orient rows parallel to the prevailing winds; control weeds; increase plant spacing and harvest/prune to improve airflow around plants.

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