

A Plant-Breeding Breakthrough: Downy Mildew Resistant Sweet Basil

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SWEET BASIL USED to be considered a relatively easy fresh market culinary herb crop to grow. Growers saw it as a popular and profitable enterprise, and consumers enjoy delicious fresh basil.

Despite issues with basil production such as fusarium wilt, chilling sensitivity, or the periodic bacterial leaf spot, life was good and growers were able to navigate around these constraints.

Then the unexpected happened: a new disease showed up with virtually no warning in 2007, basil downy mildew (BDM). The rapid appearance and spread led to significant crop loss as none of the commercial sweet basils available on the marketplace were resistant.

A New Disease, No Genetic Resistance, and Few Control Options

While downy mildew is a well-known disease that impacts a wide variety of vegetables and fruits, including lettuce, spinach, cucurbits, and grapes, it had never before impacted basil in the U.S.



Photos: Jim Simon

The Rutgers and UMass downy mildew research team (left to right): James E. Simon, Anne Gersheson, Kelley Allen, Li-Jun Ma, Robert Wick, and Andy Wynandt

By 2009, BDM had spread to many of the states on the East Coast and in the Midwest. By 2015, it spread to most sweet basil growing parts of the country. Growers, the commercial herb industry, as well as the research community, were not prepared.

We first reported on the downy mildew wars in American Vegetable Grower in 2010. (visit GrowingProduce.com and search for “Downy Mildew Wars.”) Cornell established an early warning system to determine where and when BDM was occurring in the U.S. and to follow its movement. That is now being done with a map-based program.

Growers and gardeners alike can report when the disease reaches their area so it may provide warnings to those growers located further north and west to be on the lookout, as control programs need to be implemented prior to seeing the disease in your field.

In 2011, with funding from a USDA grant program, Rutgers University and collaborators at Cornell University (at the Long Island Horticulture Research & Extension Center), University of Massachusetts – Amherst, and the University of Florida (at the Belle Glade Everglades Research and Education Center) came together to provide solutions to growers, including a plant breeding program led by the Rutgers team with the other teams focusing on the control of the pathogen.

This program, in addition to the strong support by the IR-4 and commercial companies, helped provide the needed data that facilitated the registration of commercial products that are now

A united effort by four universities delivers four new sweet basil varieties resistant to the disease that almost wiped out field-grown basil in the U.S.



A healthy field of sweet basil during downy mildew season showing no symptoms.

approve for use in controlling or reducing BDM.

Breeding for Basil Downy Mildew Resistance

In 2011, Rutgers expanded its basil-breeding program to focus on creating new downy mildew resistant sweet basils.

After making thousands of crosses, backcrosses, and field selections and trials in New Jersey and Southern Florida (where BDM pressure is greatest and where it was first identified in the U.S.), we finally developed a series of stable sweet basil varieties with a high level of resistance to *P. belbahrii* and lines that growers found acceptable.

From this breeding program emerged 12 new downy mildew sweet basils, with four of the new varieties commercialized by VDF Specialty Seeds in record-breaking time:

- Rutgers Obsession DMR
- Rutgers Devotion DMR
- Rutgers Passion DMR
- Rutgers Thunderstruck DMR

Resistance has been verified across multiple U.S. locations by Rutgers University, USDA collaborators, and independently at the University of Hawaii and many other U.S. universities and growers, as well as abroad.

Importantly, these downy mildew resistant (DMR) varieties are resistant, not immune. Under heavy disease pressure, they can show signs of BDM. These varieties offer meaningful DMR to growers who, until now, depended upon frequently applying targeted, conventional fungicides to achieve control

Disease Controllable, Not Gone

Producing DMR sweet basils still requires growers to apply a moderate schedule of conventional fungicides to ensure control. These new DMR sweet basils offer high-yielding varieties, even when BDM is present, and protect growers from the threat of complete crop loss under high disease pressure.

Field growers have been able to harvest later into the season than has been possible since the occurrence of BDM. And they find the quality of the new basils met consumer expectations.

A robust disease management program includes good cultural practices, an effective spray program, and now, the use of improved disease resistant varieties.

The War Against BDM Continues

As new sweet basil varieties emerge on the marketplace, whether highly resistant

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or even immune, the BDM war is far from over. Lessons learned from downy mildew (DM) on other crops show that new races are likely to eventually evolve with the deployment of DMR varieties.

As such, we anticipate that this DM pathogen will mutate over time and overcome resistance. Work continues at Rutgers, private seed companies, and other public plant breeding groups both here in the U.S. and abroad to identify additional sources of genetic resistance and increase the durability of DMR in sweet basil. **AVG**

Editor's note: A more in-depth version of this article is available on GrowingProduce.com. Also, follow the new downy mildew resistant sweet basils news and other basil breeding projects on Instagram: [#rutgersbasil](https://www.instagram.com/rutgersbasil)