BASIL, SWEET (*Ocimum basilicum*)
Downy mildew; *Peronospora belbahrii*

M. T. McGrath and C. T. Downing
Plant Pathology & Plant-Microbe Biology Section
SIPS, Cornell University, LIHREC
3059 Sound Avenue, Riverhead, NY 11901

Evaluation of commercial and experimental cultivars of sweet basil resistant to downy mildew, 2022.

An experiment with field-grown basil was conducted at the Long Island Horticultural Research and Extension Center (LIHREC) in Riverhead, NY, in a field with Haven loam soil. The field was moldboard plowed on 12 Apr. Controlled-release fertilizer (N-P-K, 19-10-9) was broadcast at 525 lb/A (101 lb/A N) over the bed area and incorporated on 5 Jul. Beds were formed with drip tape and covered with black plastic mulch on 7 Jul. Weeds between mulched beds were managed by covering the soil with landscape cloth and by hand weeding. A waterwheel transplanter was used to make planting holes in the beds and apply starter fertilizer (9-18-9). A late planting date was used for the experiment to increase the likelihood of downy mildew developing during the experiment. The primary source of initial inoculum in this area is considered to be sporangia dispersed by wind from infected plants potentially a long distance away. Basil for the experiment was seeded in trays in a greenhouse on 14 Jun. All plants were placed outdoors to harden for a few days and then transplanted in the field by hand on 11 Jul. No fungicides were applied. A randomized complete block design with four replications was used. Each plot had 8 plants in 6-ft rows with 9-in. in-row plant spacing. The plots were 3 ft apart in the row. Downy mildew was assessed in all plots weekly from 27 Jul through 26 Sep, and then resistant cultivars only on 10 Oct. Incidence of plants with symptoms (yellowing in vein-delimited bands) was recorded and percentage of leaves per plant with symptoms was estimated for each plant in each plot. Values for the area under the disease progress curve (AUDPC) were calculated from 17 Aug to 26 Sep using the formula: $\sum n_{i=1}[(R_{i+1} + R_i)/2] [t_{i+1} - t_i]$, where R = disease incidence rating (% leaves with symptoms on affected plants) at the *i*th observation, t_i = time (days) since the previous rating at the *i*th observation, and n = total number of observations. To determine if leaf yellowing observed on Prospera cultivars was due to downy mildew, branches from nine plots of the Prospera cultivars with a total of 47 leaves with yellowing resembling that caused by downy mildew were collected on 12 Oct and placed separately on damp paper towel in closed plastic bags kept in a dark room. They were examined for spores after 1 and 2 days. Defoliation, which was mostly due to downy mildew, was assessed on 12, 20 and 26 Sep for all plots. Data were analyzed with one-way ANOVA and Tukey's HSD to separate means using JMP statistical software. Average monthly high and low temperatures (°F) were 85.3 and 68.9 in Jul, 85.4 and 68.7 in Aug, 76.3 and 60.3 in Sep, and 64.7 and 48.1 in Oct. Rainfall (in.) was 4.1, 2.0, 4.3 and 6.1 for these months, respectively.

Symptoms of downy mildew were first observed at LIHREC on 27 Jul in an adjacent basil experiment. Symptoms were first observed in this experiment on 17 Aug in 5 of the 36 plots (all plots of DiGenova and one of Rutgers Passion DMR); none were observed on 27 Jul or 3 and 9 Aug. Downy mildew quickly became severe on the susceptible cultivar. The Prospera commercial and experimental (Pb-2) cultivars provided exceptional control with very few potential symptoms of downy mildew. Sporulation of the pathogen was usually visible on the underside of leaves of DiGenova and the Rutgers DMR cultivars when humidity the previous night was high to promote their formation. Characteristic symptoms of downy mildew on the Prospera cultivars were never associated with visible sporulation, including on branches that were put in high humidity environment that induced sporulation on Rutgers cultivars; thus, it is possible at least some of the yellowing seen was not due to downy mildew. Two experimental Prospera cultivars evaluated have a new resistance gene (Pb-2). While a high percentage of the Rutgers DMR plants had symptoms of downy mildew starting with the 31 Aug rating, few symptomatic leaves were seen. These cultivars provided excellent control: 95-99% based on AUDPC values. Rutgers Devotion DMR and Rutgers Thunderstruck DMR were more effective than Rutgers Obsession DMR. Due to control of downy mildew, there was little defoliation on all resistant cultivars through the last assessment on 26 Sep. Very few flowers were observed on Rutgers Obsession DMR and Rutgers Passion DMR on 26 Sep in contrast with the other entries (not quantified). Windy conditions the previous week resulted in branches breaking, mostly in some plots of Prospera CG1, Prospera Italian Pb-2, Rutgers Devotion DMR, and Rutgers Passion DMR. Rutgers Devotion DMR and Rutgers Passion DMR were not as effective when evaluated in 2021 (PDMR 16:V092). Photographs are posted at https://blogs.cornell.edu/livegpath/research/basil-downy-mildew/evaluation-of-commercial-and-experimental-varieties-of-sweet-basil-resistant-to-downy-mildew-2022/.

	Downy mildew incidence (%) *						Defoliation (%) *
	Affected plants		Affected leaves on affected plants **				
Cultivar	31 Aug	12 Sep	23 Aug	12 Sep	26 Sep	AUDPC	26 Sep
DiGenova (susceptible)	100 a	100 a	73.02 a	99.0 a	99.0 a	3492 a	99 a
Rutgers Obsession DMR	56 bc	100 a	0.03 b	10.0 b	6.4 b	189 b	13 b
Rutgers Passion DMR	74 ab	100 a	0.16 b	6.6 bc	4.1 bc	110 bc	7 bc
Rutgers Devotion DMR	32 cd	58 b	0.00 b	1.9 cd	2.7 bcd	57 cd	10 bc
Rutgers Thunderstruck DMR	22 cd	46 b	0.03 b	1.6 cde	1.5 bcd	40 cde	3 bc
Prospera CG1	0 d	10 c	0.00 b	0.3 de	0.0 cd	15 def	4 bc
Prospera Red	0 d	0 c	0.00 b	0.0 e	0.0 d	3 f	0 c
Prospera Italian Pb-2	3 d	3 c	0.00 b	0.0 de	0.1 cd	9 ef	8 bc
Prospera Compact Pb-2	0 d	0 c	0.00 b	0.0 e	0.4 cd	4 ef	4 bc
P-value (cultivar)	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001

* Numbers in each column with a letter in common or no letters are not significantly different from each other (Tukey's HSD, P=0.05).

** Values were square root transformed before analysis because raw data were not distributed normally. Table contains de-transformed values.