Basil Variety Trial Report

Rebecca Brown
brownreb@uri.edu, brownreb@uri.edu

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INTRODUCTION

Over the past decade basil downy mildew, caused by the oomycete *Peronospora belbahrii*, has become the primary limiting factor for basil production in New England. The pathogen attacks the leaves, resulting in chlorotic patches on the upper surface and purplish-brown spore masses on the underside. Infected leaves are unmarketable. Basil downy mildew is an obligate parasite, requiring living tissue to survive. It does not overwinter in New England, and may not become widespread in the region until late in the summer. However, basil downy mildew can also be introduced in infected seedlings, which develop obvious symptoms with the first hot, humid days of summer. Spores are transported on the wind, and once sporulation begins the disease spreads quickly. Basil downy mildew can be controlled by rigorous application of effective synthetic fungicides beginning before the disease is present, but the need to treat every seven to ten days, to rotate among fungicides with different modes of activity, and to obtain thorough coverage of leaves make disease management with fungicides expensive.

In 2018 several new varieties of Genovese-type basil were introduced with high levels of resistance to basil downy mildew. These varieties have the potential to be game-changing for growers who prefer not to use synthetic fungicides, or do not have the resources to maintain a rigorous spray program. However, the unpredictable arrival of basil downy mildew each year means that for best results the resistant varieties should yield comparably to the best susceptible varieties in the absence of basil downy mildew. The objective of the 2019 basil variety trial was to compare the new resistant varieties with the current tolerant varieties and the susceptible yield standard ‘Nufar’.

MATERIALS AND METHODS

The variety trial included nine entries, listed in Table 1. Seed of all entries was started in the greenhouse on May 8 using 50-cell plug trays filled with conventional soilless mix. Seedlings were thinned to one per plug two weeks after seeding. Transplants were moved to an outdoor shade structure on June 1, and were transplanted into the field June 5-8.

The trial was designed as two separate plantings, located 1,000 feet apart at the Gardiner Crops Research Center at URI. Each planting had four replications, with 20 plants per plot. Basil was planted into plastic-covered raised beds with 2 rows per bed. Plants were spaced 12 inches apart both within and between rows in the bed, and beds were 5 feet apart on center. Water and fertilizer were supplied through drip tape under the plastic. All plants were pinched June 26 to encourage branching.

One planting was managed to promote yield and delay development of downy mildew. This planting was fertilized weekly, and was sprayed with Regalia fungicide on June 26, Quadris fungicide on July 19th, Revus on July 25th, Quadris on

<table>
<thead>
<tr>
<th>Variety</th>
<th>Source</th>
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<tbody>
<tr>
<td>Emma</td>
<td>Osborne Seeds</td>
</tr>
<tr>
<td>Prospera</td>
<td>Johnny’s Selected Seeds</td>
</tr>
<tr>
<td>Everleaf</td>
<td>Johnny’s Selected Seeds</td>
</tr>
<tr>
<td>Eleonora</td>
<td>Johnny’s Selected Seeds</td>
</tr>
<tr>
<td>Devotion</td>
<td>VDF Specialty Seeds</td>
</tr>
<tr>
<td>Obsession</td>
<td>VDF Specialty Seeds</td>
</tr>
<tr>
<td>Thunderstruck</td>
<td>VDF Specialty Seeds</td>
</tr>
<tr>
<td>Passion</td>
<td>VDF Specialty Seeds</td>
</tr>
<tr>
<td>Nufar</td>
<td>Johnny’s Selected Seeds</td>
</tr>
</tbody>
</table>

Table 1. Variety names and suppliers for the basil trial entries. The entries supplied by VDF Specialty Seeds were bred by James Simon and Andy Wyenandt at Rutgers University, and are available from multiple seed companies. ‘Everleaf’ and ‘Obsession’ are compact varieties, while ‘Thunderstruck’ has slightly ruffled leaves. All others are standard Genovese types.
August 7th and Phiticide on August 14th. Basil was harvested July 16th and August 12th, and was rated for downy mildew severity on August 8th. Plant height was measured July 15th and flowering was noted on July 15th and September 6th. One plant from each plot was separated into stems and leaves, dried, and weighed to calculate the leaf yield as a percentage of total biomass. The other planting was managed to promote development of basil downy mildew. Highly susceptible ‘Italian Large Leaf’ basil plants were planted at the ends of the beds and between plots to serve as spreader plants, and the trial was covered with spun-bonded rowcover to increase humidity. No fungicides were applied. This planting was harvested on July 16th. Downy mildew was observed in the susceptible spreader plants on July 25th, and disease severity was rated on August 8th, August 20th and September 6th.

RESULTS

DOWNY MILDEW RESPONSE

The five resistant varieties remained free of sporulating downy mildew for the entire trial period, even without fungicides (Figure 1). ‘Devotion’ and ‘Passion’ developed noticeable chlorosis, particularly on older leaves, but most foliage remained marketable. ‘Prospera’, ‘Thunderstruck’, and ‘Obsession’ remained completely clean, with no foliar damage. In contrast, ‘Nufar’ developed extensive sporulation, chlorosis, necrosis and defoliation, even in the planting where fungicides were used. Regular application of fungicides kept disease severity of the tolerant varieties ‘Eleonora’, ‘Emma’ and ‘Everleaf’ significantly below that of ‘Nufar’. However, only the youngest fully expanded leaves on each shoot remained marketable, lowering yields and greatly increasing time required for harvesting. Without fungicides disease developed more slowly in the tolerant varieties than in ‘Nufar’, but the difference was not enough to usefully extend the harvest period.

Figure 1. Severity of Downy Mildew symptoms on nine basil varieties grown without fungicides. Disease severity was rated on a scale from 0 to 5 with 0 indicating no disease. A score of 5 indicates no marketable foliage, while a score of 3 indicates that the youngest fully expanded leaves remained marketable.

Figure 2. A resistant variety in the no-fungicide planting on August 20.
YIELDS

Both plantings were harvested on July 16 when the earliest-flowering varieties were fully budded and before
downy mildew was present in the no-fungicide planting. ‘Passion’ had the highest yield in the planting managed
for yields, averaging 7.6 pounds of basil from 20 plants (figure 3). ‘Nufar’ ranked second at 7.3 pounds; the
difference was not statistically significant. ‘Obsession’, ‘Everleaf’, and ‘Thunderstruck’ yielded significantly less
than ‘Passion’ and ‘Nufar’. Yields were significantly lower in the planting managed to promote disease, and there
were no significant differences among varieties. However, the rank order of the varieties was the same as for the
trial managed for yields. These results suggest that ‘Prospera’, ‘Passion’ and ‘Devotion’ will give satisfactory yields
even in the absence of basil downy mildew.

The planting managed for yield was harvested a second time on August 12th when the earliest-flowering varieties
were again fully budded. ‘Nufar’ was severely infected with downy mildew despite the fungicide program. ‘Passion’
again had the highest yield, averaging 10.6 pounds of basil from 20 plants (figure 3). The other resistant varieties
were statistically similar to ‘Passion’. ‘Emma’ yielded the most of the tolerant varieties at 4.9 pounds, followed by
‘Eleonora’ at 2.4 pounds. ‘Everleaf’ and ‘Nufar’ yielded the least, and would not have been worth harvesting for
commercial production. Resistant variety yields were higher in the second harvest than in the first because plants
were larger.

Some markets prefer basil sold as clamshell boxes or
bags of leaves, without the stems. ‘Everleaf’ had the
least stem, with 81% leaves. ‘Prospera’ was the
stemmiest with only 67% leaves. When varieties are
compared for leaf yield, rather than total yield, ‘Nufar’,
‘Passion’ and ‘Devotion’ had the highest yields on July 16
but ‘Prospera’ had significantly lower yields (Figure 4).
Among the downy mildew resistant varieties
‘Thunderstruck’ yielded significantly less than the others,
and ‘Prospera’ and ‘Obsession’ yielded significantly less
than ‘Passion’.

GROWTH HABIT AND FLOWERING

Plant height was measured on July 15, and plants were
evaluated for flowering on July 15 and September 6.
Data are shown in Table 2. The September 6 evaluation
was done on plants which had been growing
unharvested since July 17. ‘Eleonora’ and ‘Emma’ were
the first varieties to flower, and had open flowers on July
15. In contrast, ‘Everleaf’ and ‘Obsession’ had not
developed visible buds. On September 6 ‘Everleaf’ and
‘Obsession’ had buds but not open flowers. ‘Everleaf’ had the shortest plants, while ‘Prospera’ had the tallest.
CONCLUSION S

All of the new downy mildew resistant varieties tested were fully resistant under Rhode Island conditions. In the absence of downy mildew ‘Devotion’, ‘Prospera’ and ‘Passion’ yielded as well as ‘Nufar’ when harvested for bunching, and ‘Devotion’ and ‘Passion’ yielded as well when harvesting individual leaves. ‘Obsession’ is a good alternative to ‘Everleaf’, with a similar growth habit and significantly better disease resistance. ‘Thunderstruck’ has smaller, less ruffled leaves than ‘Tuscany’ and a stronger flavor than the traditional lettuce leaf varieties. If downy mildew is present, all of the resistant varieties significantly out-yield the susceptible and tolerant varieties, even with regular fungicide applications. The resistant varieties could be harvested multiple times, where only one harvest was possible with ‘Nufar’. ‘Obsession’ and ‘Thunderstruck’ yielded less than ‘Devotion’ at the first harvest, but were similar at the second harvest, and were noticeably slower to flower. Given the high likelihood of basil downy mildew outbreaks in late summer, growers are strongly encouraged to switch to resistant basil varieties.

ACKNOWLEDGEMENTS

This variety trial was funded by the University of Rhode Island Cooperative Extension and the Rhode Island Agricultural Experiment Station. Abby McLeod, Emma Fernandes, Jessica Hanley and Tim Sherman assisted with field work. Basil seed was donated by the seed companies listed in Table 1. For more information about this trial please contact Dr. Rebecca Brown at brownreb@uri.edu.

<table>
<thead>
<tr>
<th>Entry</th>
<th>Height (cm)</th>
<th>July 15</th>
<th>Sept. 6</th>
</tr>
</thead>
<tbody>
<tr>
<td>Devotion</td>
<td>40.75</td>
<td>full bud</td>
<td>full bloom</td>
</tr>
<tr>
<td>Eleonora</td>
<td>45.9</td>
<td>first flowers</td>
<td>seed set</td>
</tr>
<tr>
<td>Emma</td>
<td>45.9</td>
<td>first flowers</td>
<td>full bloom</td>
</tr>
<tr>
<td>Everleaf</td>
<td>24.4</td>
<td>no buds</td>
<td>full bud</td>
</tr>
<tr>
<td>Nufar</td>
<td>42.0</td>
<td>small buds</td>
<td>first flowers</td>
</tr>
<tr>
<td>Obsession</td>
<td>34.4</td>
<td>no buds</td>
<td>full bud</td>
</tr>
<tr>
<td>Passion</td>
<td>41.2</td>
<td>full bud</td>
<td>first flowers</td>
</tr>
<tr>
<td>Prospera</td>
<td>54.7</td>
<td>full bud</td>
<td>full bloom</td>
</tr>
<tr>
<td>Thunderstruck</td>
<td>41.0</td>
<td>small buds</td>
<td>full bloom</td>
</tr>
</tbody>
</table>

Table 2. Basil canopy height and flower development stage. A height difference of 4.2 cm was statistically significant.

CONCLUSIONS

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