

Downy Mildew Resistant Basil Variety Trials on O'ahu: Results from 2018-2019

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Introduction

Sweet basil (*Ocimum basilicum*) is a high-value herb (Year 2012= \$6.8 million, NASS) that is grown year-round in Hawai'i. However, basil downy mildew (*Peronospora belbahrii*) is a plant disease that can cause chlorotic and unmarketable leaves, especially during high humidity and cooler temperatures (Uyeda et al. 2012). Entire fields can be lost to BDM (CTAHR 2011) or, such as in Hawai'i, harvest periods can decrease by nearly half during BDM infections.

Over the past 3 years, new basil varieties bred for BDM resistance have been developed by universities and seed companies in the United States and abroad. These resistant varieties are now available to farmers, however their performance under the growing conditions of Hawai'i had not been investigated. Cooperative Extension evaluated these varieties over a series of trials during the summers and winters of 2018 and 2019.



Varieties Evaluated

Name	Additional Traits	Suppliers
Eleonora	N/A	Enza Zaden*
Emma	N/A	Vitalis Organic Seeds* Johnny's Seed* Harris Seeds*
Amazel	Sterile Only available as cuttings	Proven Winners*
Prospera	Fusarium-resistant	Johnny's Seed*
Devotion	N/A	High Mowing Seeds* VDF Specialty Seeds
Obsession	Compact	Harris Seeds*
	Fusarium-resistant	Corona Seeds
Passion	N/A	VDF Specialty Seeds Harris Seeds *
Thunderstruck	Ruffled leaf	VDF Specialty Seeds Stokes Seeds

*Indicates organic seed available



Methods

Field Trial (August 2018; previously from Silva et al. 2018)

Planting, Data Collection

- Varieties tested: Devotion, Eleonora, Obsession, Thunderstruck and Genovese (control)
- Location: Poamoho Research Station, O'ahu
- 4 double-row plots per variety (3ft apart, 5ft between centers);
 10 plants per row (1.5ft apart, 20 per plot);
 2ft between plots inline
- BDM infection assessed in August 2018 (2 months after transplanting)

Seedling Trials (December 2018; October 2019)

Planting, Data Collection

- Varieties tested: All + Amazel
 - <u>Amazel</u>: 10 plants observed in field along with susceptible Genovese variety
- Location: Poamoho Research Station, O'ahu
- Seeded into Pro-Mix HP fertilized with Nutricote 13-11-11 (1lb per 20lb Pro-Mix)
- 3 reps, 12 plants per rep (single trays)
- Overhead mister irrigated, 3 minutes 3x per day
- BDM infection assessed 28 days after seeding

Data Collection:

The percentage of plants infected by BDM was determined by comparing the number of infected and uninfected plants with the BDM Infection Score scale (Table 1). Scores were analyzed using ANOVA with a Tukey comparison.

Field Management

- Soil pH= 6.6; Fertilized monthly with 5 lbs of triple 19
- Drip irrigation, once per day
- Pest Management
 - Admire Pro (drenched 10.5oz/acre)
 - Neemix 4.5 (drench: 9 oz/1000 sq.ft.)





Table 1. Scale for BDM Infection Scores

BDM Infections Score		
Value	% of Plants Infected	
0	None	
1	1-25	
2	26-50	
3	51-75	
4	76-100	



Results & Discussion





Fig. 1. Average BDM infection levels of eight downy mildew resistant basil varieties over 2018-2019 Varieties within the same trial that do not share a letter (i.e. a, b, ab) are statistically significant from each other.



The four VDF (Passion, Devotion, Obsession, and Thunderstruck) and Prospera varieties exhibited moderate to high resistance to BDM in Hawai'i across all trials (Fig. 1). Although only 10 plants were included in this trial, the Amazel variety also had high BDM resistance. Amazel plants were completely green and healthy despite neighboring Genovese plants collapsing from BDM. Eleonora and Emma varieties, although advertised as BDM resistant, were completely infected by BDM, indicating low to no BDM resistance.

Differences in BDM resistance were also observed over time. In the 2019 trial, about one-fourth to half of plants for the VDF varieties tested were infected with BDM. This change in resistance over time may be due to the presence of multiple or new races of BDM on the island. Although a variety initially may be resistant to BDM, the sexual reproductive behavior of this pathogen can lead to the creation of new BDM races. These new races and their genetics could possibly overcome and render new basil varieties' resistances ineffective (Wyenandt 2020). Cornell University researchers also observed differences in basil varietal resistance and pathogen genetics over time and by location (McGrath 2020). Higher BDM resistance of Prospera and Amazel varieties in these trials may be due to different breeding locations (Israel and Florida respectively) than the VDF varieties which were all bred by Rutgers University in New Jersey (Bar-Illan University 2019; Silvasy 2020). It is possible that these locations have different BDM races and genetics.

Conclusion

Prospera and Amazel basil varieties exhibited the highest BDM resistance and can be a solution to local BDM production issues. The characteristics of Amazel, including its leaf shape, size, plant vigor, and minimal flowering, resemble the variety currently grown by basil farmers. Thus, Amazel appears to have the most potential for commercial basil growers. Prospera's cupped leaf shape and long stem structure differ from the traits of the current commercial variety and may be more suitable for other markets or home production. If a grower adopts the Prospera, Amazel, or the moderately resistant VDF basil varieties, other integrated management practices such as adequate spacing, sanitation, and rotational spraying should be utilized to minimize infection. Additionally, if farmers choose to grow the BDM resistant varieties evaluated, then they should know that these varieties are proprietary and cannot be used to make future seed or cuttings.

References

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Amazel in the field

Prospera

Amazel

October 2019 Trial

