Investigating Treatments for the Management of Macrophomina on California's Central Coast, Field Ratings from 2018

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Summary

Macrophomina crown rot is a serious concern for the California strawberry industry, especially as fumigation with methyl bromide is no longer possible. The continued establishment and maintenance of multiple field locations in different production regions for conducting Macrophomina crown rot trials is crucial for developing long-term sustainable disease management recommendations. The objective of our research was to screen strawberry genotypes for susceptibility to Macrophomina crown rot. A total of 90 cultivars and elite selections from both public and private breeding programs were planted at Cal Poly in October 2017 and evaluated until July 2018. Plants were inoculated using 5 g Macrophomina cornmeal-sand placed at the crown-soil interface, two weeks after planting. Plant mortality were assessed over time in both inoculated and non-inoculated plots. Genotype susceptibility varied widely from 12.8 to 100% mortality with an average mortality of 66.7% and 65.5% for the 25 cultivars common in 2017 and 2018. Each strawberry breeding program has genotypes that are representative of the spectrum of susceptibility. This proposal directly addresses these high priority research areas for the California coastal region: (1) farming without fumigants; (2) control of soilborne diseases; and (5) breeding for disease resistance..

Introduction

Crown rot, caused by the soilborne fungus *Macrophomina phaseolina*, is a damaging pathogen that has become established in California strawberry production areas (Koike et al., 2016). After introduction into a field, the pathogen can cause extensive plant decline and mortality. *Macrophomina phaseolina* can be difficult to manage due to its persistence in soil and crop residues as microsclerotia (Islam et al., 2012). Previous research at Cal Poly has shown that host plant resistance will be a critical tool for managing this disease in the post-methyl bromide era. The objectives of this year's research were to evaluate host resistance against Macrophomina crown rot under field conditions.

Materials and Methods

A replicated field trial was established to evaluate 90 cultivars and elite breeding selections for resistance to Macrophomina crown rot. For year-to-year comparison, 25 of the cultivars in this experiment were also included in last year's experiment. Strawberry germplasm was selected from six public and private breeding programs: University of California-Davis, University of Florida, Driscoll's, Plant Sciences, Inc., Lassen Canyon Nursery and Planasa. The trial was conducted during the 2017-2018 growing season and consisted of 20-plant plots replicated four times, with a fifth non-inoculated replicate. On October 23, 2017, bare-root strawberry transplants were set in field 35b on the Cal Poly San Luis Obispo campus farm. Two weeks later, each plant in the inoculated plots received 5 g of cornmeal-sand inoculum (Mihail, 1992) colonized with three isolates of locally sourced *M. phaseolina* placed at the crown-root interface of each plant.

Host resistance was assessed by recording disease incidence (plant mortality) in each plot. A plant was considered dead when 100% of the foliage was brown and dry. Plant mortality was assessed every four weeks, then every two weeks once symptoms were observed; the last assessment occurred on August 10, 2018. Presence of the pathogen in symptomatic plants was confirmed by plating pieces of the internal crown tissue on acidified potato dextrose agar (APDA).

Results

The first wilt symptoms due to infection by *M. phaseolina* were observed on May 15, roughly 200 days after planting. The majority of plant mortality occurred after the first week of July, when air temperatures exceeded 100°F (37°C) for several days. Genotypes exhibited a wide range of susceptibilities (Figures 1 and 2). Elite selections 'LC-D,' 'LC-F' and 'Ruby June' were the most susceptible genotypes, with 100% mortality by August 2, 2018. Elite selections DR-N, DR-L and 'UC-L' were the most resistant genotypes to Macrophomina crown rot, with less than 21% mortality by August 10, 2018. Average mortality across all genotypes in the trial was 66.7%. Average mortality for the 25 cultivars common to both 2017 and 2018 trials was 65.5%. An evaluation of the weather patterns shows that 2017 and 2018 had typical high temperatures in June and July while 2017 was decidedly warmer than 2018 during the winter months.

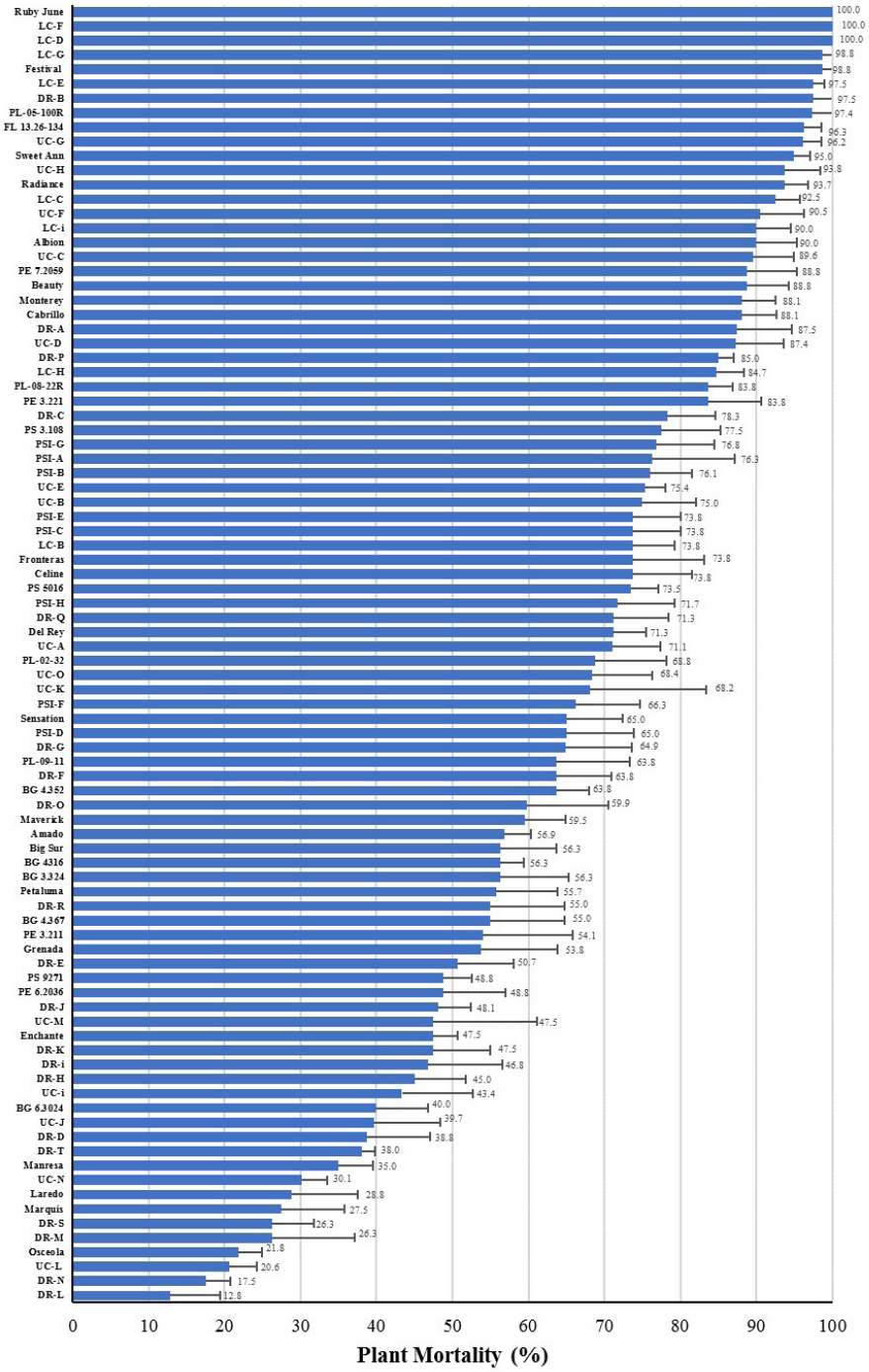

Figure 1. Average percent plant mortality due to Macrophomina crown rot as of August 10, 2018. Cultivars are representative of public and private breeding programs. Error bars represent the standard error of the mean.

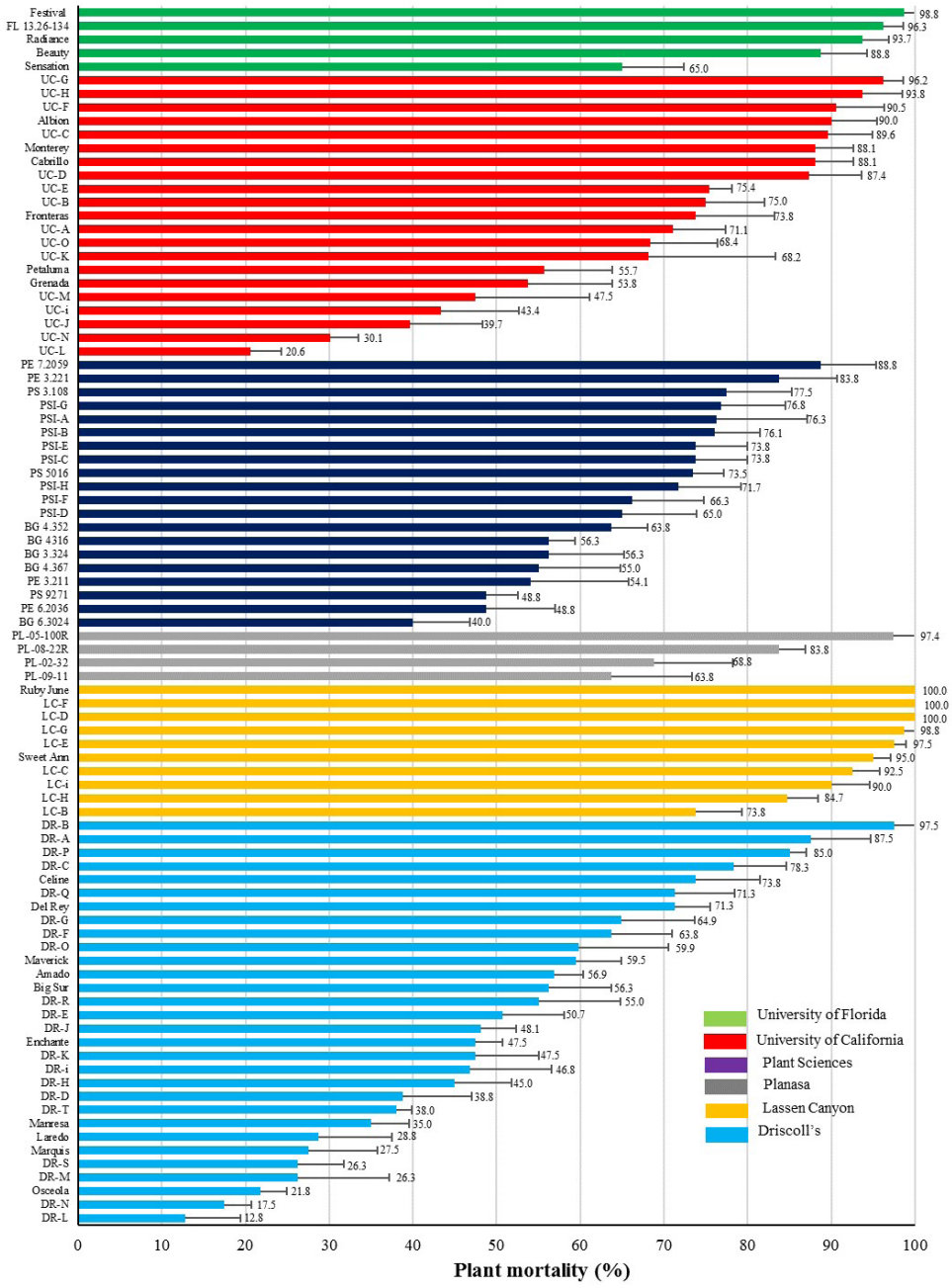

Figure 2. Average percent plant mortality due to Macrophomina crown rot as of August 10, 2018, sorted by breeding program. Cultivars are representative of public and private breeding programs. Error bars represent the standard error of the mean.

Discussion

All breeding programs have genotypes that are found at both ends of the susceptibility spectrum for Macrophomina crown rot. Overall, disease levels were much lower in this experiment (66.7%) compared to 2017's experiment (36.2%). This was true for all entries as well as the 25 cultivars common to both years. We speculate that this is due to higher temperatures during planting and early crop development in 2017. Zveibil et al., (2012) concluded that disease due to *M. phaseolina* occurs late in the season and is exacerbated by high temperatures. The cornmeal-sand inoculation method provided consistent, but not overwhelming, disease pressure for field evaluation of host resistance to *M. phaseolina*. These results can serve as both a guide to growers for managing Macrophomina crown rot, and for the development of new resistant cultivars for existing breeding programs.

Acknowledgments

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