Final Technical Report

Grant 22*1564 Field scale management of late season cluster rots to increase crop quality of Michigan wine grapes

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Abstract

Michigan vineyards are subject to a wide range of pests. Many of these can be effectively controlled each year through cultural and chemical methods, however our Michigan climate is highly conducive to cluster rots that can ruin an otherwise excellent crop. Mitigating losses in yield due to cluster rots, such as gray mold and sour rot, is always a problem in a cool and humid environment. Sour rot in particular is a significant challenge for growers to manage because it is a disease complex where bacteria, yeasts, filamentous fungi, and insects are involved. These infections can compromise quality-related metabolites, such as organic acids, phenolics, and volatiles which impacts the quality and flavor of wine. Our research aims to minimize the risk of these diseases by improving understanding of the insect-disease interactions and developing improved management strategies.

Goals and Objectives

The MSU grape Entomology and Small Fruit and Hop Pathology programs have been developing integrated pest management (IPM) strategies that utilize less pesticide inputs and optimize pest control in Michigan vineyards. While we have shown that our programs do decrease late season crop loss from diseases such as sour rot and Botrytis, many growers do not utilize the most recent research available for sour rot management and do not consider issues with fungicide resistance in Botrytis when building management programs. This project will combine disease and insect monitoring, on-farm demonstrations of insect and disease control programs, and assessment of cluster protection to develop and deliver IPM programs to growers. Through these approaches, we also aim to encourage growers and scouts to monitor vineyards so they can make timely decisions to prevent the overuse of pesticides.

Objective 1. Compare conventional and organic control options for cluster rot control in small plot trials.
Objective 2. Test reduced IPM programs for cluster rot with Michigan grape growers to improve control.
Objective 3. Identify insect vectors and the importance of their control for reducing cluster rots.
Objective 4. Develop infrastructure at MSU to study rot-resistant grapevines.
Objective 5. Update extension materials as a result of the research.

Brief Literature Review

Michigan's vineyards are subject to a wide range of pests, but some of the most economically important are active late in the growing season. Cluster rot, consisting of gray mold (*Botrytis cinerea*) and sour rot (a complex of yeasts and bacteria vectored by insects) is especially problematic for growers due to Michigan's humid climate and high volumes of rain during the ripening period. Tight clustered and thin-skinned cultivars, including the commonly grown Pinot Noir, Vignoles, and Riesling, are more susceptible to developing cluster rots. Both sour rot and Botrytis bunch rot degrade the fruit, cause a loss of yield, and compromise quality-related metabolites, such as organic acids, phenolics, and volatiles that impact the flavor of wine.

Botrytis bunch rot is challenging to manage due to an increase in resistance to many of the most effective fungicide chemical classes. A recent study in Michigan vineyards identified *B. cinerea* isolates that are resistance to six out of the eight major FRAC groups commonly used for gray mold. To manage the sour rot complex, both the microbial communities (yeasts and bacteria) and insects need to be addressed. In previous studies, the recommended management for sour rot was to apply a combination of an antimicrobial sterilant, like Oxidate or Fracture, with an insecticide weekly starting at 12-14 Brix. However, our previous efficacy trials in southwest Michigan found that Oxidate with Mustang Maxx is only moderate effective at controlling cluster rot, while Fracture applied with Mustang Maxx provided excellent disease control. Due to the late season nature of the disease the application of conventional fungicides is difficult because of residue restrictions. Thus, having effective organic options is essential for growers to

avoid residue concerns for worker safety and marketability for export. Through this project, we aimed to investigate the efficacy of organic control options for cluster rots.

Results, Conclusions, and Outcomes

- In a small plot efficacy trial, we found that the conventional treatment of Switch and Mustang Maxx had the lowest cluster rot incidence and severity, while the organic treatment of Oxidate and Entrust resulted in moderate disease incidence and severity.
- The insecticide only treatment was more effective at reducing disease than the fungicide only treatment.
- We worked with three SW Michigan and three NW Michigan growers to compare our recommended management programs to their traditional programs. In many instances, the MSU program resulted in similar or better disease control than the grower standard, while being more aware of pesticide residues and rotating FRAC codes.
- We harvested clusters from the small plot efficacy trial and evaluated the number of *Drosophila* larvae and adults. There was a correlation between the number of *Drosophila* and disease incidence.
- A vineyard of 160 USDA disease resistant grapes was planted at the Clarksville Research Station and rated for foliar diseases. A range of resistance was observed.
- MSU extension materials were updated to reflect the findings of this project and a fact sheet on sour rot is in progress.
- Results from this project were presented at multiple extension meetings throughout the grant period, such as the Great Lakes Expo, NW Orchard and Vineyard Show, and SW Michigan Hort Days.

Time Span

01/27/2022 to 08/01/2023

Work Accomplished/Methods

No significant changes were made to the methods as described in the proposal.

Communication Activities, Accomplishments, and Impacts

Publications:

- Crandall, S.G., Spychalla, J., Crouch, U., Flor, A., Naegele, R.P., **Miles, T.D**. 2022. Rotting grapes don't improve with age: cluster rot disease complexes, management, and future prospects. Plant Disease Feature Article. 106:2013-2025.
- Alzohairy, S.A., Gillett, J., Saito, S., Naegele, R., Xiao, C.L., **Miles, T.D.** 2021. Fungicide resistance profiles of *Botrytis cinerea* isoaltes from Michigan vineyards and development of a TaqMan assay for detection of fenhexamid resistance. Plant Dis. 105:285-294.

Presentations:

- Spychalla, J., Heger, L., **Miles, T.D**. Crandall, S. 2022. It's not the heat, it's the humidity: Moisture within grape clusters could influence sour rot severity. Poster presentation, August 2022. Annual American Phytopathological Society Meeting Pittsburg, PA. S3.78
- Neugbebauer, K., Perkins, J., Isaacs, R., **Miles, T.D.** 2022. Management of late season cluster rots to increase crop quality of Michigan wine grapes. Poster presentation, August 2022. Annual American Phytopathological Society Meeting Pittsburg, PA. S3.186

Extension Presentations:

- **Miles, T.D.** Integrated late season disease control and controlling cluster rots. Southwest Horticultural Research Days. February 2023. Benton Harbor, MI.
- **Isaacs, R.** Miles, T., Neugbebauer, K., Perkins, J., and Goldstein, L. Managing sour rots in your vineyards. Northwest Orchard and Vineyard Show. December 2022. Acme, MI.