

Final Technical Report

Influence of cluster rots on the crop quality of wine grapes from Michigan vineyards

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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 bunch rot diseases, such as gray mold and sour rot, is always a problem in a cool and humid environment. Cluster rots are a significant challenge for growers to manage because they are pest complexes 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 team is committed to helping the growing Michigan wine grape industry produce a high-quality crop that can reliably meet the expectations of winemakers and consumers across the state. Cluster rots, consisting of Botrytis bunch rot and sour rot, are challenging for growers to manage because they occur late in the season near harvest and growers need to be cautious about applying chemical treatments at this time of the season. Strategies to manage Botrytis bunch rot are well known to the grower community, but there has been a significant increase in resistance to many of the most effective fungicide chemical classes. Because of these reasons, management strategies for cluster rots are needed for growers. We have been developing integrated pest management (IPM) strategies that utilize less pesticide input and optimize pest control in Michigan vineyards. This IPM program has included disease/pest monitoring, testing mass-trapping approaches for insect pests like vinegar flies and yellow jackets and comparing reduced inputs or organic products to conventional programs. This project aimed to increase the statewide control of late season cluster rots by improving our IPM program and further investigating the role of insects as disease vectors near harvest.

The goals of this project were to gain greater insight to the bunch rot and sour rot challenges growers face in northwest and southwest Michigan, improve fruit quality, reduce the environmental impact of Michigan viticulture, and to deliver that information to the industry through our extension programs through the following objectives:

- Objective 1. Compare conventional and organic control options for cluster rot control.
- Objective 2. Investigate skin thickeners for cluster rot 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

Significant research has been conducted recently at Michigan State University and Cornell University to manage sour rot (Hall et al., 2018; Hall et al., 2019). To manage sour rot, both the microbial communities (yeast and bacteria), and insects need to be addressed. Applying an antimicrobial sterilant by itself does not offer much control of sour rot. In previous studies, the most effective treatment strategy was a combination of an antimicrobial sterilant and an insecticide, specifically, Oxidate 2.0 or Fracture (sterilant) and Mustang Maxx (insecticide) sprayed weekly starting before symptoms develop at around 12-14 Brix (Gillett et al., 2018; Hall et al., 2017). Some of the main take aways from this research have been emphasizing the importance of fruit wounds on disease development, and the importance of the presence of fruit flies (*Drosophila melanogaster*) in the spread and persistence of sour rot. In 2018, Cornell University reported vinegar fly populations resistant to Mustang Maxx, Assail, and Malathion in a Finger Lakes vineyard (Sun et al., 2019). Additionally, growers have reported higher populations of yellowjackets that can also vector pathogens among clusters and cause initial damage to the fruit.

Results, Conclusions, and Outcomes

- We conducted two years of small plot efficacy trials comparing conventional products and organic products for cluster rot control.
- The conventional products provided higher levels of cluster rot control than organic products.
- Organic products resulted in significantly lower cluster rot incidence and severity than the untreated control.
- Switch with Mustang Max or Leverage 360 and Fracture with Mustang Maxx provided the highest cluster rot control.
- Oxidate with Entrust provided the highest disease control of organic products.
- Significantly higher disease control is obtained when spraying an insecticide with a fungicide versus only a fungicide.
- There was a positive correlation between the number of *Drosophila* larvae extracted from diseased clusters and cluster rot incidence in 2021.
- *Drosophila* larvae and adult counts on diseased clusters vary greatly from year to year.
- The *V. labrusca* x *V. vinifera* population planting has been established and has shown varied levels of disease resistance.
- The plot which was established at the Clarksville Research Center was rated in 2022 for powdery and downy mildew resistance, we aim to rate this plot in 2023 and 2024 once the plants are large enough to have clusters.
- Numerous extension activities were conducted for this project including talks at Great Lakes Fruit and Vegetable Expo, Northwest Orchard and Vineyard Show, Southwest Horticulture Days and MSU Viticulture Days. These talks were given by Drs. Miles and Isaacs at different times.
- This work was also professionally presented at the 2022 American Phytopathological Society Annual Meeting by Dr. Neugebauer.

Time Span

1/1/2021 to 8/31/2022

Work Accomplished/Methods

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

Communication Activities, Accomplishments, and Impacts

In the 2022 season, we partnered with four commercial vineyards (two in each major grape growing region in Michigan) to trial our recommended management program. We disease incidence, disease severity, and *Drosophila* counts compared the grower's standard practice program to the recommended program. Management of late season cluster rots to increase

crop quality of Michigan wine grapes, Poster presentation at American Phytopathological Society annual meeting, August 2022. 2,500 participants.

Extension Content

MSUE Articles:

- 1.) Nasrollahiazar, Reinke, M., **Miles, T.**, Isaacs, R., Perkins, J., Sabbatini, P., Chaudhari, S., Sloan, September 21, 2022. C. Michigan grape scouting report – September 21, 2022.
<https://www.canr.msu.edu/news/michigan-grape-scouting-report-september-21-2022>
- 2.) Nasrollahiazar, Reinke, M., **Miles, T.**, Isaacs, R., Perkins, J., Sabbatini, P., Chaudhari, S., Sloan, September 14, 2022. C. Michigan grape scouting report – September 14, 2022.
<https://www.canr.msu.edu/news/michigan-grape-scouting-report-september-14-2022>
- 3.) Nasrollahiazar, Reinke, M., **Miles, T.**, Isaacs, R., Perkins, J., Sabbatini, P., Chaudhari, S., Sloan, September 7, 2022. C. Michigan grape scouting report – September 7, 2022.
<https://www.canr.msu.edu/news/michigan-grape-scouting-report-september-7-2022>
- 4.) Nasrollahiazar, Reinke, M., **Miles, T.**, Isaacs, R., Perkins, J., Sabbatini, P., Chaudhari, S., Sloan, August 24, 2022. C. Michigan grape scouting report – August 31, 2022.
<https://www.canr.msu.edu/news/michigan-grape-scouting-report-aug-31-2022>
- 5.) Nasrollahiazar, Reinke, M., **Miles, T.**, Isaacs, R., Perkins, J., Sabbatini, P., Chaudhari, S., Sloan, August 24, 2022. C. Michigan grape scouting report – August 24, 2022.
<https://www.canr.msu.edu/news/michigan-grape-scouting-report-aug-24-2022>
- 6.) Nasrollahiazar, Reinke, M., **Miles, T.**, Isaacs, R., Perkins, J., Sabbatini, P., Chaudhari, S., Sloan, August 17, 2022. C. Michigan grape scouting report – August 17, 2022.
<https://www.canr.msu.edu/news/michigan-grape-scouting-report-aug-17-2022>

Outreach/Extension Presentations

- 1.) **Miles, T.D.** Integrated late season disease control and controlling cluster rots. Southwest Horticultural Research Days. February 2023. Benton Harbor, MI.
- 2.) **Miles, T.D.** Using Fungicides in Vineyards: balancing efficacy, resistance, pathogen target and other considerations. Southwest Horticultural Research Days. February 2023. Benton Harbor, MI.
- 3.) **Miles, T.D.** Picking a fungicide: balancing resistance, pathogen target, price and chemical residue while protecting your grapes. Northwest Orchard and Vineyard Show. January 2023. Traverse City MI. .
- 4.) **Miles, T.D.** and FRAME Team. Workshop for Michigan grape growers. Building Better Fungicide Spray programs – Michigan. March 2022. Available online/videoconference.
- 5.) **Miles, T.D.** Late Season Bunch Rots, Lessons Learned from 2021. Southwest Horticultural Days. Benton Harbor, MI February 2022.
- 6.) **Miles, T.D.** What fungicides are still working in grapes? A discussion of powdery mildew, botrytis and downy mildew. Orchard and Vineyard Show. Traverse City, MI January 2022.
- 7.) **Miles, T.D.** What can diagnostics tell us about managing grape diseases?. Great Lakes Fruit and Vegetable Expo – Grape Session, Grand Rapids, MI December 2021.

Scientific Abstracts:

- 1.) Neugebauer, 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

Funding Partnerships

In 2023 we received some funding from the Michigan State Horticulture Society (7,500) to test some additional organic fungicides on the sour rot disease complex. Additionally we have been getting support from Project GREEN throughout the years and this project partners well with our research on grape powdery mildew (funded by a USDA-SCRI project on fungicide resistance).



Botrytis bunch rot of grape



Sour rot of grape



Sour rot treatments, industry standard on the left and untreated control on the right



Dr. Rufus Isaacs discussing sour rot control at the Great Lakes Fruit and Vegetable Expo in 2022 during the grapes session.