Final Technical Report

Grant 23*2219 Field scale management of late season cluster rots to increase crop quality of Michigan wine grapes

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Abstract

The sour rot complex initiates on berries when wounds are infected by yeast and bacteria. The bacteria and yeast convert fruit sugars into acetic acid and other metabolites which attract insects including vinegar flies. The insects cause further damage to the fruit and act as vectors to spread yeast and bacteria. Infections caused by sour rot and botrytis degrade the fruit, cause a loss of yield, and compromise quality-related metabolites. Michigan often receives high volumes of rain during the ripening period, increasing sour rot pressure. The goal of this project is to develop integrated management strategies with organic products to reduce the economic impacts of this disease complex.

Goals and Objectives

The MSU Grape Entomology Program and the MSU Small Fruit and Hop Pathology Program have been collaborating to develop integrated pest management (IPM) strategies that utilize less pesticide input while achieving pest control in Michigan vineyards. We have developed an understanding of the types of *Drosophila* we collect from vineyards near harvest, and have been assessing rot control from different programs. While we have shown that grower programs do decrease late-season crop loss from diseases such as sour rot and botrytis, many of these programs do not utilize the most recent research available for sour rot, do not consider issues with fungicide resistance in *Botrytis* species, and are using conventional pesticides with no organic options. This IPM project will combine disease and insect monitoring, on-farm demonstration of combined insect and disease control programs using organic pesticides, and assessment of cluster protection to provide improved management recommendations.

Objective 1. Evaluate the effectiveness of organic options for cluster rot control in small plot trials.
Objective 2. On-farm studies with grape growers in Michigan to improve cluster rot control.
Objective 3. Identify insect vectors and the importance of their control for reducing cluster rots.
Objective 4. Compare the chemical profiles of healthy and infected fruit.
Objective 5. Update extension materials as a result of the research.

Brief Literature Review

Most of Michigan's vineyard acres are spread across the southwest and northwest regions of the state (USDA NASS Statistics 2017). The MSU Grape Team continues to work across this industry to deliver information on IPM and crop protection strategies in Michigan vineyards. These projects have generated information on the control of grape diseases and insects, such as the most effective insecticides for use in grapes for control of rot and *Drosophila*.

Significant research has been conducted over the last 5 years in both Michigan State University and Cornell University to prevent sour rot (Hall et al., 2018; Hall et al., 2019). To reduce sour rot infections, both the microbial communities (yeast, bacteria) and the insect vectors need to be addressed. 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 twice, a week apart, starting at 12-14 Brix (Hall et al., 2017; Gillett et al., 2018). However, our efficacy trials in SW Michigan found that Oxidate with Mustang Maxx or Entrust is only moderately effective at controlling cluster rot, while Fracture and Mustang Maxx provided much better disease control. In 2018, Cornell University reported vinegar fly populations resistant to Mustang Maxx, Assail, and Malathion in a Finger Lakes vineyard (Sun et al., 2019), and recent MSU research has found a similar situation (Hubhachen et al. 2022). Additionally, growers have reported higher populations of yellowjackets that can also vector pathogens among clusters and cause initial damage to the fruit. Targeting these insects to reduce movement of the pathogens seems like a critical component of preventing economic losses from cluster rots. Understanding what vectors are present through the harvest season, and what connection they have to moving Botrytis and sour rots will allow us to target

the most important insect vectors of this disease complex. Field tests of insecticides that have shown promise in our recent trials for protecting clusters will also help demonstrate to growers the importance of an insect control component to the sour rot management program.

Results, Conclusions, and Outcomes

- We conducted two years of small plot efficacy trials focused on comparing organic products for control of cluster rot.
- Entrust applied with ProBlad, Stargus, Oso, LifeGard, or Serifel starting at 12 Brix provided the highest levels of cluster rot control.
- The highest amount of pesticide residues in the harvested grapes was detected with Switch + Leverage 360, Switch + Verdepryn, and Fracture + Mustang Maxx.
- The lowest amount of pesticide residues was detected from JetAg + Mustang Maxx, Oxidate + Entrust, and Switch + Entrust.
- The findings from this research were used to update the Michigan Fruit Management Guide for 2023 and 2024.
- The results from this project were also presented at Great Lakes Expo, SW Michigan Hort Days, and the NW Michigan Orchard and Vineyard show.
- Results from this research have also been used to initiate an IR-4 project in their Integrated Solutions Program.
- We recruited a graduate student from Cornell University to work in our MSU team focused on sour rot. She is working between the two collaborating labs.

Time Span

January 2023 – August 2024

Work Accomplished/Methods

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

Communication Activities, Accomplishments, and Impacts

Publications

Neugebauer, K.A., Perkins, J.A., Sysak, R., Isaacs, R., and Miles, T.D. 2024. Reducing cluster rots in Michigan wine grapes using combined pathogen and vinegar fly control. Crop Protection. doi:10.1016/j.croppro.2023.106528.

Scientific Presentations

Neugebauer, K. , Alzohairy, S., and Miles, T.D. 2023. Assessing fungicide resistance and management of late season cluster rots in Michigan wine grapes. April 2023. 20th International Reinhardsbrunn-Symposium. Friedrichroda, Germany.

Extension Presentations

Miles, T.D. Fungicide Resistance. MSU Fruit School. February 2024. Okemos MI

Miles, T.D. Fungicide Resistance in Grapes. Ontario Fruit and Vegetable Meeting. February 2024. Niagara Falls, Canada.

Isaacs, R., Goldstein, L., and Bhandari, R. 2024. Balancing beneficials and pests in your vineyards. Northwest Orchard Show, Acme, MI. January 2024.

Isaacs, R., Goldstein, L., Reinke, M., Nasrollahiazar, E., Van Timmeren, S., Wise, J., Neugebauer, K., and Miles, T. 9024. Protecting berries against insect pests. Great Lakes Expo 2024.

Miles, T.D. Mid-season disease management in grapes and research update. MSUE Viticulture Days at SWMREC. July 2023. Benton Harbor, MI.

Budget Narrative

The project was conducted consistent with the budget proposed by the principal investigator and approved by the State of Michigan.