2017 Report to the
Michigan Grape & Wine Industry Council

Proposal Title:
Increasing potential for biological control of grape diseases.

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Abstract
Fungal pathogens of grapevines are responsible for annual losses as well as multiple fungicide applications per year in Michigan vineyards. These pathogens usually overwinter in the vineyard either in leaf and fruit debris or on/in the overwintering wood. Disease severity varies from year to year depending on the amount of inoculum surviving from the previous season and the weather conditions which may be more or less conducive to disease development that year. There is a general interest in environmentally friendly disease control options and biological control agents have been shown to be effective against grape pathogens. Even so, biological control agents have not been used widely in grape production. The reason is that, in general, they tend to be more variable in their efficacy than chemical fungicides and do not have systemic activity. In addition, applying conventional fungicides in a program with biological control agents may be more complicated as some chemicals may adversely affect biocontrol agents which are living organisms. Instead of using biological control agents during the growing season, it may make more sense to apply them at the end of the growing season and allow them to parasitize or antagonize grape pathogens as they prepare to overwinter. The objectives of this study are designed to test that hypothesis.

Original objectives for the project:

1) Study the effects of biocontrol agents on overwintering inoculum of grape pathogens in the vineyard
2) Assess efficacy of leaf removal in reducing downy and powdery mildew disease pressure

Work accomplished by objective

1) *Study the effects of biocontrol agents on overwintering inoculum of grape pathogens in the vineyard*

   The following inoculum was collected at the appropriate times in August, 2017:

   - Black rot infected grape berries
   - Botrytis infected grape clusters
   - Phomopsis infected grape canes
   - Powdery mildew infected grape leaves with cleistothecia

   As the inoculum was collected, it was aliquoted into individual aluminum mesh bags measuring approximately 6 x 6 inches and stored at 4 C.

On 14 Sep, 4 liter solutions of the following fungicides were made at the following concentrations (to be equivalent to rates/acre as listed on the labels):

- Rootshield Plus (1.5 lb/20 gal)
- Blight Ban (5.3 oz/100 gal)
- Actinovate AG (12 oz/100 gal)
- Double Nickel (6 qt/100 gal)
- Cueva (2 gal/100 gal)
- Sulforix (2 gal/100 gal)
- Tap water control

Immediately after the solutions were made, the inoculum filled mesh bags were soaked in the appropriate solution for 5 min then removed and air dried. The following day, the mesh bags were hung approximately 4 ft above the ground on grapevines in a mature vineyard (Figure 1). In the case of black rot, two bags were made for each treatment and one bag was hung above the ground and one bag was pinned to the ground under the vine. All treatment/fungicide combinations were replicated 4 times.

Figure 1. Mesh bags with inoculum

The mesh bags have been overwintering and will be brought back to the lab in April 2018 to determine how much viable inoculum is left in the samples. In the case of black rot, the berries will be wetted and suspended over petri dishes of water agar to allow release of ascospores. The phomopsis canes and botrytis clusters will be placed in moist chambers and examined over a period of 14 days for the presence of spore development. Cleistothecia from the powdery infected leaves will be removed with tweezers, placed on water agar and the percent of ascospore germination determined.

In a second experiment, downy mildew infected leaves were collected in Sept 2017 and place in 3 by 2 foot plots under mature grapevines. Plots were covered with chicken wire and secured in place with metal pins to ensure the leaves stayed within the plot (Figure 2). On 13 Oct, individual treatments were applied and replicated 4 times:

- Water
- 22% Urea (at a rate of 200lbs/acre)
- Rootshield Plus (equivalent to 8 oz/acre)
- Compost Tea (undiluted)
- Compost (1 cubic foot/rep)

Figure 2. Downy mildew leaves under chicken wire

All applications were made to the point of saturation (approximately 0.8 gallons per plot). The compost used was a commercial blend from Miracle Grow called "Nature's Care" and was composted from yard waste, manure, mushroom compost, and food waste. The compost tea was made by placing 2 lbs of the commercially made compost into a mesh paint strainer bag and then placing the bag into a 5 gallon bucket of tap water. The compost was left to steep anaerobically for 7 days at which time it was applied to the plots undiluted.

All plots were rated for percent decomposition on 20 Oct through 8 Dec (Figure 3). In the case of the plots applied with compost itself (i.e. not tea), the compost was gently moved out of the way to make the rating, then replaced. Ratings will be resumed in March after the snow melts. At this time, the compost, urea and Rootshield Plus have almost completely decomposed the leaf litter. The compost tea has not significantly increased decomposition as compared to the water control. In early April, any remaining leaf litter and the soil under the plots will be tested to see if they contain viable oospores.

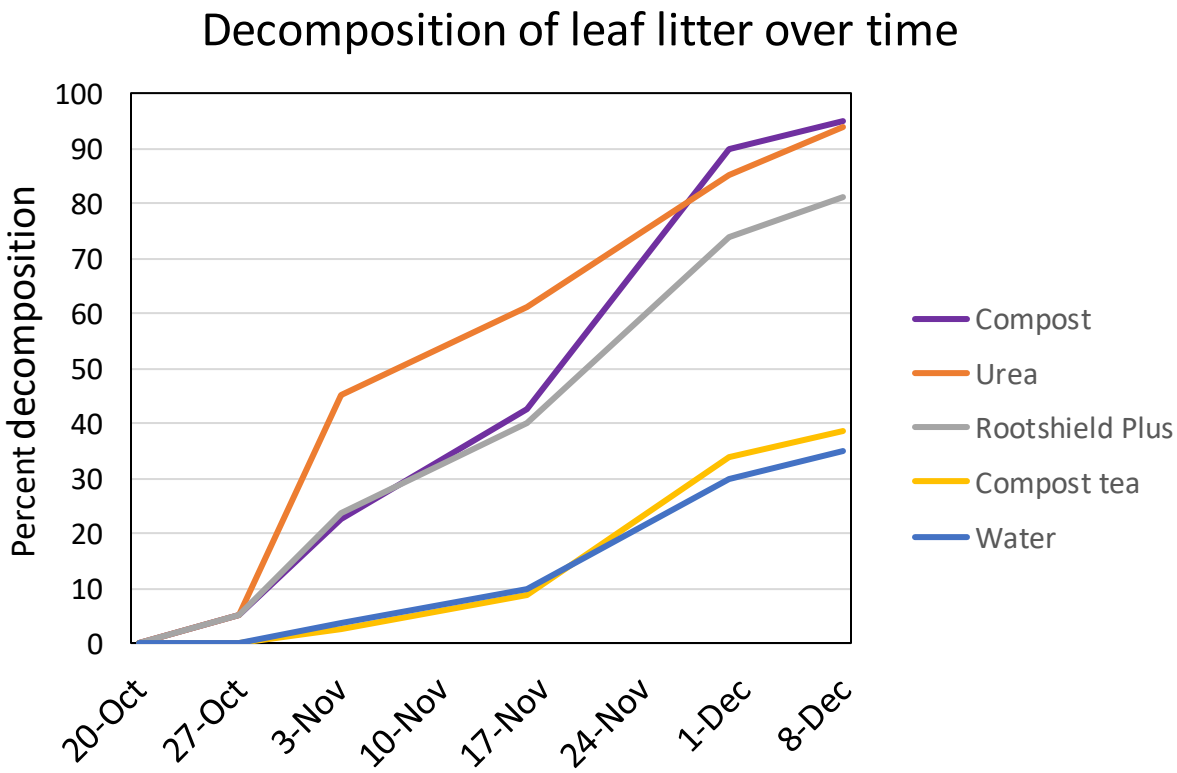

Figure 3. Decompostion of leaf litter

2) *Assess the efficacy of leaf removal in reducing downy and powdery mildew disease pressure*

To provide further proof of the efficacy of leaf treatments on the reduction of disease as a viable way to control disease, a leaf removal trial is being conducted in a vineyard with powdery and downy mildew pressure to determine the effects of inoculum removal. In October 2017, leaves were completely removed from 10 foot sections of a vineyard and replicated 4 times (Figure 4). In similar sections of the vineyard, the leaves were left undisturbed. The treatments (leaf removal vs. no leaf removal) will be rated for powdery mildew and downy mildew onset and disease pressure every 2 weeks starting in late spring through summer of 2018. It is expected that removal of leaves should reduce both disease onset and disease pressure. This would provide further proof that leaf treatments (as tested in objective 1) that speed up leaf decomposition will reduce disease.

Figure 4. Leaf removal

Communication Activities, Accomplishments, and Impacts

Understanding the utility of biological control agents for controlling disease through inactivating overwintering inoculum and also understanding the utility of ground sprays on speedy decomposition and inactivation of downy mildew inoculum in leaf litter could help growers manage disease in an environmentally friendly manner. When results of these experiments are finalized, they will be communicated to the growers in extension talks. Demonstration plots will also be conducted to demonstrate proof of concept and real world control.

Research publications resulting from this project

No research publications have been completed at this time.

Funding partnerships

There were no funding partnerships associated with this grant.