Onion Research and Development Program
2022-2023 Proposal

Funding Period April 1, 2022-March 31, 2023

Project Title:
Screening Biofungicides with Novel Modes of Action for Activity on Stemphylium Leaf Blight

Principal Investigator:
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Regional Vegetable Specialist
Cornell Cooperative Extension Eastern New York Commercial Horticulture Program
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eg572@cornell.edu

Amount Requested: $5,539
Project Summary:
Stemphylium leaf blight (SLB), caused by the fungal pathogen *Stemphylium vesicarium*, has become the most significant foliar disease of onions in New York state. Premature leaf necrosis caused by the disease can result in a reduction in both onion yield and bulb quality as onions “dying standing up” are more susceptible to bacterial bulb rots. Cornell Plant Pathologist Dr. Frank Hay has screened multiple isolates submitted from Orange County, NY and found that the population of *Stemphylium vesicarium* present in the region has already mutated to develop resistance to multiple fungicide groups (FRAC groups). Fungicides that used to provide effective suppression of the disease, such as Luna Tranquility, Scala, Rovral, and Quadris, are no longer effective tools for managing SLB in Orange County. While FRAC 3 chemistries like Tilt and one of the active ingredients in both Quadris Top, Viathon, and Luna Experience are still providing acceptable levels of SLB control, onion growers need to identify fungicides in different FRAC groups to comply with resistance management label restrictions and in order to develop season-long spray programs. Statewide onion specialist Christy Hoepting has evaluated several biofungicide and biorational fungicides in Elba, NY for activity on SLB, but no formal trials have been conducted under the different environmental conditions in Orange County. Several biorational fungicides, such as Oso (Polyoxin D zinc salt) and Stargus (*Bacillus amyloliquefaciens* strain F727 cells and spent fermentation media) have shown potential to manage pathogens like *Alternaria brassicicola* that are similar to *Stemphylium vesicarium* in recent field trials conducted by Ethan Grundberg in the Hudson Valley of New York.

This proposal aims to screen seven biofungicides and biorational fungicides stacked on top of a “grower standard” fungicide program for activity on SLB. Ethan Grundberg, regional vegetable specialist with CCE ENYCHP, would apply the treatments on a seven- to ten-day interval beginning in late June on direct seeded ‘Red Carpet’ onions planted by Mark Rogowski of S & SO Produce Farms in Goshen, Orange County, NY. The proposed treatment list includes Stargus, Oso, Howler, PerCarb, Double Nickel LC, Sil-Matrix, and Carb-O-Nator in addition to the grower’s standard fungicide program without the addition of biofungicides or biorationals. Grundberg will collect SLB disease severity data from the trial with support from technician Sarah Tobin and will lead the analysis of all trial data. Results from the trial will be shared at Orange County Onion School in late February 2023 and in articles to appear in ENYCHP’s Produce Pages newsletter and the Cornell Vegetable Program newsletter Veg Edge. The outreach from this project should reach at least 650 growers and industry professionals with the potential to improve SLB management on all 7,500 acres of dry bulb onions grown in New York.

Organizational Capacity:
As a regional vegetable specialist of Cornell Cooperative Extension’s Eastern New York Commercial Horticulture Program (ENYCHP), Ethan Grundberg (MS ’09, International Agricultural Development, University of California, Davis) enjoys deep institutional support to conduct applied field research. Grundberg receives support from a full-time field technician, Sarah Tobin, who will assist with the data collection and trial maintenance required to complete the proposed work under Grundberg’s supervision. Since joining extension in August 2016, Grundberg has worked with Dr. Steve Beer in coordinating and collecting data from his sodium hypochlorite trials in Orange County, collaborated with Dr. Brian Nault on preliminary insecticide efficacy evaluations for allium leafminer management, served as PI on the 2018 ORDP-funded research on biostimulants and biofungicides used as pre-plant dips on transplanted onions, and acted as PI on two Northeast SARE Partnership Grants and a USDA AMS Specialty Crop Block Grant. Grundberg also benefits from the grants administration support offered by Cornell University’s Office of Sponsored Programs as a Cornell University employee.
Objective 1:
To screen seven biofungicides and biorational fungicides stacked on top of a “grower standard” fungicide program for activity on SLB.

Task 1.1
Design and Execute the Field Trial
The proposed trial will be located at S & SO Produce Farm in Goshen, New York in a commercial planting of direct seeded ‘Red Carpet’ red bulb onions. Mark Rogowski will be responsible for field establishment and plot maintenance until early June 2022. A trial plot 4 beds wide by 180 bed feet long will be flagged off within the field and divided into a Randomized Complete Block Design (RCBD) with 4 replications and 8 treatments, each 20 bed feet in length with a 5 bed foot buffer between treatment plots. Grundberg will be responsible for applying the experimental fungicides to the trial plots on a 7- to 10-day schedule using a CO2-powered research boom sprayer with 4 twin turbojet nozzles spaced 17.5-inches apart and calibrated to apply approximately 40 gallons per acre of tank mixed solution. The 8 proposed treatments are described in the table below. The “grower standard” program will be developed in cooperation with Mark Rogowski and will follow currently proposed programs developed by Christy Hoepting, Dr. Frank Hay, and Grundberg. The 7 other experimental treatments will be stacked on top of the “grower standard” program.

<table>
<thead>
<tr>
<th>Treatment</th>
<th>Fungicide</th>
<th>Active Ingredient</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>Untreated Control</td>
<td>N/A</td>
</tr>
<tr>
<td>B</td>
<td>Stargus</td>
<td>Bacillus amyloliquefaciens strain F727 cells and spent fermentation media</td>
</tr>
<tr>
<td>C</td>
<td>Oso</td>
<td>Polyoxin D zinc salt</td>
</tr>
<tr>
<td>D</td>
<td>Howler</td>
<td>Pseudomonas chlororaphis strain AFS009</td>
</tr>
<tr>
<td>E</td>
<td>PerCarb</td>
<td>Sodium Carbonate Peroxyhydrate</td>
</tr>
<tr>
<td>F</td>
<td>Double Nickel LC</td>
<td>Bacillus amyloliquefaciens strain D747</td>
</tr>
<tr>
<td>G</td>
<td>Sil-Matrix</td>
<td>Potassium silicate</td>
</tr>
<tr>
<td>H</td>
<td>Carb-O-Nator</td>
<td>Potassium Bicarbonate</td>
</tr>
</tbody>
</table>

Performance Measure 1.1.1
Coordinate with Mark Rogowski regarding trial placement and the “grower standard” fungicide program details by April 15, 2022

Performance Measure 1.1.2
Apply experimental fungicide treatments beginning in late June through August 2022, or as needed based on crop development and disease severity.

Task 1.2
Collect Trial Data on SLB Severity and Crop Yield

Performance Measure 1.2.1
SLB stage and severity data will be collected twice during the growing season, once in late July and once in late August or at 50% lodging. Percent leaf dieback will also be estimated during each of the two evaluations. 10 randomly selected onions per plot will be inspected to generate this data.
Performance Measure 1.2.2
Collect crop yield data in late September 2022. Grundberg will coordinate with Mark Rogowski to determine when the field will be mechanically harvested. One week prior to field harvest, 100 randomly selected bulbs per plot will be hand harvested and topped in the field for evaluation. Each bulb will be weighed using a precision Ohaus balance.

Task 1.3
Analyze the Data to Generate Trial Results
SLB data will be analyzed in several ways. First, percent green foliage and percent dying standing up by plot will be analyzed using a one-way ANOVA with \( p = 0.05 \), followed by comparison by Tukey’s HSD if the treatment effect is statistically significant. SLB severity, stage, and percent leaf dieback data will be converted to a 100-point scale each and summed to calculate a SLB index rating. The SLB index will then be analyzed using a one-way ANOVA with \( p = 0.05 \), followed by comparison by Tukey’s HSD if the treatment effect is statistically significant. Yield data will be analyzed similarly using a one-way ANOVA with \( p = 0.05 \), followed by comparison by Tukey’s HSD if the treatment effect is statistically significant.

Performance Measure 1.3.1
Complete analysis of yield data by November 2022

Performance Measure 1.3.2
Complete analysis of SLB severity data by December 2022

Task 1.4
Disseminate Trial Results to NY Onion Growers and Industry Representatives
Once the statistical analyses have been completed, the results will be prepared for dissemination using three primary approaches. First, results will be prepared to share with growers during in-person (or virtual depending upon COVID restrictions) grower meetings, specifically the Orange County Onion School (approximately 55 attendees). Second, results will be used to draft a newsletter article that will be included in both the Cornell Vegetable Program’s VegEdge publication (approximately 600 recipients) and the Eastern New York Commercial Horticulture Program’s Produce Pages (approximately 450 recipients) during the winter of 2022-23. Finally, Grundberg will complete a progress report to be shared with the members of the ORDP board in December 2022.

Performance Measure 1.4.1
Prepare and deliver a presentation of the trial results at Orange County Onion School in February 2023

Performance Measure 1.4.2
Draft and publish a newsletter article in Veg Edge and Produce Pages summarizing the trial results by February 2023

Performance Measure 1.4.3
Draft and submit progress report to ORDP board in December 2022

Outcome and Benefits Expected:
Objective 1: The proposed research is expected to generate two primary outcomes and benefits to onion growers in New York. First, this trial is expected to inform and potentially improve SLB
management in muck grown onion production. As described in the project summary, the development of *Stemphylium vesicarium* resistance to multiple FRAC groups has made disease management a significant challenge for New York onion growers. It is hoped that the proposed work can help to identify new and novel modes of action with some activity on SLB to help preserve the remaining FRAC 3 fungicides with demonstrated activity on the pathogen. Second, the research should help growers make more informed decisions about the cost-effectiveness of including commonly incorporated biofungicides like Double Nickel into a spray program, thereby improving the economic viability of New York onion farms.

**Research Experience Relevant to the Proposal:**
Ethan Grundberg (MS ’09, International Agricultural Development, University of California, Davis) has served as PI on several research trials relevant to the proposal since joining extension in August 2016. He recently completed a 2-year USDA Specialty Crop Block Grant to adapt reduced tillage vine crop systems to muck soils in 2020 with the primary goal of reducing weed pressure and reliance on post-emergent Sandea applications while improving crop quality. Grundberg is also the PI on a Northeast SARE partnership grant investigating organic management tactics for the new invasive allium leafminer. Grundberg has previously conducted two years of trials evaluating adjuvant efficacy on onion thrips and Stemphylium Leaf Blight severity in dry bulb onions with support of the Orange County Vegetable Growers Association in 2019 and the Onion Research and Development Program in 2020 and was the PI on a 2018 ORDP-funded trial to evaluate using biostimulants and biofungicides as pre-plant dips to mitigate pink root in transplanted onions. More recently, Grundberg has completed two out of three years of research trials evaluating biorational fungicides and biofungicides for managing alternaria leaf spot and head rot of broccoli in the Hudson Valley.
Budget: –

<table>
<thead>
<tr>
<th>POSITION TITLE (Exempt)</th>
<th>ANNUALIZED SALARY PER POSITION</th>
<th>PERCENT OF EFFORT FUNDED</th>
<th>TOTAL</th>
</tr>
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<tbody>
<tr>
<td>Extension Associate, Unbanded 11154 (Grundberg Program)</td>
<td>$69,583.20</td>
<td>400%</td>
<td>$2,783.00</td>
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<table>
<thead>
<tr>
<th>POSITION TITLE (non-Exempt)</th>
<th>HOURLY PAY RATE PER POSITION</th>
<th>STANDARD WORK HOURS PER WEEK</th>
<th>NUMBER OF WEEKS FUNDED</th>
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<tbody>
<tr>
<td>Technician I, Band A 10952 (Grundberg Program)</td>
<td>$16.50</td>
<td>36</td>
<td>2</td>
<td>$965.00</td>
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**TOTAL SALARY**

SALARY TOTAL $3,748.00

<table>
<thead>
<tr>
<th>OPERATING EXPENSES - TYPE/DESCRIPTION</th>
<th>TOTAL</th>
</tr>
</thead>
<tbody>
<tr>
<td>Materials &amp; Supplies - Field and lab supplies</td>
<td>$500.00</td>
</tr>
<tr>
<td>Services:</td>
<td></td>
</tr>
<tr>
<td>Cornell Fleet Vehicle Rental Services 10 trips x $12.36/day=$123.60, 1150 miles x $0.29/mile = $322</td>
<td>$446.00</td>
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OPERATING EXPENSES - TOTAL $946.00

<table>
<thead>
<tr>
<th>OTHER EXPENSES - TYPE/DESCRIPTION</th>
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</thead>
<tbody>
<tr>
<td>Indirect Costs - Direct Costs x 18%</td>
<td>$845.00</td>
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OTHER EXPENSES - TOTAL $845.00

Objective 1: $5,539

**Budget Justification:**

**Salary and Wages:** $3,748

Extension Associate (Grundberg Program)- These funds will be used to support trial design, treatment application, data collection, data analysis, and outreach.

Technical Support (Grundberg Program)- These funds will be used to support plot layout, data collection, and data visualization efforts in support of outreach efforts.

**Operating Expenses:** $946

Materials and Supplies- Requested for field supplies including personal protective equipment, CO2 canisters and other replacement parts for the research sprayer, field stakes and flags, topping shears and harvest supplies, and adjuvants and pesticides not donated by industry.

Cornell Fleet Vehicle Rental Services- Travel to plot sites for treatment applications, data collection, data analysis, and outreach.

**Other Expenses:** $845

18% Indirect Costs- $845