



**2019 SPECIALTY CROP BLOCK GRANT  
APPLICATION FORM  
USDA SCB COMPETITIVE GRANT  
MICHIGAN DEPARTMENT OF AGRICULTURE & RURAL  
DEVELOPMENT**

**PROJECT TITLE**

Leaf Blight Decreases Michigan Onion Yields and May Increase Bulb Rot: New Approaches Are Needed

**DURATION OF PROJECT**

**Start Date:** 10/1/2019 **End Date:** 8/30/2021

**PROJECT PARTNER AND SUMMARY**

Leaf blight, caused by *Stemphylium vesicarium*, has emerged as a critical issue for Michigan onion producers. In 2017 and 2018, onion growers struggled to control this disease despite close adherence to management recommendations. Recent field trials show that strobilurin fungicides are no longer working; these products had been a cornerstone of fungicide control programs. This finding that this important group of fungicides is not able to protect the onion foliage leaves the industry vulnerable to destructive leaf blight. Only a couple of newer fungicides are effective but are cost-prohibitive. In addition, these high-cost fungicides can only be used 2-3 times (per the label) over the course of the relatively long growing season. Growers are concerned that severe foliar blight in the field results in increased bacterial bulb rot during storage. In this proposal, the Michigan Onion Committee aims to mitigate the impact of *Stemphylium* leaf blight by 1) determining whether *Stemphylium* leaf blight renders the bulb more susceptible to bacterial bulb rot, 2) developing strategies that maximize fungicide applications, 3) testing a *Stemphylium* disease forecaster as a tool to time fungicide sprays, and 4) integrating novel research findings into grower practices.

**PROJECT PURPOSE**

PROVIDE THE SPECIFIC ISSUE, PROBLEM OR NEED THAT THE PROJECT WILL ADDRESS

Michigan ranks 7<sup>th</sup> in the U.S. for production of storage onions. In 2015, Michigan produced 88.7 million pounds of onions worth \$10 million dollars on 2,400 acres. Foliar and bulb rot diseases may be contributing to reduced productivity and profitability. The acres planted to onions in Michigan has dropped to nearly half of that planted in 2010 (4,200). Profitability is a key driver for Michigan's onion growers who seek enhanced and improved tools to limit the risk of destructive and costly foliar and bulb rot diseases.

Onions produced in Michigan are susceptible to several foliar diseases, including purple blotch (*Alternaria porri*), Botrytis leaf blight (*Botrytis* spp.), downy mildew (*Peronospora destructor*), and *Stemphylium* leaf blight (*Stemphylium vesicarium*) (Schwartz and Mohan 2008). *Stemphylium* used to be considered a minor disease in the state but in recent years has become an aggressive and annual challenge for onion producers.

Stemphylium leaf blight (SLB) is characterized by initially small white elongated lesions on the leaves that become sunken and purple in color with a light margin (Suheri and Price 2000). As the disease progresses, lesions coalesce resulting in larger blighted areas and eventually the leaves become brown and necrotic (Schwartz and Mohan 2008). Leaf blighting and premature death of the foliage reduce bulb yield due to the loss in photosynthetic area. Stemphylium infection is thought to increase bulb disease as a result of secondary pathogens that enter the bulb through the damaged tissues.

Stemphylium is difficult to control and effective fungicides are cost-prohibitive. Typically, fungicides are sprayed every 7-10 days, however, recent SLB outbreaks indicate that growers are not achieving an acceptable level of control, regardless of the number of fungicide applications. *A. porri* and *S. vesicarium* have commonly been found together in onion fields as a disease complex. Current recommendations include using fungicides that manage purple blotch (*A. porri*) to also control SLB (Schwartz and Mohan 2008); however, a recent report from New York found fungicides that are effectively managing *Alternaria* are not providing control of *Stemphylium* (Pethybridge et al. 2016).

The class of fungicides known as strobilurins were not effective in recent Michigan trials. This class represents a number of commonly used active ingredients including azoxystrobin (Quadris SC, Quadris Top SC), picoxystrobin (Approach SC), pyraclostrobin (Cabrio WG, Pristine WG), and trifloxystrobin (Luna Sensation SC). Of the 49 products registered for SLB control in onions, 21 of those products contain a strobilurin active ingredient. In addition to the strobilurins, famoxadone is also within the same FRAC (Fungicide Resistance Action Committee) code grouping and therefore, cannot be used with these products in a rotational program. Many of the remaining options for Stemphylium control in onion are limited to the same FRAC codes, further restricting fungicide rotations. Field trials conducted in 2018 have identified the most efficacious fungicides currently available to onion growers in Michigan. These include Omega SC, Luna Tranquility SC and Luna Experience SC. In addition, these products are subject to restrictions in the number of applications per year. For example, Luna Experience SC is limited to 2 applications per year (max. 25.6 fl oz/acre/year). Unfortunately, these products are often the most expensive/cost-prohibitive. Growers are also required to pay a premium for these products: Omega 500F \$60.70/acre; Luna Experience \$37.60/acre versus Bravo WeatherStik SC \$16.20/acre. It is of vital importance to growers to maximize the utility of these products to ensure these are dollars well spent.

Research is needed to determine the most effective timing to apply fungicides in onions, either based on weather-related events, or developmental crop stages. In this proposal, we will target three time periods within a fungicide rotational program to determine when the highly effective fungicides are most beneficial: early season prior to disease onset (3-4 leaf stage, 50-70 days post seedling (p.s.)); mid-season at disease onset or bulb initiation (8-12 leaf stage, 90-110 days p.s.); late season during bulb enlargement (130-150 days p.s.). By protecting the plants prior to disease onset, later epidemics could be delayed or limited as initial inoculum may be unable to overcome the treatments and successfully infect the plants. Timing applications at disease onset could eradicate the inoculum before it is able to take hold and proliferate, thus restricting or delaying the production of secondary inoculum. Delaying applications to bulb enlargement may enable what energy is available in the plant to be directed to the bulb, thus providing some yield protection. Tayviah (2017) found that high SLB incidence was correlated with high conidia concentrations which, in turn, were correlated with favorable weather conditions including warm temperatures ( $\geq 18^{\circ}\text{C}$ ) and prolonged leaf wetness periods ( $\geq 8$  hrs).

Disease management programs that reduce the total number of fungicide applications also reduce grower costs, potential residues on the produce, and risk of development of fungicide resistance in the pathogens. One way to reduce the number of necessary fungicide applications without compromising disease control is to use a disease forecaster that predicts potential outbreaks or increases in disease severity based on the weather (Campbell and Madden 1990). A disease forecaster, Tom-Cast, has been used to effectively manage foliar diseases in Michigan while limiting the number of fungicide applications in important crops including asparagus (Meyer et al. 2000) and carrot (Bounds et al. 2007). Tom-Cast is derived from the disease forecasting system (FAST) originally developed to help time fungicide sprays for *Alternaria solani* on tomato (Madden et al. 1978). The Tom-Cast program uses the duration of leaf wetness and the average air temperature during the wetness period for each 24-hour period to determine a disease severity value (DSV) of 0 to 4 corresponding to an environment unfavorable to highly favorable for disease development, respectively (Pitblado 1992). Once a DSV threshold has been reached, a fungicide application is triggered. MSU field trials indicated that Tom-Cast was an effective tool in managing foliar blight in carrots (Bounds et al. 2007) and permitted a 60% reduction in the number of sprays compared to the standard spray program without sacrificing disease control. In addition, Tom-Cast has been field tested against *S. vesicarium* in asparagus in Michigan and was found to reduce the number of fungicide applications up to 50% without increased risk of yield or quality loss (Meyer et al., 2000).

PROVIDE A LISTING OF THE OBJECTIVES THAT THIS PROJECT HOPES TO ACHIEVE

- Objective 1:** Determine whether Stemphylium leaf blight renders the bulb more susceptible to bacterial bulb rot.
- Objective 2:** Develop strategies that maximize fungicide applications.
- Objective 3:** Test a Stemphylium disease forecaster as a tool to time fungicide sprays.
- Objective 4:** Integrate novel research findings into grower practices.

PROJECT BENEFICIARIES

**Estimate the number of project beneficiaries:** 40 Enter the Number of Beneficiaries

**Does this project directly benefit socially disadvantaged farmers as defined in the RFA?**  
 Yes  No

**Does this project directly benefit beginning farmers as defined in the RFA?**  
 Yes  No

CONTINUATION PROJECT INFORMATION

DESCRIBE HOW THIS PROJECT WILL DIFFER FROM AND BUILD ON THE PREVIOUS EFFORTS

This project builds upon a previous proposal “Assessing the role of onion thrips and nutrients in bacterial leaf blight in Michigan onions” (MI Onion Comm/MDARD SCBG 791N7700192), focusing on bacterial foliar diseases in that bacterial diseases will be investigated in this proposal, but as secondary bulb and not foliar pathogens. This project will focus on research and management of Stemphylium leaf blight, an increasing concern for onion growers.

PROVIDE A SUMMARY (3 TO 5 SENTENCES) OF THE OUTCOMES OF THE PREVIOUS EFFORTS. PROVIDE LESSONS LEARNED ON POTENTIAL PROJECT IMPROVEMENTS

**What was previously learned from implementing this project, including potential improvements?**

The previous project confirmed that bacterial leaf blight disease severity increased in the field as thrips populations increased. In addition, using insecticides to control thrips populations can significantly reduce foliar disease severity caused by the bacterial leaf blight pathogen *Pantoea agglomerans*. This project clearly defined the foliar symptoms associated with a bacterial pathogen. Through the effective management of onion thrips, the overall threat from the bacterial foliar blight has lessened.

**How are the lessons learned and improvements being incorporated into the project to make the ongoing project more effective and successful at meeting goals and outcomes?**

Through the previous project, we established good relationships with onion grower cooperators for our in-field, on-site research plots. This lays the groundwork for the work proposed in this project.

DESCRIBE THE LIKELIHOOD OF THE PROJECT BECOMING SELF-SUSTAINING AND NOT INDEFINITELY DEPENDENT ON GRANT FUNDS

This project is designed to become self-sustaining by engaging industry scouts, consultants, extension educators, grower cooperators, industry representatives, and all growers attending our educational programs. The information transfer will occur at every stage of this project so that the grower industry can make the needed changes immediately and not require additional time via granting programs. Further, we have experience in developing similar technology for other crops/grower groups that has been successfully “handed-off” and continues to be used without additional resources and input from grants. In the event that there are ongoing issues following the end of this project, any additional follow-up work that may be needed can be supported directly by the Michigan onion industry rather than through the Michigan Block Grant program.

**EXPECTED MEASURABLE OUTCOMES**

OUTCOME MEASURE(S)

- x **Outcome 4:** Enhance the competitiveness of specialty crops through greater capacity of sustainable practices of specialty crop production resulting in increased yield, reduced inputs, increased efficiency, increased economic return, and/or conservation of resources
- x **Outcome 5:** Enhance the competitiveness of specialty crops through more sustainable, diverse, and resilient specialty crop systems

OUTCOME INDICATOR(S)

- **Outcome 4, Indicator 2a.** Number of growers/producers indicating adoption of recommended practices \_\_\_20\_\_\_
- **Outcome 4, Indicator 2b.** Number of growers/producers reporting reduction in pesticides, fertilizer, water used/acre \_\_\_20\_\_\_
- **Outcome 4, Indicator 2c.** Number of producers reporting increased dollar returns per acre or reduced costs per acre \_\_\_20\_\_\_
- **Outcome 5, Indicator 1.** Number of new or improved innovation models (biological, economic, business, management, etc.), technologies, networks, products, processes, etc. developed for specialty crop entities including producers, processors, distributors, etc. \_\_\_1\_\_\_
- **Outcome 5, Indicator 2.** Number of innovations adopted \_\_\_1\_\_\_
- **Outcome 5, Indicator 7.** Number of viable technologies/processes developed or modified that will increase specialty crop distribution and/or production \_\_\_1\_\_\_

- **Outcome 5, Indicator 8.** Number of growers/producers that gained knowledge about science-based tools through outreach and education programs \_\_20\_\_

DATA COLLECTION TO REPORT ON OUTCOMES AND INDICATORS

We will conduct surveys at Great Lakes Expo and winter meetings as well as in-person interviews with onion growers to acquire the data for outcome indicators.

**WORK PLAN**

<b>Project Activity</b>	<b>Who</b>	<b>Timeline (Month/Year)</b>
Project planning and discussion with key growers.	Hausbeck	Dec 2019, Dec 2020
Single-product fungicide field studies will be conducted. Plots will be established in a commercial production onion field in a randomized complete block design with four replications for each treatment and maintained according to commercial production standards. Plots will be treated with registered and unregistered fungicides and biocontrol products every 7 to 10 days. An untreated control will also be included. Treatment sprays will be initiated immediately following the first disease symptoms. Disease severity will be evaluated throughout the growing season. At harvest, onions from treatments representing foliar disease levels varying from low to high severity will be stored according to commercial storage standards, in collaboration with a grower-cooperator. Following storage, onions will be evaluated for bulb diseases, yield and quality.	Cook, student laborer	May-Nov 2020 May-Aug 2021
Analyze data, write reports.	Hausbeck	Sep-Dec 2020, Aug 2021
Field trials conducted in 2018 have identified the most efficacious fungicides currently available to onion growers in Michigan. These include Omega SC, Luna Tranquility SC and Luna Experience SC. These products are very cost-prohibitive with a limited number of applications allowed per year based on the label. A field study will be conducted to investigate the timing of applying these highly efficacious products within an overall fungicide program to limit Stemphylium leaf blight. Plots will be established in a commercial production onion field in a randomized complete block design with four replications for each treatment and maintained according to commercial production standards. Three fungicide programs will be tested to determine when the highly effective (and most effective) fungicides are	Cook, student laborer	May-Oct 2020 May-Aug 2021

<p>most beneficial: 1) early season application prior to disease onset (3-4 leaf stage, 50-70 days post seedling); 2) mid-season application at disease onset or bulb initiation (8-12 leaf stage, 90-110 days p.s.); 3) late season during bulb enlargement (130-150 days p.s). Foliar disease severity will be visually assessed weekly. Bulbs will be harvested at the end of the season, weighed and graded for size.</p>		
<p>Analyze data, write reports.</p>	<p>Hausbeck</p>	<p>Sep-Dec 2020, Aug 2021</p>
<p>The Tom-Cast forecasting system will be used to develop recommendations for timing fungicide spray applications using a rotational fungicide program following current recommended practices. The disease forecaster will be tested and compared in two commercial onion fields. Each program will be applied using the following intervals: 1) 7 days, 2) 10 days, 3) 14 days, 4) according to TOM-CAST with a threshold of 15 disease severity values (DSVs), 5) according to TOM-CAST with a threshold of 20 DSVs, and 6) control (no sprays). Calendar-based sprays and accumulation of DSVs will begin once disease is detected in the field. TOM-CAST utilizes the duration of leaf wetness and average air temperature during the wetness period to calculate a DSV of 0 to 4, corresponding to conditions unfavorable to highly favorable for disease development (Pitblado, 1992). Weather recording instruments in the field will provide hourly records of temperature, rainfall, relative humidity, and leaf wetness. Foliar disease severity will be visually assessed weekly at each site. Bulbs will be harvested at the end of the season, weighed and graded for size.</p>	<p>Cook, student laborer</p>	<p>May-Oct 2020 May-Aug 2021</p>
<p>Analyze data, write reports.</p>	<p>Hausbeck</p>	<p>Sep-Dec 2020, Aug 2021</p>
<p>Research results and management recommendations will be disseminated to growers through extension publications (online and print) and presentations at field days and grower meetings. Presentation attendance and grower surveys distributed during sessions at the annual Great Lakes Fruit, Vegetable, and Farm Market Expo in December 2020 and Onion Twilight Meeting in August 2020/2021 will be used to collect data on the number of growers reached by the research, gaining new knowledge on the topics, adopting recommended practices, and report input reductions or other production or economic benefits</p>	<p>Hausbeck</p>	<p>Aug 2020, 2021 Dec 2020</p>

