

Project GREEN

2016 Legislative Summary



AgBioResearch
MICHIGAN STATE UNIVERSITY



Extension
MICHIGAN STATE UNIVERSITY

MESSAGE FROM THE COORDINATOR

This summer's outbreak of spotted wing drosophila (SWD) was a serious concern for fruit growers throughout Michigan. Fortunately, the agriculture industry was better prepared than it would have been just a few years ago, thanks in large part to MSU research and Extension activities funded by Project GREEN. The invasive insect from Asia is one of many industry concerns that GREEN continues to address in timely and relevant ways.

In this year's report, we showcase some of the ongoing work and impacts of Project GREEN – the plant-based research endeavor that began nearly two decades ago – including a feature on SWD. MSU scientists at research facilities throughout the state, including Traverse City and Fennville, continue to test several integrated pest management strategies for SWD management with some promising results.

The unique Project GREEN partnership between MSU, the Michigan Department of Agriculture and Rural Development, the plant-based commodity organizations and others, with funding support from the state, has served as the model for the formation of other similar groups – most recently, the Michigan Alliance for Animal Agriculture (M-AAA).

I'd like to thank all of our partners and the Michigan legislature for their continued support of programs such as Project GREEN and M-AAA. These partnerships allow MSU to tackle emerging issues and help farmers face day-to-day threats.

It's wonderful to see MSU build on its strong research history,

most recently with the announcement of the new MSU Plant Resilience Institute. The institute will conduct fundamental research to identify mechanisms that contribute to plant resilience and enhance plant productivity. The work will also focus on understanding how plants cope with environmental conditions associated with climate change.



DOUG BUHLER

Estimates indicate that agricultural production must nearly double by 2050 to feed the world's growing population. Add the impacts of climate change and the growing scarcity of land and water, and you have one of the world's greatest challenges.

From fields, orchards and vineyards to world-class growth chambers that enable scientists to simulate environmental conditions associated with climate change to state-of-the-art genomics instrumentation, MSU's investment in infrastructure has created a plant science research community that is among the best in the world. Go GREEN!

Doug Buhler
Program Coordinator, Project GREEN
Director, MSU AgBioResearch

DIRECTORS' ACTION TEAM

The Directors' Action Team is the decision-making body that establishes goals and strategic action plans for Project GREEN.

DOUG BUHLER
MSU AgBioResearch

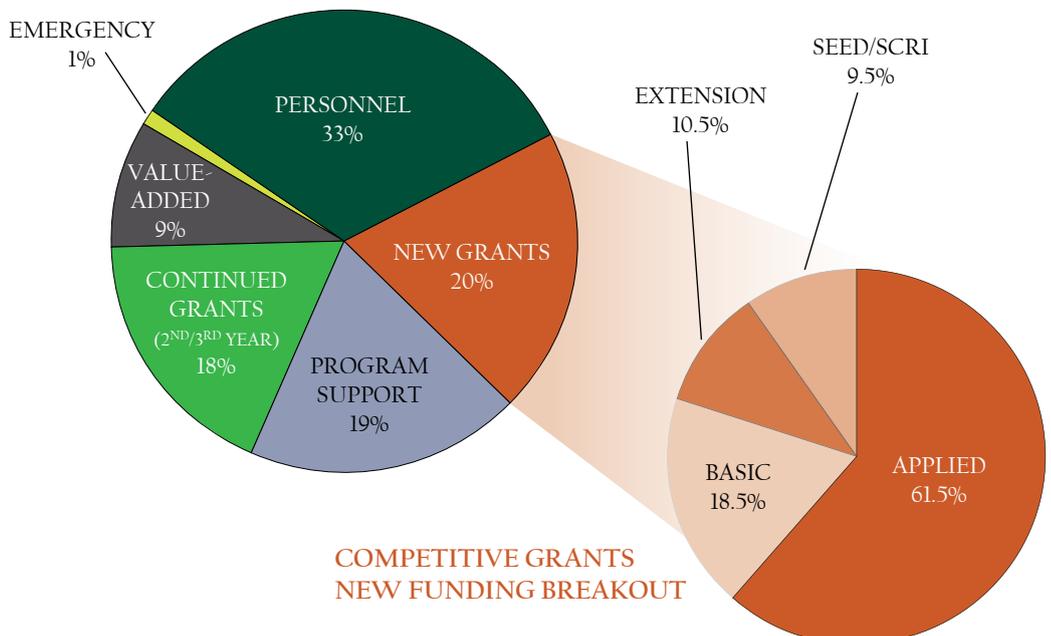
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FINANCE AND OPERATIONS



COMPETITIVE GRANT SUMMARIES

Competitive grants are the foundation of Project GREEN. Michigan State University, the Michigan Department of Agriculture and Rural Development, and Michigan plant commodity organizations work together to ensure that Project GREEN research aligns with industry priorities and scientists respond to the changing needs of plant agriculture in Michigan.



GOSS'S WILT OF CORN: ANALYSIS OF EPIPHYTIC GROWTH ON CORN LEAVES AND SYSTEMIC INVASION OF *CLAVIBACTER MICHIGANENSIS* SUBS. *NEBRASKENSIS*

GEORGE SUNDIN

Awarded: \$79,800 Leveraged: \$90,000

Goss's wilt is a devastating bacterial disease of corn caused by the pathogen *Clavibacter michiganensis* subsp. *nebraskensis* (Cm subsp. *nebraskensis*). This disease was first discovered in Nebraska in 1969, and through the 1970s and 1980s was restricted to Nebraska, Colorado, Kansas, Iowa, South Dakota, Minnesota, Wisconsin, and Illinois. However, since 2006, Goss's wilt has begun spreading out of this eight-state area and the range of this disease has expanded to Oklahoma, Texas, Wyoming, Louisiana, Indiana, Michigan and also into Canada. The best method of control for this disease is through using resistant corn hybrids, and this research provides virulence traits suitable for study in assessing differences in and resistance potential among hybrids.

BUILDING POLLINATOR-SUPPORTIVE LANDSCAPES FOR MICHIGAN'S DIVERSE AGRICULTURE

DOUGLAS LANDIS

Awarded: \$79,100 Leveraged: \$199,638

Insect pollination is critical to production of many of Michigan's fruit and vegetable crops. Producers of pollination-dependent crops typically rent hives of the European honey bee from commercial beekeepers to supplement the activity of native pollinators. However, both honey bee and wild pollinator communities are in decline, and the potential for loss of pollination services is of concern. Objectives were to screen pollinator-supportive plants for dry soils, develop methods for reliable establishment of pollinator-supportive plants on dry soils, and test the effects of dry soil plant mixtures on pollinator communities on fruit farms. Researchers established three common garden trials on sandy soils, at the Southwest Michigan Research and Extension Center, the Clarksville Research Center, and the Northwest Michigan Horticultural Research Center. Researchers identified 12 species of perennial plants for dry soil sites that in combination, provide season-long floral resources and are consistently attractive to pollinators and natural enemies. Native plant producers are including these species in pollinator mixes and experiencing increased demand for these plants.

POTATO LATE BLIGHT: HOST/PATHOGEN INTERACTIONS AND MANAGEMENT OF INVASIVE AND ESTABLISHED GENOTYPES OF *PHYTOPHTHORA INFESTANS*

WILLIAM KIRK & NOAH ROSENZWEIG

Awarded: \$79,644 Leveraged: \$30,000

The sudden appearance of a new genotype of *Phytophthora infestans* in 2009 devastated tomato production in the eastern U.S. Potato late blight is a significant global constraint to potato production and due to climatic conditions and growing practices in the upper Midwest make potato production particularly vulnerable. Objectives were to breed improved cultivars for the industry that have foliar and tuber resistance to late blight using a combination of conventional breeding, marker-assisted strategies and transgenic approaches. The release of cultivars with resistance to foliar and tuber blight will be of great economic benefit to the industry and to the environment and reduces the risk of threats to food security.

SOLVING THE CHALLENGES TO ORGANIC RASPBERRY PRODUCTION

ERIC HANSON

Awarded: \$56,600 Leveraged: \$972,526
(Directly and Indirectly)

High tunnels are lower cost greenhouse-like structures that are increasingly popular for raspberry production because they provide a means of increasing yields, extending harvest seasons and reducing fungal diseases and damage from some insect pests. Profits from organic production under tunnels can be higher than for field-grown raspberries because of improved yields, berry quality and disease control. A critical challenge that limits the efficacy of high tunnel culture for organic raspberries is the invasive insect, spotted wing drosophila (SWD). Organic control is very difficult since approved insecticides provide only marginal control at best. However, harvest frequency may affect SWD infestation levels. Frequent harvesting may be less efficient, but costs may be offset by higher marketable yields. Approaches used in this research can help manage this invasive pest, while reducing insecticide use by 50% or more.

GROWING HIGH-VALUE PROPAGULES UNDER LED LIGHTING

ERIK RUNKLE

Awarded: \$69,500 Leveraged: \$73,940

Michigan is the largest producer of propagative floriculture materials in the United States, with wholesale sales in 2015 of \$83 million. Most of these are seedlings, rooted liners and tissue culture propagules of annual bedding or herbaceous perennial plants that are intensively and commercially grown in controlled greenhouse environments from December through April. During this time, light intensity is a limiting factor and a substantial amount of energy is consumed to keep greenhouses warm. Therefore, high-intensity lighting and heating are significant greenhouse production expenses. Researchers identified the benefits of introducing far red and white light to a conventional LED spectrum to improve quality attributes of high-value propagules, including increased biomass, regulation of extension growth, earlier flowering, and creation of a more pleasant environment for workers. Researchers estimate that growing high-value propagules under LED lighting can reduce production costs by as much as 25 to 40 percent, but the actual values are dependent upon the situation.

COMPETITIVE GRANT SUMMARIES CONTINUED...

VEGETABLE UPTAKE OF PHARMACEUTICALS FROM SOIL AND WATER

HUI LI

Awarded: \$69,900 Leveraged: \$474,948

Consumption of pharmaceutical-tainted fresh produce, particularly eating raw vegetables, represents a direct route of human exposure to pharmaceuticals. The sources of pharmaceuticals in vegetables can be tracked to contaminated agricultural lands and irrigation water. The overarching objective was to elucidate the mechanism of vegetable uptake and accumulation of pharmaceuticals from water. Researchers measured uptake and accumulation of 15 target pharmaceuticals in lettuce roots. These studies demonstrate the ability to quantify the distribution and accumulation of certain pharmaceutical chemicals in vegetables, and provide some interesting mechanistic insight into the primary determinants of such distributions. However, much work remains to gain a comprehensive mechanistic understanding of pharmaceutical uptake by vegetable crops. The project has also received funding from the United States Department of Agriculture’s National Institute of Food and Agriculture.

INCREASING CELERY YIELDS BEGINS IN THE GREENHOUSE WITH HEALTHY TRANSPLANTS

MARY HAUSBECK

Awarded: \$50,000 Leveraged: \$10,000

Michigan ranks as the No. 2 producer of celery in the U.S., an industry valued at \$18.9 million. Celery growers must deal with new (anthracnose) and old (crown and root rot) diseases. These diseases can attack celery seedlings during greenhouse production and can occur in the field causing severe production losses. Objectives were greenhouse scouting and pathogen diagnosis, identifying effective reduced-risk fungicides and/or biocontrol agents, providing data to registrants of key products, and implementing greenhouse disease management strategies. This project identified an effective biocontrol product that celery greenhouse growers can use immediately to protect their plants and ensure that only healthy plants are used to establish their production fields. A root rot pathogen previously unreported in Michigan that can negatively impact yield was detected in celery greenhouse seedlings destined for field production. Other root rot pathogens were also detected over the course of this study. Root rot disease was limited by a biocontrol product tested during this study that is labeled for use in the greenhouse to protect the yields in the field.

For a complete list of competitive grant summaries, visit green.msu.edu.

ACADEMIC INFRASTRUCTURE REPORTS AND PROGRAM SUMMARIES

ENVIRO-WEATHER

To assist Michigan producers with pest, plant production and natural resource management decisions, Enviro-weather provides weather data from a network of stations located throughout the state. Enviro-weather data are shared with other weather groups across the region and are also used in college and university classrooms to teach students about topics such as weather, agriculture and pest management.

Enviro-weather also serves the National Weather Service Forecast Office in Grand Rapids, which collects its data for short-term weather monitoring and forecasting. Since the creation of the Enviro-weather program, data requests have grown from 96 on average per day to more than 600 in 2015. Peak usage rates can reach as high as 2,000 accesses per day during growing seasons.

Project GREEN funds supported:

- Upgraded 16 Enviro-weather stations with new loggers and sensors in 2015-16.
- Additional operational upgrades including strategic network and system modernization, as well as routine weather network maintenance. Most of the Enviro-weather servers have now been relocated to a central IT facility on MSU’s main campus. The servers that have been relocated are now kept in a much better, more climate-controlled environment. Upgraded software and tools also will improve disaster-recovery plans.
- Two new stations were added to the Enviro-weather network: Deerfield in September 2015 and Elbridge/Hart in May 2016.

“Project GREEN funding is essential to the Enviro-weather program,” said Jeff Andresen, the codirector of Enviro-weather and state climatologist for Michigan. “Upgrading our capacity to deliver data to growers allows us to help them even further in the decision-making process by reducing weather-related risk and allowing them to use their resources efficiently.”



Enviro-weather
Co-director
Jeff Andresen

For a complete list of academic infrastructure reports and program summaries, visit green.msu.edu.

SPOTTED WING DROSOPHILA THREAT LOOMING LARGE



MSU's Nikki Rothwell (left) and Emily Pochubay examine spotted wing drosophila larvae caught in traps.

Michigan's cherry industry is valued at nearly \$100 million, ranking No. 1 in the U.S. in tart cherry production and close to the top for sweet cherries. Michigan State University (MSU) cherry research spans the Great Lakes State, including at the Northwest Michigan Horticultural Research Center (NWMHRC) in Traverse City and the Trevor Nichols Research Center (TNRC) in Fennville.

Nikki Rothwell, the center coordinator for NWMHRC and an extension specialist, has used these two locations in particular to conduct a series of pesticide efficacy trials for spotted wing drosophila (SWD). The small fly is an invasive pest from Asia and is ravaging fruit crops across the country. Soft skin on both tart and sweet cherries makes them particularly vulnerable to SWD, but there was little concern until recently.

"Once SWD was found in Michigan

(in 2010), we started to monitor the situation for cherries but weren't extremely worried," Rothwell said. "We thought the cold winters would help, and cherry harvest was over before the SWD population got out of control late in the summer and into fall. That seemed to hold true until 2015."

Financial loss estimates to the cherry industry are unavailable for 2015, according to Rothwell, but the damage was vast. Many growers had fruit rejected at the processor, and some didn't bother trying to sell, she said.

Starting in 2013, funding from Project GREEN has helped Rothwell perform laboratory tests of several insecticides at NWMHRC and TNRC. She has found varying results thus far. After the cherry harvest Rothwell examines fruit still on the tree, which is susceptible to infestation.

Untreated fruit is collected as a control to determine the extent of SWD damage, while other fruit is treated with various insecticides. Some of the treated fruit is gathered after seven days and some after 14 days. Rothwell has seen promising results, but more research is needed.

In 2014 and 2015, SWD summits were held at NWMHRC with researchers and growers to discuss measures that can be taken. A plan was devised that would incorporate further insecticide trials and other management methods, such as removing mulberries and other

wild hosts near farms.

Rothwell is also analyzing the impact on tart cherry orchards from neighboring sweet cherries. She postulates that sweet cherries, which have experienced a large amount of drop in 2016 (falling to the ground), are creating the ideal scenario for tart cherry infestation. If growers see even one fly, she believes they should start their management program. Where there's one SWD, there are many more.

"We're fortunate that people in the cherry industry are early adopters of new integrated pest management strategies," Rothwell said. "2015 was the first big year for SWD in cherries in Michigan, and although it's still a substantial problem, we have a whole host of individuals working on finding appropriate answers.

"MSU is trying to stay out in front of this issue as much as possible. We have experts doing a lot of great work, of course, but we are also making ourselves available to address the growers' concerns. The continued partnership among universities, commodity groups and growers will be essential."

In addition to Project GREEN, Rothwell's work is funded by the Michigan Cherry Committee.

Learn more about MSU's work with SWD by visiting us online at agbioresearch.msu.edu and searching, "Tiny fly, big problem."



RECOGNIZING INDUSTRY PARTNERS

Our research is aided by organizations that identify critical agricultural issues. Project GREEN would not be possible without these valuable partners:

- Celery Research Inc.
- Corn Marketing Program of Michigan and the Michigan Corn Growers' Association
- Great Lakes Canola Association
- Growing U.P. Agricultural Association
- Hop Growers of Michigan
- Michigan Apple Committee
- Michigan Asparagus Research Inc.
- Michigan Bean Commission and Michigan Bean Shippers' Association
- Michigan Blueberry Advisory Council
- Michigan Carrot Committee
- Michigan Cherry Committee
- Michigan Christmas Tree Association
- Michigan Commercial Beekeepers Association
- Michigan Cranberry Council
- Michigan Crop Improvement Association
- Michigan Farm Bureau
- Michigan Floriculture Growers Council
- Michigan Grape and Wine Industry Council
- Michigan Grape Society
- Michigan Hay and Grazing Council
- Michigan Integrated Food and Farming Systems
- Michigan Nursery and Landscape Association
- Michigan Onion Committee
- Michigan Organic Food and Farm Alliance
- Michigan Peach Sponsors
- Michigan Pear Research Committee
- Michigan Plum Advisory Board
- Michigan Potato Industry Commission
- Michigan Sod Growers Association
- Michigan Soybean Promotion Committee
- Michigan State Millers' Association
- Michigan Turfgrass Foundation
- Michigan Vegetable Council
- Michigan Wheat Program
- Midwest Nut Producers
- National Grape Cooperative
- Pickle Seed Research Fund
- Sugarbeet Advancement Committee
- Western Michigan Greenhouse Association