



PROJECT GREEN
— 2013 —
**LEGISLATIVE
SUMMARY**



===== RICH =====
IMPACT

— Growing the science and industry of Michigan's plant agriculture —

MICHIGAN STATE
UNIVERSITY



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Mission

- Develop research and educational programs in response to industry needs.
- Ensure and improve food safety.
- Protect and preserve the quality of the environment.

Vision

Founded in 1997, Project GREEN (Generating Research and Extension to meet Economic and Environmental Needs), Michigan’s plant agriculture initiative housed at Michigan State University, is a cooperative effort by plant-based commodity groups and businesses in cooperation with AgBioResearch, Michigan State University Extension and the Michigan Department of Agriculture and Rural Development to advance Michigan’s economy through plant-based agriculture.



Letter from the Director



DOUG BUHLER

On July 16, our colleagues at the Michigan State University Product Center introduced the first Michigan Agriculture and Food Index* showing that leaders in the industry feel strongly that food and agriculture have a bright future in this state. I have no doubts that the overall index rating of 147 is due, in part, to the positive outcomes of the work we've accomplished through Project GREEN.

The strong partnership between the Michigan Department of Agriculture and Rural Development, MSU AgBioResearch, MSU Extension and our 43 other partner organizations continues to strengthen our research and outreach initiatives in plant agriculture. Year after year, we fund forward-thinking research and outreach projects that help farmers, turf managers, greenhouse operators and others make the most of that investment.

The strength of that partnership continued to be evident over the past two years, when duties as interim dean of the College of Agriculture and Natural Resources limited my involvement in Project GREEN. As I transition back to my role as coordinator of the project, I want to publicly thank Steve Lovejoy and Ray Hammerschmidt for taking the helm. As the associate director of MSU Extension and the chair of the MSU Department of Plant Pathology, they both already had full plates. But their passion for Project GREEN and desire to see plant agriculture continue to thrive led them both to quickly agree to jump in as interim co-coordinators. Though I'm back at project GREEN as the coordinator, Steve and Ray will continue to lend their expertise and continue their excellent work in support of the project.

This legislative summary highlights the research and outreach made possible because of the investment in Project GREEN and the partnerships that make it thrive. I hope you will take the time to review the successes and consider how we work together to lead to a prosperous food and agriculture economy.

It's good to be home. And it's even better to be home in such great company. We all look forward to continuing our dedication to the mission of Project GREEN.

Sincerely,

Douglas E. Buhler
Program Coordinator, Project GREEN
Director, MSU AgBioResearch

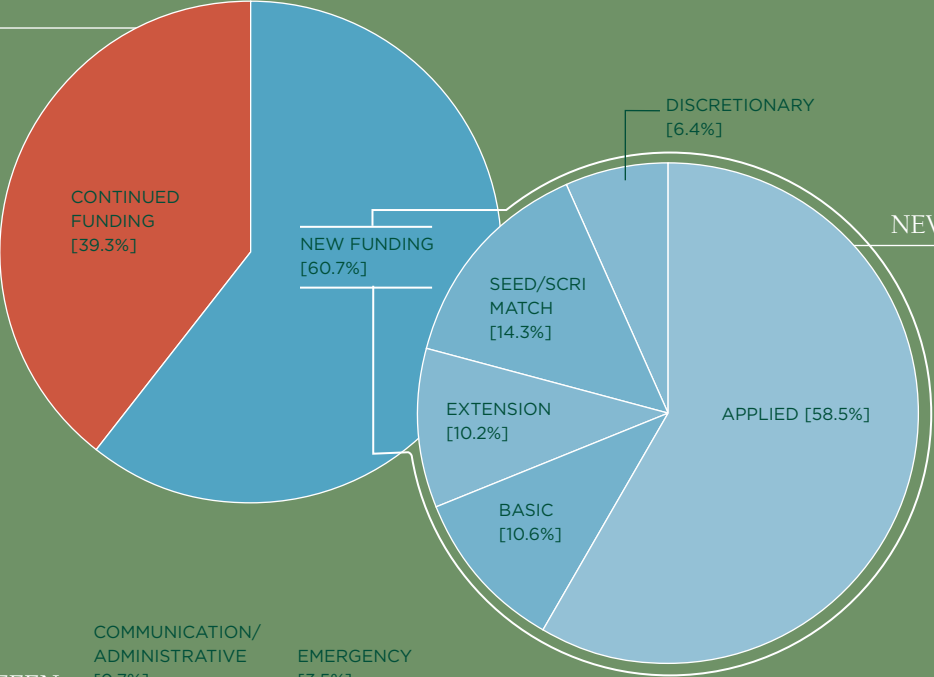
* To learn more about the MAFI, visit ow.ly/n0OGL



RAY HAMMERSCHMIDT

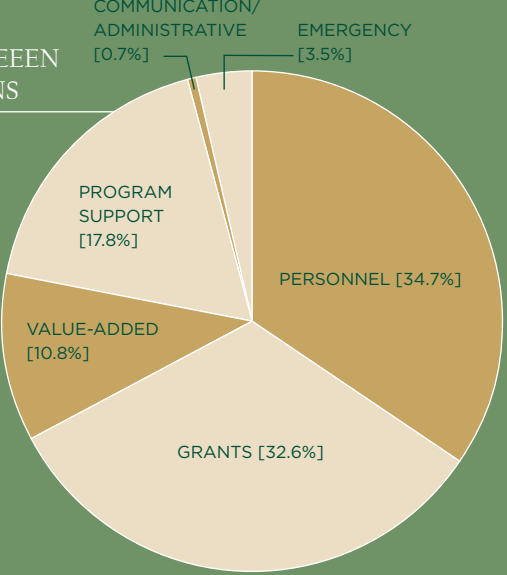
Financial Investment

COMPETITIVE GRANTS AT WORK



COMPETITIVE GRANTS NEW FUNDING BREAKOUT

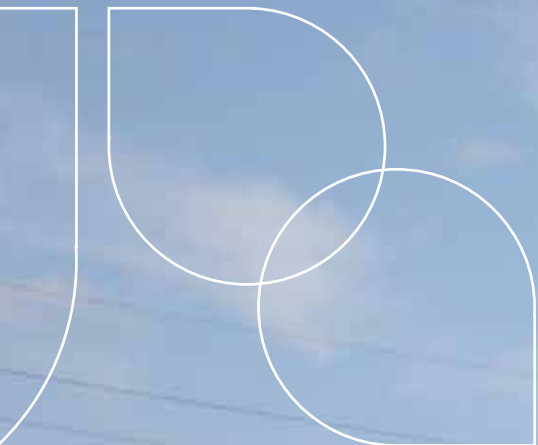
ANNUAL GREEN ALLOCATIONS



Project GREEN engages all plant agriculture commodity groups in Michigan. Housed on the Michigan State University campus, Project GREEN is led by AgBioResearch, Michigan State University Extension (MSUE) and the Michigan Department of Agriculture and Rural Development. Administration costs make up a small portion of Project GREEN's annual expenditures. Project GREEN researchers are AgBioResearch—and MSUE-funded, all allowing GREEN funding to supply the materials, labor, travel and collateral funds to conduct research and Extension programs. But the big ideas—the ground-breaking, world-changing, people-feeding work—is possible because of our partnerships in research and Extension.

MICHIGAN STATE UNIVERSITY | Extension





“Nothing moves forward well with just a single entity. The collaborative partnership between MDARD, MSU Extension and AgBioResearch creates a strong foundation that ensures that the needs of the plant commodity organizations are addressed each year. Project GREEN is a proven model of success that we hope to continue for a long, long time.”



GORDON WENK, MICHIGAN DEPARTMENT OF AGRICULTURE AND RURAL DEVELOPMENT

COMPETITIVE GRANT SUMMARIES

Competitive grants are the foundation of Project GREEN. Michigan State University, the Michigan Department of Agriculture and Rural Development and plant commodity organizations work together to ensure that research lines up with industry priorities. This ensures that scientists are connected with producers and responding to their needs.

CROSS-COMMODITY

Acoustic Technology to Protect Ash Trees from Emerald Ash Borer: A Potential Option for Non-insecticidal Control of Phloem-feeding Insects

DEBORAH MCCULLOUGH

Awarded: \$38,500 for 18 months

Numerous species of bark beetles, phloem feeders and wood borers spend most of their life span under the bark of trees in forests and landscapes. Many of these subcortical insects are major economic pests, affecting nearly all hardwood and conifer trees growing in North America. Emerald ash borer (EAB) is one example. New advances in acoustic technology could provide a cost-effective alternative to insecticides, enabling arborists to protect landscape trees without risking tree damage or environmental contamination, or affecting pollinators and other non-target organisms. **Using Project GREEN funding, MSU researchers recorded acoustic signals produced by EAB larvae and adults; conducted a field trial to assess whether acoustic signals could repel EAB or disrupt larval feeding; and developed methods to deliver these signals into live trees.** Though there was no clear indication that acoustic signals affected EAB larval density, there was evidence that natural EAB enemies may be attracted to the signals. This knowledge will be further explored and has implications for a variety of other phloem- or wood-boring insects.





Caught You Looking! What Captures Consumers’ Attention When They Buy Ornamental and Food-producing Plants

BRIDGET BEHE

Awarded: \$80,000 over two years

MSU researchers used Project GREEN funding to utilize eye-tracking technology (ETT) to identify consumer behavior leading to the purchase of ornamental and food-producing transplants. **Researchers discovered evidence that consumers use a variety of cues to make a purchase decision and narrowed them into three market segments of consumers: 73 percent were plant-oriented, 10 percent were production method-oriented, and 16 percent were price-oriented, with the last segment spending much more time looking at the price sign.** The implications of this research for retailers and others in the supply chain are numerous, but additional investigation of sign cues is required to facilitate sales at the retail level. How and where those cues are presented will affect retail sales of horticultural products.

Development of Poplar Plantations for Treatment of Food Processing Wastewaters

DAWN REINHOLD

Awarded: \$70,000 over two years
Leveraged: \$141,660

Michigan food processors apply 2,700 to 16,000 gallons of wastewater to 1 acre of field per day. Properly operating fields can assimilate wastewater through biodegradation of organic carbon and biochemical oxygen demand (BOD), but excess application of wastewaters can rapidly contribute to poor treatment and environmental deterioration. Researchers invested Project GREEN funding to determine if poplar trees could help remediate water used in fruit and vegetable processing. **Their research indicates that land application of food processing wastewaters to poplar plantations can decrease mobilization of metals and nitrate, thereby protecting groundwater resources.** Researchers have leveraged additional funding to conduct validating research using a field site in western Michigan.



Fate of Weed Seeds When Plants are Terminated Prior to Maturity

KAREN A. RENNER

Awarded: \$30,000 over two years

Farmers attempt to stop weeds from competing with crops and reducing yield and quality, but it’s a task both challenging and costly. Seed production by escaped weeds, especially, is a major concern in both conventional and organic farming systems because escaped weeds can produce hundreds to thousands of seeds that emerge over several growing seasons. Currently, there is little information on when seed maturity occurs. **Using Project GREEN funds, MSU researchers are determining the reproductive growth stage at which summer annual weeds (e.g., common lambsquarters, velvetleaf, jimsonweed, Canada thistle and giant foxtail) can be terminated and still produce viable seeds.** Providing this information to organic and conventional growers will help them manage inputs to weed seed banks in their fields, reduce future infestations and increase the sustainability of production practices.

Hunting Genes Important for Varroa Survival and Reproduction Using RNAi

ZACHARY Y. HUANG

Awarded: \$20,000 for one year
Leveraged: \$53,000

Varroa destructor is a devastating pest that threatens the honeybee industry worldwide. This mite has developed resistance to synthetic acaricides in many countries, and acaricide residues have appeared in honey and beeswax. Research indicates that these residues decrease bee vitality and survival, and they may be one of the factors contributing to colony collapse. In response to beekeepers’ need to know more about Varroa mite biology, MSU researchers set out to acquire this information and to use it to develop new and improved control methods for the mite. **Using Project GREEN funding, MSU researchers successfully used RNA interface (RNAi) technology to disrupt the Varroa mite life cycle by causing either immediate death or sterility in mites.** This represents a novel approach for mite control and has the potential to significantly reduce pesticide use to control the pest inside honeybee colonies. The next step is to explore ways to introduce RNAi to mites via honeybee larvae.



Preparing Michigan Plant Industries for the Changing Physical and Policy Climate

CLAIRE LAYMAN

Awarded: \$29,600 over two years
Leveraged: \$48,264

Michigan plant industries stand to be greatly affected by a changing climate. Fluctuations in temperature and precipitation patterns work together to affect plant growth, yield, and insect and disease outbreaks. Realizing that Michigan farmers need knowledge and skills to respond to climate change and mitigate its impact, **MSU researchers used Project GREEN funds to address the critical, complex issue of climate change through a needs assessment of stakeholders.** From it they learned how growers and Extension educators, specialists and other MSU researchers thought MSU Extension should move forward with programming related to climate change and agriculture. Their input directed the creation of informational materials and educational programming, peer-reviewed fact sheets, a peer-reviewed journal article, a website, leveraged funds, an MSU Extension climate change outreach team and the dissemination of information at numerous events.

Mechanisms of Soil Carbon Storage in Conventional and Cover-crop-enhanced Row Crop Agroecosystems at Micro Scales

ALEXANDRA KRAVCHENKO

Awarded: \$30,000 for one year

One of the promising methods of enhancing sustainability of row crop and vegetable systems is adding cover crops to the rotations. Among cover crop benefits is soil carbon sequestration achieved through enhanced soil aggregation, reduced erosion and a continuous supply of biomass inputs via root exudates and above—and belowground biomass. The specific mechanisms by which the presence of cover crops contributes to carbon storage remain unclear. **Through Project GREEN, researchers are studying the effects of cover crops on properties and microbial community compositions of soil aggregates to optimize duration, placement and management of cover crops by Michigan producers.**

Pest Management Technical Information (Updates) and State and Federal Committee Service

MARK WHALON

Awarded: \$20,000 over two years

Consistent with the MSU land-grant mission, MSU researchers use the latest technology to keep research and Extension faculty members and commodity organizations up-to-date on policy change. **Using Project GREEN funds, MSU researchers engage in consistent electronic and in-person outreach to disseminate critical state and federal policy information that affects Michigan agriculture and pest management practices.** By arming this group of people with this information, they have been able to obtain competitive federal research and extension dollars for the advancement of their fields. Additionally, commodity groups and their growers in Michigan and the Upper Midwest have successfully adapted to policy change related to pesticide legislation, integrated pest management, organic regulations and other related environmental policy arenas.

FIELD CROPS

Changing Sensitivity of Sugarbeet Roots to Decay Throughout the Storage Campaign; Germ Plasm Evaluation and Symptom Amelioration

RANDOLPH BEAUDRY

Awarded: \$54,900 over two years
Leveraged: \$24,000

Harvest time followed by storage can be tough on sugarbeets. When they're ready in the fall, the sweet roots are popped out of the ground, shaken vigorously to remove excess dirt, then dumped into 20-foot piles. There, the beets rest in the ever-changing Michigan climate before processing. Occasionally, the sugarbeet piles fall victim to decay. During the 2004-2005 season, decay from warm temperatures cost the sugarbeet industry \$25 million in crop loss. **To make sure this does not happen again, MSU researchers are collecting data to better understand the process of sugarbeet decay in relation to handling after harvest, winter temperatures and length of storage.** Doing so will help researchers optimize sugarbeet storage by designing improved pile architecture and new methods of controlling decay, which will reduce losses and improve efficiency.



Combining Strip Tillage and Dual Cover Crops to Increase Profitability

DALE R. MUTCH

Awarded: \$40,000 over two years

Leveraged: \$85,216

Soil health is an extremely important issue for Michigan's agricultural future. Cover crops and reduced tillage practices are two strategies that have shown benefits to soil health. MSU researchers hypothesized that incorporating in-row brassicas with between-row legume cover crops could reduce nitrogen rates and improve soil health. They also hypothesized that combining strip tillage with cover crops could reduce production costs while maintaining or possibly increasing yield. **Using Project GREEN funds, MSU researchers found that incorporating legume cover crops into corn crop systems could result in reduced nitrogen rates without lowering yield.** This research indicates that Michigan farmers can successfully incorporate cover crops into a corn-soybean-wheat rotation and that there was no difference in corn yield between three types of tillage practices—no-till, strip till or conventionally tilled systems.

Cover Crop Susceptibility to Herbicides

CHRISTY SPRAGUE

Awarded: \$17,200 over two years

Cover crops can be incorporated into various crop rotation systems to help control erosion, minimize nutrient mineralization, increase nitrogen availability, and suppress pathogens and weeds, all of which lead to improved soil health. Because herbicide labels list crop use and rotation restrictions for commodity crops only, little information exists about cover crops' tolerance to various herbicides. **This research was designed to provide recommendations to growers about how herbicides affect cover crops.** Preliminary recommendations for rye, clover and oilseed radish establishment following corn and wheat herbicide applications will provide a steppingstone toward increased success with cover crops and increased sustainability of field crop production systems throughout Michigan and the Midwest.

Develop Soybean Germ Plasm with Resistance to Multiple Biotypes of Aphids and Japanese Beetles

DECHUN WANG

Awarded: \$67,250 over two years

Leveraged: \$70,000

Aphids are one of soybean's greatest enemies. Luckily, there are ways to control the pest. Since soybean aphids were discovered in 2000, pesticides have been the most effective means of control. Pesticides increase production costs, however. MSU scientists developed a new aphid-resistant soybean line called Sparta that is extremely resistant to soybean aphids but not resistant to Japanese beetles, another pest that can do considerable damage to soybeans. **The new goal is to develop soybeans resistant to both aphids and Japanese beetles. MSU researchers successfully developed 17 soybean lines with resistance to both pests.** The development of these soybean lines will ultimately reduce the cost of insecticide application by tens of million of dollars in an aphid or Japanese beetle outbreak year.



Identification of Pathogens Responsible for Potato Dry Rot and other Skin-blemished Diseases in Commercial Potato Production and Sugarbeet Root Rot Diseases and Other Sensitivity to Fungicides

WILLIAM KIRK

Awarded: \$50,000 over two years

Most North American potato and sugarbeet growers rely on fungicides to fight diseases such as dry rot and root rot. Many fungal pathogens can cause these and other related diseases, and these pathogens often develop resistance that renders fungicides useless. The result is poor crop quality and decreased yields that cost farmers across the world billions each year. **To help growers better manage these common diseases in commercial potato and sugarbeet production, researchers are working to identify exactly which fungal pathogens are the culprits.** In addition, several of the pathogens are being screened for resistance to commonly used fungicides such as thiabendazole. This ongoing project will ultimately allow for the development of more effective chemical applications to prevent disease that will help growers realize better crop quality and yields and delayed resistance to fungicides.

Improving the Ecological Efficiency of Michigan Sugarbeet Production

KURT STEINKE

Awarded: \$80,000 over two years

Leveraged: \$85,000

Michigan is one of the top three producers of sugarbeets in the U.S. sugar market. The success of this crop largely depends on the percentage of sugar derived from the beets. As a result, Michigan growers must strike a balance between producing high-yield crops and high-sugar crops. Thanks to improvements in sugarbeet germ plasm, sugarbeet yields have nearly doubled since the late 1990s, but nutrient recommendations that greatly influence sugar percentages—specifically nitrogen recommendations—have remained unchanged. Having access to this information is critical to Michigan growers. **Using Project GREEN funding, MSU researchers identified specific sugarbeet nitrogen application ranges for beets following corn, wheat and soybean that promote environmental sustainability and foster economic growth.** Their recommendations may lead to increased net economic return for the grower and decreased environmental contamination through improvements in the ecological efficiency of this cropping system, and move both the industry and the environment closer to sustainability.



Initiation of Immediate and Long-term Management Strategies for Invasive Genotypes of Phytophthora infestans on Potato Foliage

WILLIAM KIRK

Awarded: \$80,000 over two years

Potato late blight, the fungus responsible for the Irish potato famine of the 1840s, remains the largest threat to potato production. On a worldwide scale, the disease costs \$6.7 billion annually in control and loss. One reason that late blight continues to plague potato production is its ability to quickly change its genetic makeup. When this happens, once resistant cultivars may no longer be able to fight off infection. The North American potato industry needs to find solutions as quickly as late blight mutates. **Researchers are looking at what factors allow the late blight fungus to evolve and are using this information to create more resistant cultivars.** In cooperation with Simplot, the MSU team has developed a potato line that is resistant to late blight through a combination of breeding and transgenic approaches. Creating more resistant cultivars will significantly reduce the need for fungicides.

Managing and Using High-yielding Corn Residue in Michigan

TIM HARRIGAN

Awarded: \$17,000 over two years
Leveraged: \$14,400

Many corn growers have adopted no-till cropping—planting crops without plowing to improve the health of the soil. When growers plant genetically engineered (GE) corn, many find that the corn residue—the stalks and leaves of a corn plant that remain after harvest—is very slow to break down. As a result, the residue interferes with planting in the spring and can lead to reductions in yield and profitability. There is a need to understand if and why GE corn residue is slow to breakdown, and how to manage it in no-till cropping systems. **Research done at MSU suggests that GE corn is not slower to break down. Rather, it is healthier and greener at harvest than non-GE corn damaged by insects throughout the season.** In addition, researchers found that tilling fields in the spring can significantly reduce the amount of residue left in cornfields.

Managing Soil Health and Sugarbeet Cyst Nematode to Improve Yield in Michigan Sugarbeet Production Soils

HADDISH MELAKEBERHAN

Awarded: \$20,000 for one year

Developing management practices that reduce the impact on yield of sugarbeet cyst nematode (SBCN) and other nematodes and understanding soil biology and food web structure to improve soil health and long-term viability of beet production are two of the research priorities for the Michigan sugarbeet industry. **Through Project GREEN, researchers are determining the effects of rotation crops on SCBN by testing a combination of sugarbeet cultivars, corn and soybean in mineral and muck soils.** This study showed that the crops have similar effects on all nematodes.

How the perks of pollination are playing out in Michigan agriculture



and bring to the farm work—under what settings are those the most effective and the most economical,” Isaacs said. “We’re working with economists, social scientists and entomologists, so this is a proactive look into ways to pollinate other than using honeybees.”

Isaacs explained that there is significant concern about the long-term health of honeybees. With the increase in production of fruit, vegetable and nut crops, at some point there may not be enough honeybees to pollinate these crops.

More than 400 species of wild bees live in Michigan. Some of them are really good at pollinating the state’s abundant fruit and vegetable crops. With the help of Project GREEN funds and a \$9 million Specialty Crops Research Initiative (SCRI) grant from the U.S. Department of Agriculture, Michigan State University entomologist Rufus Isaacs is trying to understand what contributions these pollinators provide, how to enhance their numbers, and if they can augment the pollination provided by commercially managed honeybees.

The SCRI grant allows MSU to lead a team of 15 universities and other collaborating organizations across the country to study pollination of specialty crops including almonds, watermelons, raspberries, apples, cherries, blueberries and squash. In Michigan, Isaacs and his team are studying pollination in blueberries, apples and cherries.

“The goal is to study the crop context where honeybees or wild bees or other managed bees such as bumblebees that you can purchase

“We want to have information available to give growers some alternatives and give them guidance on which strategy would be best and most effective for their farm systems,” Isaacs said. “Part of what we’re doing in this project is figuring out what farmers can do to adapt their farms to be more suitable for the wild bees to live and survive there. Simple manipulations to a grower’s farm to make it better for bees should help support overall pollination.”

The journey to get to where Isaacs and his team are today has been a long one. Over the past 10 years, multiple Project GREEN grants have helped get the ball rolling to work on this pollination project and, ultimately, to obtain this large SCRI grant.

“If the funding from Project GREEN pollination research hadn’t been there, we might never have even started down this road,” Isaacs said. “My program is also very focused on pest management, so we might not have gone in the direction of pollination research quite as much.”



Project GREEN funds have helped establish a program in crop pollination at MSU that allowed Isaacs and his team to lead this group of institutions to get the SCRI grant. Other MSU programs that contributed to the acquisition of the SCRI grant are those of Larry Gut, Nikki Rothwell and Julianna Wilson.

Isaacs went on to add that one really important thing about the pollination research is that the SCRI grant requires a one-to-one match.

“We’ve asked for this much money, but we also have that same amount in match from Michigan agriculture to support our project,” he explained. “It’s definitely a partnership. We have 60 Michigan farms that we’re working on in this project.”

For more information on the pollination research project, visit www.icpbees.org.



Managing Potato and Tomato Late Blight Epidemics Through the Use of Weather-based IPM Systems to Predict Overwinter Survival of Volunteer Potato Tubers

WILLIAM KIRK

Awarded: \$38,400 over two years
Leveraged: \$119,400

Since 1950, climate conditions in Michigan have become more conducive to the initiation and development of potato and tomato late blight epidemics, which are initiated by mycelium of *Phytophthora infestans*. As *P. infestans* populations continue to develop tolerance to colder temperatures, winters in Michigan continue to become warmer, favoring overwinter survival of the pathogen in cull and volunteer potatoes left in fields after harvest. **Using Project GREEN funding, MSU researchers developed a weather-based IPM web tool that enables Michigan growers to determine whether environmental conditions are favorable for the initiation of a late blight epidemic.** Using data from the Michigan Automated Weather Network provided by Enviro-Weather, this volunteer prediction model provides critical information that allows growers to make informed decisions and to take steps to manage the risk of late blight epidemics, such as the timely application of effective fungicides.

MSU-conducted and-coordinated Industry Wheat Evaluations for Wheat Quality Testing of Advanced Lines

PERRY K.W. NG

Awarded: \$14,000 over two years
Leveraged: \$42,148

In Michigan, soft wheat contributes more than \$100 million each year to the state’s economy; the milling industry adds another \$1.5 billion. Consistent, high-quality crops are needed to help maintain and improve Michigan’s soft wheat market. It is essential that Michigan’s wheat industry leaders and breeders have access to comprehensive information on wheat quality to make the best planting decisions. **Using Project GREEN funding, MSU researchers are improving wheat quality in MSU wheat breeding lines by coordinating quality evaluations from the Michigan wheat industry. This program— the MSU Wheat Quality Testing Program—also evaluates these lines for potential commercial release.** As a result of these efforts, quality information about soft wheat varieties grown in Michigan has become more readily available. Compiled information contributed to the release of one variety in 2011 (E5024) and revealed a number of advanced lines with great potential for release in the near future.

Precise Gene Manipulation for Potato Improvement

DAVID S. DOUCHES

Awarded: \$35,000 for one year

In response to growers’ needs for potatoes that can better contend with pest and pathogen threats, potato-breeding efforts have been under way for some time. It is critical for the success of the potato industry to test and evaluate approaches that increase breeding efficiency and reduce the length of breeding cycles. Recent advances have made it possible to precisely alter plant genomes, thereby creating plants with new and valuable traits. One such advancement was the discovery of transcription activator-life effector nucleases (TALEN), which work to regulate host resistance mechanisms in plants. **Using Project GREEN funding, MSU researchers are using TALEN-based gene replacement procedures to target a herbicide resistance gene in potatoes.** Successful demonstration of TALEN in potatoes has the potential to be extended to other Michigan crops such as tart cherries, blueberries, sugarbeets, soybeans and maize.

Transcriptome Analysis of Resistant and Susceptible Potato Varieties to Common Scab

DAVID S. DOUCHES

Awarded: \$40,000 for 18 months

In the United States, the annual potato crop generates approximately \$3.2 billion, with Michigan accounting for more than \$160 million of the product value. Despite this success and decades of research, many diseases still hamper potato production. One such disease is potato common scab. Previously considered a cosmetic disease because of its superficial, raised or pitted lesions, common scab has increased in severity and now affects the economic value of potatoes. Although several scab- resistant/tolerant potato varieties are available, little information on their mechanism(s) of resistance is available. **Using Project GREEN funding, MSU researchers are learning more about the genetic basis of scab resistance and identifying genetic markers of scab resistance that can be used to improve breeding effectiveness and efficiency.** Their findings and insights have been the basis of ongoing research to enhance scab resistance breeding in potato.



PHOTO COURTESY OF: MICHIGAN POTATO INDUSTRY COMMISSION

FRUIT

Conidial Attachment and Disease Initiation in the Apple Scab Pathogen

FRANCES TRAIL

Awarded: \$35,000 for one year

Michigan produces more apples than any other fruit crop. The product is used for fresh apples, sliced apples for pies and fresh sliced apples, in addition to more processed products. Particularly for fresh apples, blemishes greatly reduce the market value. Apple scab disease occurs in years when weather is conducive to infection. In recent years, the development of fungicide resistance among Michigan scab populations has threatened the ability to keep this important disease in check. Growers need solutions, including better strategies for resistance management, to increase the window of time that new compounds remain efficacious, and also novel alternatives that provide effective, sustainable disease control. **Through Project GREEN, researchers are working to identify cellular processes between apples and the scab fungus to better determine effective control methods for eliminating or reducing recurrent infections.**

Control of Berry Maturation to Improve Total Fruit Antioxidant in Concord Vines

PAOLO SABBATINI

Awarded: \$66,000 over two years
Leveraged: \$87,701

Michigan juice grape growers and the National Grape Cooperative (the group that owns Welch's) have an increasing interest in producing higher quality grapes. A recent discovery of significant quantities of antioxidant in red grapes has marked them as a healthful food in the U.S. market. Unfortunately, information on antioxidant content of grapes grown in Michigan was not available, nor were there any studies that explored the viticultural and environmental impacts on antioxidant accumulation in Concord grapes. **Using Project GREEN funds, MSU researchers investigated the effects of temperature, light and yield on fruit antioxidant capacity and accumulation of polyphenols; they then developed specific recommendation practices to improve the fruit quality of Concord grapes in Michigan.** Their results were shared with the National Grape Cooperative, which has worked with the researchers to develop a strategic plan to implement these newly developed viticultural techniques. Outreach efforts informed Michigan growers of these new recommendations, helping them to produce quality fruit consistently and economically.



Critical Invasive Pests of Michigan Tree Fruit

LARRY GUT

Awarded: \$65,900 over two years
Leveraged: \$119,400

Among the 10 to 15 invasive species that attack North American fruit crops, the brown marmorated stink bug (BMSB), spotted-wing drosophila (SWD) and light brown apple moth (LBAM) are the most documented and high-profile threats to the Michigan tree fruit industries. The establishment of these pests in Michigan greatly complicates the integrated pest management (IPM) programs developed for insect management in tree fruit, increasing the need for monitoring, chemical applications and Extension education programs. **Using Project GREEN funds, MSU researchers provided timely, vital information to the Michigan apple, cherry and peach industries on the distribution and biology of two recent invasive pests, BMSB and SWD.** The project also made the first documentation of the SWD in most Michigan cherry production regions. By acting proactively, researchers were able to help mitigate the damage caused by SWD in Michigan cherries. This effort and others like it have played an important role in helping Michigan fruit growers maintain their current IPM programs and avoid tens of millions of dollars in damage by these pests.

Development and Delivery of Biologically Based Pest Management for the Apple Flea Weevil

MATTHEW GRIESHOP

Awarded: \$70,000 over two years

Michigan's apple industry has an economic impact of \$700 million to \$900 million annually, with an increasing proportion coming from organic farms. The apple flea weevil (AFW) is a native pest that has begun causing significant damage on organic and conventional farms within the past four years, with some growers experiencing up to 90 percent fruit loss. **Researchers are using Project GREEN funds to determine AFW's biology and life history to develop effective IPM programs for all apple growers in Michigan.**

Elucidating the Effects of Apple Orchard Floor Management and Canopy Architecture on the Effectiveness of Codling Moth Natural Enemies

MATTHEW GRIESHOP

Awarded: \$25,000 for one year

The codling moth remains the most serious pest of apples in Michigan, and biological control is likely to become a more important factor in management as growers transition to reduced-risk insecticides. **Through Project GREEN, researchers found that connective canopies may improve egg predator movement among trees and that ground cover interferes with soil-based codling moth biological control using entomopathogenic nematodes.**

A Biorational Approach to Management of Downy Mildew in Michigan

ANNEMIEK SCHILDER

Awarded: \$70,000 over two years
Leveraged: \$30,500

Michigan's high-value grape crop often requires up to 14 applications of fungicides in a single season to control various diseases, including deadly downy mildew. **Scientists used their Project GREEN investment to investigate biorational approaches to managing downy mildew in grapes, using biological information to make rational disease management decisions and reduced-risk tactics to reduce the number of fungicide applications.** This project has provided growers with new information on fungicide efficacy against downy mildew as well as the use of ground covers and a primary inoculum prediction model. At this time, fungicides provide the best control option, and ground sprays with copper may help.



Grower Decision Support Tool for Conversion to a High-efficiency Tart Cherry Orchard System

CHRIS WOLF

Awarded: \$44,400 over two years
Leveraged: \$53,725

Michigan growers produce 70 percent of U.S. tart cherries. Global competitors continue to try to edge out Michigan growers by producing more cherries on less land. As part of a large ongoing effort to evaluate the feasibility of a comprehensive redesign of Michigan tart cherry production systems to keep Michigan growers competitive, economists began creating a tool to help growers determine if changing their production systems from a traditional system to a high-efficiency system is profitable. **They used Project GREEN funds to collect production data and consult with growers and researchers from other cherry-producing regions.** Research results and the decision tool have been distributed in printed and electronic form to tart cherry growers.

The Impacts of Expanding Chinese Production on Michigan's Blueberry Sector

MOLLIE WOODS

Awarded: \$7,600 for one year
Leveraged: \$87,701

Grown, harvested and processed by more than 600 family farms in the state, blueberries contribute more than \$118.5 million annually to Michigan's economy. MSU researchers are invested in helping Michigan growers sustain and expand this industry, and they have looked to China to examine its emerging market and demand for the fruit. **MSU researchers utilizing Project GREEN funds found that China is a growing market for U.S. blueberry products and should be viewed as an export opportunity for the U.S. and Michigan industries.** High-value products such as dried blueberries (which fit well with the Chinese supply chain) should be emphasized. On the basis of their gathered data, MSU researchers believe that Michigan blueberry production and processing industries could successfully target a dried blueberry export program at China and South Korea. Their findings also suggest that Michigan and other U.S. blueberry producers should be aware of trends in prices and take care to respond accordingly.



Improvements to Moth Mating Disruption by Insights from Comparative Studies of Oriental Fruit Moth v. Codling Moth

JAMES MILLER

Awarded: \$70,000 over two years
Leveraged: \$250,000

Mating disruption—the use of pheromones to lure male pests away from their female counterparts to stop reproduction—is an environmentally friendly means of controlling pests such as the Oriental fruit moth and the codling moth in apple orchards. Like most other pest management strategies, however, this tricky method of pest control drives up growers’ production costs. **In an effort to make mating disruption more economically attractive to growers, MSU researchers are studying how these pheromones actually work on pests and have used this information to improve commercial pheromone-dispensing products.** Their research suggests that dispensers are just as effective with reduced amounts of the expensive pheromone. Companies are already using this knowledge to adjust the amount of pheromone in their dispensers. Researchers expect significant cost savings will be passed along to Michigan apple growers in the near future.

Inheritance and Mapping of Resistance to Anthracnose Fruit Rot in Highbush Blueberries for Marker-assisted Selection

ANNEMIEK SCHILDER

Awarded: \$65,600 over two years
Leveraged: \$10,000

Michigan growers produce 99 million of the 350 million pounds of blueberries grown in the United States annually. As evidence of blueberries’ nutritional and health benefits mounts, market demand continues to increase. Anthracnose fruit rot can have a severe economic impact on blueberries, with preharvest losses estimated at 10 to 20 percent and postharvest storage losses as high as 100 percent. **Thanks to Project GREEN funding, scientists were able to screen various blueberry families to determine their resistance to anthracnose.** They determined that anthracnose fruit rot resistance in blueberries is highly heritable, so disease resistance breeding is a suitable approach to reducing chemical disease management. A marker-assisted selection protocol developed in this project will facilitate future development of anthracnose-resistant blueberry cultivars.

Immuno-marking to Understand the Effects of Conservation Plantings on the Movement Patterns of Key Insect Natural Enemies, Pollinators and Pests

RUFUS ISAACS

Awarded: \$25,000 for one year

The pest control and pollination services provided by beneficial insects are worth billions of dollars annually. How might growers capitalize on them even more? MSU researchers have demonstrated how planting wildflower fields immediately next to crops such as blueberries can encourage more beneficial insects to visit the adjacent blueberry field. **Researchers followed the movement of beneficial insects using an immuno-marking technique that involves tracking their movement after they pick up a protein marker in the wildflower planting.** This has helped researchers verify that beneficial insects are visiting the plantings and also moving into adjacent crop fields to pollinate and to feed on pests. The study also demonstrated that fields next to these plantings had higher crop yield from improved pollination and higher levels of pest control from predation of pest insect eggs.



Investigating Horticultural Methods for Overcoming *Armillaria* spp. on Cherry Orchard Sites

ERIN LIZOTTE

Awarded: \$15,100 over three years

Armillaria root rot (ARR) is caused by a native pathogen of many Michigan forest, stone fruit and ornamental tree species. Commonly found in forested areas that have been cleared for fruit production, this pathogen has caused high mortality rates of cherry trees in northwestern Michigan. Michigan is the No. 1 producer of tart cherries in the United States, with crops valued at more than \$50 million that account for more than 75 percent of the total U.S. tart cherry production. There is no known control for ARR, and this disease has devastating effects on orchards, renders land unsuitable for planting other stone fruit trees and has great potential to seriously affect the agricultural economy of Michigan. **Using Project GREEN funds, MSU researchers are determining the viability of novel ARR-tolerant rootstocks.** The insights from this long-term project will provide Michigan growers who have ARR-infested orchards with an alternative management strategy for continued production of tart cherry in infected fields.



Managing Gall Wasp in Michigan Blueberries

RUFUS ISAACS

Awarded: \$37,800 over two years
Leveraged: \$17,000

Gall wasps are becoming a big problem for some Michigan blueberry growers. The wasps damage growing shoots by depositing eggs whose larvae feed on the shoots, causing the plant to produce galls 1 to 2 inches in diameter. To make matters worse, because this wasp is closely related to bees, effective insecticides with the potential to kill the pest also poison beneficial insects. **MSU researchers are trying to determine the safest method and best time to control gall wasps in blueberries.** One approach involved treating the galls with a mixture of ultrafine oil and insecticide before bees arrive for the growing season. Results have shown how difficult it is to safely control gall wasps. Researchers were able to develop a model to predict the emergence of the blueberry gall wasp, however, and this model will be incorporated into Enviro-Weather, an online weather-based information system that helps users make pest, plant production and natural resource management decisions in Michigan.

Responding to Spotted-wing Drosophila’s Arrival in Michigan Small Fruit Crops

RUFUS ISAACS

Awarded: \$72,400 over two years
Leveraged: \$53,000
Pending Leverage: \$70,000

The spotted-wing drosophila (SWD) fly, first detected in Michigan in 2010, can wreak havoc on soft-skinned fruits such as blueberries, raspberries and cherries. It slits the skin of healthy ripe or ripening fruit to deposit eggs. The SWD fly is a relatively new pest to North America, and fruit growers need to know how to monitor and manage it. **In response, MSU researchers and Extension staff members have developed several SWD fly monitoring tools and gathered information about the pest, including the best monitoring approach, the timing of first activity, its overwintering potential and the most effective insecticides for fruit protection.** Researchers have shared this information and provided training to growers through several workshops and online through the MSU Integrated Pest Management website (www.ipm.msu.edu). The training has given growers and scouts crucial information to help them manage this new invasive pest.

LANDSCAPE AND NURSERY

Advancing Native Plants to Support Agriculture and the Environment

DOUG LANDIS

Awarded: \$37,400 over two years
Leveraged: \$563,445

More and more Michigan residents are showing interest in the use of native plants to support a variety of ecosystem services. MSU has rich resources in this area, but key information was slow to reach audiences. **Thanks to Project GREEN funding, researchers were able to support educators with increased training in use of native plants for ecosystem services, and to develop new resources to train clients in this emerging topic.** By developing novel educational materials, training MSU Extension and K-12 educators in their use, and linking to non-traditional audiences, this project has expanded the knowledge and use of native plants for ecosystem services and opened new market opportunities for the Michigan native plant industries.



Analyzing the Impact to Colorado Blue Spruce Quality in Michigan Landscapes, Nurseries and the Christmas Tree Industry from *Stigminia* and *Rhizosphaera* Needlecasts

DENNIS FULBRIGHT

Awarded: \$43,000 over two years
Leveraged: \$58,000

Spruce trees throughout Michigan are experiencing branch dieback. Initially, the problem was presumed to be caused by one of three diseases. **Project GREEN funds were invested in a project to determine the precise cause of the problem so arborists, Christmas tree farmers and homeowners would have accurate treatment information.** Researchers determined that *Phomopsis*, normally a nursery fungal pathogen, is now causing cankers and branch death on spruce trees. Though fungicides are available to manage it in nurseries and tree farms, they are not practical for home landscapes. Thanks to data collected through this initial project, scientists secured a second grant that will help them to continue searching for options for homeowners.

A Comprehensive Approach to Coning in Fraser Fir Christmas Trees

BERT CREGG

Awarded: \$62,100 over two years

Michigan Christmas tree producers annually harvest 1.5 million to 2 million trees with a wholesale value of \$40 million. Michigan Christmas tree production has shifted from growing Scotch pine to Fraser fir. Profitability of Fraser firs is reduced by prolific cone production. Cone removal represents the largest single labor cost for Fraser fir growers in Michigan. **Through Project GREEN, researchers established a network of monitoring plots to determine the effect of site factors on cone development on Fraser fir.** Research findings provide options for growers to reduce coning and open new avenues for continued advances.

Impact and Social Acceptance of Selected Sustainable Practices in Ornamental Crop Production Systems

THOMAS FERNANDEZ

Awarded: \$79,500 over two years
Leveraged: \$1,550,793

As consumers exhibit increasing environmental awareness, mass marketers are adopting strict purchasing guidelines that encourage environmental sustainability, and government policies are evolving toward incentives for reduction in greenhouse gas emissions. **With Project GREEN funding, researchers are working to provide sustainable production information that increases environmental, social and economic sustainability in container-grown horticultural crops.** Research will focus on sustainability improvements in the use of two production inputs—biocontainers and water—evaluating the economic and environmental impacts of implementing sustainable production practices.



Water Management for Container Nurseries to Improve Irrigation Efficiency and Reduce Runoff and Off-site Agrichemical Movement

THOMAS FERNANDEZ

Awarded: \$78,100 over two years
Leveraged: \$85,940.

Container-grown nursery crops require frequent irrigation, fertilizer and pesticide applications, which can lead to agrichemicals and pathogens negatively affecting water reuse and possibly contaminating surrounding waters. **Researchers used Project GREEN funds to improve water management through irrigating on the basis of plant requirements derived from real-time sensor measurements, which reduced water runoff and leaching of fertilizer and other agricultural chemicals.** This research created the largest data source on water use for more than 60 varieties of container-grown ornamental plants. Growers can use the data to refine irrigation applications and group plants in zones on the basis of irrigation requirements and to reduce the amount of irrigation applied by 40 to 75 percent without affecting the growth or quality of container-grown plants. Reducing irrigation will result in less runoff and reduced movement of contaminants off nursery production sites. and will allow growers to irrigate more crops with the same sized irrigation well.

OTHER CROPS

Development of Genetic Resources for Improvement of American Ginseng

ROBIN BUELL

Awarded: \$64,000 over two years
Leveraged: \$20,500 of in-kind donations

Ginseng is a high-value crop that faces several agronomic barriers to reliable, robust and efficient production. Because of its array of pharmaceutical and health benefits, successful production of this crop fits in nicely with the Growing Upper Peninsula Agricultural Association priorities, which include the continued investigation and development of potential cash crops with a specific request for domestication of native plants and nutraceuticals. Though there is a \$50 million inventory of ginseng in Michigan, root diseases limit growers' success. **Thanks to Project GREEN funding, researchers were able to collect ginseng samples from Michigan and Wisconsin to establish the first ginseng germ plasm collection in the United States.** This project provides linkages between disease management and genetics that help determine effective fungicides essential for improving ginseng production in the United States.

Development and Field Evaluation of True Firs Genetic Material for Michigan Christmas Tree Production

PASCAL NZOKOU

Awarded: \$48,900 over two years

Fraser fir is one of Michigan's top-selling Christmas trees. Though the popular conifer is indeed grown in the state, it is not indigenous. Fraser firs truly thrive in the higher elevations of the southern Appalachians. As a result, Michigan growers have to recreate Fraser firs' natural environment through steps such as irrigation and fertilization. Michigan growers also have to contend with its propensity to produce cones, which can make trees unsalable. Fraser fir is also susceptible to certain pests and diseases. **MSU researchers have launched a long-term program to develop improved genetic material for Michigan Christmas tree production.** For starters, researchers have traveled around Michigan, selecting Fraser firs with superior qualities, such as the absence of cones, insects and disease. In addition, they have obtained fir species seeds from several European countries that have ideal genetic potential. This ongoing project will help strengthen the foundation and ensure the long-term viability of the Christmas tree industry in Michigan.

Investigating Hop Varieties for Michigan Production

ROBERT SIRRINE

Awarded: \$22,700

Because of national hop shortages in 2008, many Michigan brewers expressed interest in having access to locally sourced hops, an interest that remains persistent despite improvements in the national market. **Using Project GREEN funding, MSU researchers set out to determine the viability of the Michigan hops industry.** In addition to identifying hop varieties best suited for Michigan's climate and soils, the group also assessed the brewing quality of Michigan-grown hops and created best management practices for growers. Because of this project, statewide hops acreage has increased dramatically since 2009, and millions of dollars have been invested in processing equipment and facilities. Michigan's floriculture industry has also made significant investments to supply the increasing demand for certified disease-free hop plants. Additionally, MSU Extension collaboration with growers and researchers in Vermont, New York, Minnesota, Ontario and Quebec yielded an exchange of pest and disease information that has served to support this emerging industry. MSU Extension will continue to work with growers to equip them to successfully meet the demands of a burgeoning craft brewery movement.

TURF

Genomic Characterization of a New Bacterial Turfgrass Pathogen of Creeping Bentgrass Putting Greens in Michigan

JOSEPH M. VARGAS, JR.

Awarded: \$20,000 for one year
Leveraged: \$78,608

An emerging bacterial disease caused by *Acidovorax avenae* is plaguing creeping bentgrass putting greens on golf courses around the country. Identified by MSU researchers in 2009, the disease—bacterial etiolation—is capable of causing severe loss of turfgrass with extensive economic ramifications. For this recurring problem on golf courses in Michigan, conventional fungicide strategies are ineffective, and devastating losses of creeping bentgrass continue to be observed. No information related to the pathogen’s geographic dispersal, virulence mechanisms on turfgrass, host specificity or phylogenetic relatedness to other *Acidovorax* species was available. With an increasing number of incidences of this disease, there is a great need for reliable molecular diagnostic tools. **Using Project GREEN funding, MSU researchers have identified the molecular framework necessary for the development of robust, accurate molecular assessments and diagnostic protocols.** These findings will work to provide rapid diagnostic turnaround for golf course superintendents and other turfgrass professionals battling the disease and making decisions about fungicide applications.



Management Strategies to Alleviate Winterkill

KEVIN FRANK

Awarded: \$40,800
Leveraged: \$20,000

Winterkill, a general term that encompasses multiple types of turf loss during cold months, can devastate Michigan golf courses. The cost to replace a damaged putting green is about \$20,000. **Project GREEN funding was used to help researchers determine best management practices to avoid winterkill.** Scientists determined that using dark-colored materials such as black topdressing sand or natural organic fertilizers may reduce turfgrass susceptibility to winterkill and enhance spring recovery, and that late autumn nitrogen fertilizer applications are inefficient.



VEGETABLES

Development of a Spectral Index to Facilitate the Efficient Scouting of *Phytophthora Capsici* in Squash

MARY HAUSBECK

Awarded: \$30,000 over two years
Leveraged: \$99,646

Phytophthora capsici is a pathogen that causes Phytophthora crown, root and fruit rot. When conditions are favorable, *P. capsici* can destroy entire fields over the course of several weeks, resulting in grower losses of \$1,500 to \$4,000 per acre. Early disease detection can reduce loss by giving growers the opportunity to employ a combination of cultural and fungicide treatments to limit disease progression. To investigate whether remote sensing tools could provide an additional or an alternative tool to traditional scouting, **MSU researchers using Project GREEN funds identified the wavebands necessary for effective *P. capsici* detection using hyperspectral sensors.** These insights work together to improve the efficiency and quality of scouting and save Michigan growers time and money as they attempt to prevent disease outbreaks in their squash fields.

Enhancing Cover Crop Selection and Performance for Field Crop and Vegetable Farmers in Michigan

DALE R. MUTCH

Awarded: \$72,800 over three years

Cover crops are a viable means of improving plant-based agriculture because of their ability to improve soil organic material, protect water resources and build soil quality. MSU researchers work to help Michigan growers incorporate these crops into farming systems by identifying which kinds of crops are most likely to meet the needs of growers in Michigan’s diverse planting regions. **Convening a diverse group of stakeholders to provide input, MSU researchers used Project GREEN funding to develop an online agronomic tool to help Michigan vegetable farmers decide which cover crop or crops best suit their purposes.** MSU Extension educators, crop advisers, conservation personnel and farmers can use the cover crop decision tool to increase their knowledge of, broaden options for, and make better decisions about cover crops and their application. The easily accessible, user-friendly tool also includes agronomic systems data for Indiana, Ohio, Minnesota, Wisconsin, Ontario, Illinois and Iowa; vegetable systems are planned for Wisconsin and Ontario.

Grower-initiated Project to Enhance the Profitability of Cucumber and Tomato Production with Low Tunnels

MATHIEU NGOUAJIO

Awarded: \$42,000 over two years
Leveraged: \$107,590

Commercial vegetable production in Michigan spans 65,000 acres and is valued at more than \$150 million. A major challenge facing Michigan vegetable growers is the short growing season. If growers plant too early in the growing season, they risk losing crops to a late spring frost. Greenhouses are one way to extend the growing season, but they are a solution that not all growers can afford. **MSU researchers are exploring a new low tunnel design that can provide frost protection in open fields and thereby extend the growing season.** Results also suggest that growers may realize an earlier harvest date and an increase in marketable yield. This ongoing study will ultimately improve the production efficiency, productivity and profitability of the Michigan vegetable industry.

New *Colletotrichum* Diseases of Michigan Onion and Celery

MARY HAUSBECK

Awarded: \$100,000 over two years
Leveraged: \$20,000

The world’s first known occurrence of *Colletotrichum coccodes* described as an onion pathogen was reported in 2010—the same year that *Colletotrichum acutatum*, an equally destructive pathogen, was found on celery. Because Michigan growers are the No. 7 producers of onion and the No. 2 producers of celery in the United States, MSU researchers were deeply invested in helping them protect these two agricultural crops and moved quickly to equip them with tools and strategies to contend with the diseases. **Using Project GREEN funding, MSU researchers confirmed that the fungi were causing disease in Michigan,** determined the environmental conditions that encouraged disease development, and identified effective fungicides and application strategies to manage and prevent disease outbreaks. Researchers found that the pathogens thrive in hot, wet weather but could be limited if growers choose more tolerant cultivars and effective fungicides. These discoveries and outreach efforts prevented a revenue loss of up to \$28.3 million in 2012 for Michigan celery and onion growers.



“Without Project GREEN, the emphasis of research would switch. Researchers would have to focus on basic science instead of broadening their horizons and finding the purpose behind their research. Project GREEN helps bridge the gap between fundamental research and agriculture”

BRAD DAY, ASSOCIATE PROFESSOR, DEPARTMENT OF PLANT, SOIL AND MICROBIAL SCIENCES, MSU

ACADEMIC INFRASTRUCTURE REPORTS

Project GREEN invests funding in Michigan State University departments that, in turn, conduct research and Extension programs to help farmers, agriculturists, entrepreneurs and others.

THE DEPARTMENT OF Agricultural, Food and Resource Economics

Project GREEN funds allowed the collection of data related to both third-party certification and local government finance/taxation and implications for local producers, as well as development of economic models related to both of these projects.

The MSU Product Center doubled the number of nutritional labels created, and the number of pH/water tests provided to Michigan businesses almost doubled compared with last year.

The MSU Product Center:

- Conducted 36 counseling sessions with 20 clients.
- Helped Michigan businesses create or retain 130 jobs.
- Helped three groups incorporate their cooperatives.
- Trained 30 cooperative directors and managers about communications in cooperatives.

THE DEPARTMENT OF Biosystems and Agricultural Engineering

Project GREEN funding gave professionals in this department the opportunity to mentor 36 students in instrumentation, environmental monitoring and project management, and to conduct work that led to the development of a new model for soybean white mold detection. They were also able to design a unique methodology for non-contact temperature detection in apple blossoms, which helped improve the early frost warning capabilities of Michigan’s apple Industry.

In addition, Project GREEN dollars were invested in:

- Designing an instrumented system to monitor the water table in multiuse production crops.
- Designing an instrumented system for monitoring constructed wetland test fixture.
- Remediating wastewater on treated croplands.
- Designing a system using an instrumented retort for canning analysis.

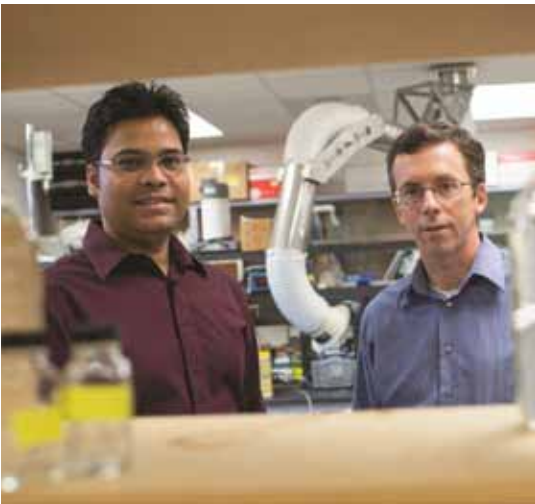


THE DEPARTMENT OF Plant, Soil and Microbial Sciences

Funds from Project GREEN allowed the corn testing program to expand its capabilities to harvest corn silage plots by investing in machinery with improved speed and safety. The department was able to purchase a tractor with enough horsepower to pull large research equipment and meet the tillage needs of the Agronomy Research and Extension Center.

The following projects benefited from Project GREEN funding:

- Potato and dry bean breeding.
- Weed science.
- Oat, barley and canola breeding.
- Soils science and modeling.
- Forages.
- Plant pathology.
- Vegetables.
- Field crops.
- Groundwater stewardship.
- Christmas trees.
- Master Gardener Program.



Boosting our economy with food processing

A quick look at Kirk Dolan’s resume exposes a lot of industry jargon. Phrases such as “optimization and scale-up of value-added food processes, parameter estimation and inverse solutions, kinetics of food processes and extrusion food processing” may not resonate with the average Joe, but Dolan’s basic goal does: he helps people get jobs.

Dolan, manager of the MSU Fruit and Vegetable Processing Center, works with graduate students interested in thermal processing—the combination of temperature and time required to eliminate microorganisms from a food. Food processing is a major component of Michigan’s food and agriculture businesses, which generate more than \$91.4 billion in economic activity annually. And most of the jobs related to food preservation are in some type of thermal processing.

Dolan’s position and his operating budget are partially funded through Project GREEN. He uses those funds to maintain equipment, upgrade equipment, employ student labor and partially fund student projects.

“When I’m not in the lab teaching students, I’m usually out networking with members of the industry,” Dolan explained. “My big push is to train up students and then help them find internships out there in the real world. A lot of graduate students may not think about internships at first, but I recommend internships and co-ops for at least three to six months. It makes them more competitive when they leave here.”

His tenacity for connecting students and industry works. His graduate students have a high job placement record, and many return to the companies where they interned.

Dolan has also created a graduate student fellowship, whereby a graduate student connects with a company to intern with and completes some of his or her grad work there. The company gets a chance to see the student and may pay for some or all of the student’s research or grad school.

“It’s a win-win situation,” Dolan said. “Students see both the industry and academia. The companies win because they get to see the student before making an offer, and it’s cheaper for them to not have to hire someone full-time.”

This couldn’t have worked out any better for Dolan’s former graduate student Dharmendra Mishra. Upon finishing his master’s degree in 2007, Mishra immediately began a doctoral program. He attended the annual meeting of the Institute for Thermal Processing Specialists with Dolan, who introduced him to Ferhan Ozadali, principal research and development scientist for Nestle, the world’s largest food processor.

“They offered him an internship right then and there,” Dolan said with a smile. “After just two years into his Ph.D. and 11 months interning at Nestle, they offered him a full-time job and paid for the rest of his education. It really doesn’t get much better than that.”

The success doesn’t end there. Janice Harte, visiting associate professor in the Department of Food Science and Human Nutrition, occasionally works alongside Dolan and his students and help encourage these students to reach their high levels of achievement. Another part of Harte’s position is working through the MSU Product Center with entrepreneurs on nutritional label preparation.



“Part of my position, funded through Project GREEN, is research, and that allows me to work with Kirk’s students,” Harte explained. “Working with them prepares them for future careers because it teaches them everything from the seed of an idea to making a product that would be successful out in the marketplace.”

Dolan said his Extension appointment and Harte’s work with the Product Center allow them to maintain strong connections with industry. “Because of those connections, all of my students are working in what they did at Michigan State,” he said. “They all have jobs in their field. And that tells me that I’m doing the right thing.”

INVESTMENT IN LAB COULD LEAD TO MORE OPPORTUNITY

Some may say that Kirk Dolan’s successes are connected to his work at the Fruit and Vegetable Processing Center at Michigan State University. Others would say that he’s successful despite the lab. Much of his equipment is old and needs constant attention to keep it in running order.

A greater investment in Dolan’s lab could lead to more and better research, outreach and training.

“We do the best we can,” Dolan said. “The larger equipment is somewhat outdated. I do my best to at least make sure it’s maintained and cleaned. Newer equipment would prepare my students better for when they begin working for industry.”

Not only Dolan’s students but Michigan residents would benefit from new equipment. Dolan explained that the Meat Lab and the Dairy Processing Center at MSU are up-to-date facilities funded by different initiatives.

“Those two are great examples of what can be done when we invest in our research facilities,” Dolan explained. “They both do excellent teaching and research, and sell their goods to the public. It’s important that we train our students in food processing for fruits and vegetables. It would be nice if we could also have some upgrading of our equipment to improve our teaching and research capabilities. We’re really missing an opportunity there.”



THE DEPARTMENT OF
Entomology

Project GREEN infrastructure dollars supported the development, delivery and adoption of integrated pest management (IPM) for insect and nematode pests of forests, organic agriculture, small fruit, field crops, tree fruit, turfgrass and greenhouse crops, and vegetables, and resulted in reductions of pesticides applied and increased growers’ profits.

Through MSU research and Extension programs, the department delivered information to IPM practitioners in a readily accessible form. The IPM program was also able to build public interest and understanding of IPM within an ecosystem approach and collaborate in activities encouraging adoption of IPM practices.

- Some of the department’s other accomplishments through Project GREEN funding included:
- Producing regional pest alerts and similar documents for spotted-wing drosophila.
 - Continuing on-farm trials of an organic formulation of entomopathogenic nematodes to reduce populations of codling moth.
 - Contributing to the MSU response to two new insect-transmitted blueberry virus diseases detected in Michigan.
 - Identifying IPM alternatives to pesticides targeted for increased use restrictions and/or label removal by the U.S. Environmental Protection Agency as a result of the Food Quality Protection Act.
 - Evaluating differences in ash tree resistance to emerald ash borer and recently publishing a paper showing that blue ash is relatively resistant to EAB.

THE DEPARTMENT OF
Food Science and Human Nutrition

Project GREEN support is critical in maintaining the department’s ability to provide pilot-scale processing and research and development for Michigan plant commodity groups and growers. Most of the machinery and equipment in the Fruit and Vegetable Lab is more than 30 years old. Without Project GREEN funding, lab managers would not be able to maintain and service the aging equipment in this lab or in the milling and baking labs for the MSU wheat quality testing project. The Wheat Quality Lab is key to exploring extruding technology that helps create value-added products from Michigan-grown wheat.

Project GREEN funding is also critical to supporting the Food Sensory Laboratory through maintenance of equipment, purchase of sensory software and licensing for computers, and student assistance to maintain equipment and facilities.

- Other projects that benefited from Project GREEN funding were:
- Canning quality of Michigan bean breeding lines.
 - Value-added dried product from apple processing waste.
 - Pilot plant support for drying of chestnuts by Michigan chestnut growers.
 - USAID-funded beans extruded products project for Africa.
 - Other small projects supporting producers and commodity groups.

THE DEPARTMENT OF
Forestry

With funding from Project GREEN, the department was able to provide critical infrastructure support for the AgBioResearch Tree Research Center and projects based there. The funding allowed researchers there to establish the first phase (10 acres) of a planned 60-acre hybrid poplar bioenergy plantation that will supply the MSU power plant with wood chips, a renewable energy source. This operational level project will be an important testing ground and demonstration site for other landowners in the vicinity who may want to grow fast-growing poplar for bioenergy production.

- These are some of the other Department of Forestry projects benefitting from Project GREEN funding:
- Bioenergy supply chain and logistics.
 - Treatment options for and variation in ash species resistance to emerald ash borer.
 - Tree seedling responses to biochar amendments.
 - Improved Scotch pine for Christmas trees.
 - Installation of deer fence at the MSU Forest Biomass Innovation Center in the Upper Peninsula.



THE DEPARTMENT OF
Geography

The use of the Enviro-weather website (enviroweather.msu.edu) continues to grow. Since its launch in 2006, data requests and visitor hits have grown from fewer than 500 per day to an average of 11,432 per day, an increase of more than 2,200 percent in 2012, and an increase of 5.5 percent over 2011. Although resource limitations prevent unrestricted growth, targeted expansion continues. Three new stations were added to the network: McMillan/Newberry in the Upper Peninsula, Flint and Oshtemo (near Kalamazoo). There are now 78 active automated weather stations in the Enviro-weather network.

- Some accomplishments thanks to Project GREEN funding are:
- Enviro-weather staff members participated in more than 20 conferences, workshops, meetings and symposiums in 2012 and early 2013 and gave presentations and updates, presented posters and distributed materials to educate users about the availability and benefits of Enviro-weather.
 - Two new commodity-specific tools were added this year, including a new interactive potato maturity and stress graphical tool.
 - Cellular modems were replaced at 24 Enviro-weather stations.
 - Enviro-weather offered its first premium service, a frost alarm, in 2012. The alarm helps growers avoid potential damage by alerting them of impending frost.

THE DEPARTMENT OF Horticulture

The MSU AgBioResearch Horticulture Teaching and Research Center conducted 106 research projects on its 180 acres, thanks to funding from Project GREEN. The facility is a prime location for research and outreach-related activities because of its close proximity to the MSU campus and its varied soil types.

The teaching orchard plantation was key to obtaining federal funding for a study conducted by an interdisciplinary team from Michigan State University, Washington State University and Cornell University on solid-set delivery of crop protection chemicals. The researchers' long-term goal is to help growers better manage chemical inputs, improve pest and crop management, and reduce labor and fuel costs, thereby enabling tree fruit producers to remain globally competitive and environmentally responsible.

Many other projects benefited from Project GREEN funds, including:

- Quantifying carbon sequestration potential in landscape systems.
- Developing best management practices for growing vegetables on green roofs.
- Student Organic Farm year-round farming and organic farmer training program.
- Worm composting and composting of campus food scraps for cycling nutrients.
- Grafting rootstocks.
- Emerald ash borer research.
- Effects of sugarbeet crop rotation systems.
- Cabbage strip tillage and mulch effects.
- Nematodes and soil under carrot production.
- Flower germ plasm.
- Tree transplant study.
- Irrigation with hybrid asparagus.

THE DEPARTMENT OF Plant Biology

Project GREEN funds were used to provide information technology (IT) support for several large genomics and bioinformatics projects. Several faculty members in the department conduct research that uses bioinformatics and genomics and rely heavily on the use of servers for computation. Because of the specialized programs used in this research, they cannot use the university computing facility but must maintain their own. More than half of the IT person's time is spent working with faculty members and maintaining the infrastructure that allows them to conduct their research.

With the help of Project GREEN infrastructure funding, the Department of Plant Biology was able to allocate funds to IT support that has allowed faculty members to generate more than \$10 million in external research grants that meet Project GREEN objectives and priorities.





Outreach and Education Through MSU Extension

Project GREEN fosters collaboration between research and education delivery to key audiences by supporting MSU Extension educators throughout the state.

- Three biomass pelleting demonstrations, one on-farm, were conducted to teach participants how and why densification of biomass may be a necessary step in the handling and logistics of biomass for energy production. Conducting demonstrations with the portable biomass pellet mill and the portable biodiesel unit helped MSU Extension educators develop support networks for these conversion technologies. The networks provided access to resources and expertise to improve the technology and the demonstrations.
- In the Upper Peninsula, educators and researchers compared multispecies and monoculture cover crop systems to improve soil fertility and crop performance. They determined that oat yields increase more following Nitrogen Builder, a multispecies cover crop, than following most single-species cover crops.
- Educators in southwestern Michigan determined that there is no statistically significant difference in corn leaf diseases between disease-resistant and susceptible corn hybrids. Further, areas treated with fungicide showed no differences when compared with untreated controls. Because these studies were conducted during the 2012 drought, further investigation may be necessary.

Some specialized educators who work with key plant agriculture industries receive operating funds from Project GREEN.

- One educator reported helping 740 people evaluate biodiesel production systems and increasing knowledge of residents about alternative energy.
- Two educators made fertilizer recommendations for Christmas tree growers and worked with them to improve disease management. Because of this work, growers reported increasing their collective income by more than \$1 million by selling trees that otherwise would have gone unharvested. The Extension duo also helped growers reduce pesticide and phosphorus use and save nearly \$30,000 in unnecessary applications.

IPM ACADEMY

MSU Extension educators continue to invest funds into the highly successful IPM Academy. This two-day program covers the fundamentals of integrated pest management (IPM) and identifies resources and technology for sustainable agriculture practices. Following a successful pilot program in 2012, more than 20 educators and specialists collaborated to redesign the program to include agriculture educators and public and private sector crop advisers as well as growers. In 2013, 52 percent of participants reported that skills learned there helped improve the financial viability of their businesses by reducing management costs or increasing their pest-detection skills. Another 44 percent said it improved their position at their jobs.



WWW.MSUE.MSU.EDU

MSU Extension works to increase farmers' success while protecting the environment, ensuring food safety, helping Michigan crops reach new markets and advancing agriculture through applied research.

MSU EXTENSION NEWS DIGESTS

Project GREEN funding helps support communications professionals responsible for disseminating MSU Extension Digests (formerly Crop Advisory Team Alerts). The digests -- electronic newsletters featuring educational articles written by educators and specialists -- help keep farmers, horticulturists, landscape professionals, gardeners, turfgrass professionals and others current on information relevant to their businesses. (Visit bit.ly/MSUENews,

and follow the prompts to get customized digests.) More than 6,500 people receive the digests; many receive multiple digests focused on plant agriculture.

In addition, the articles generated by educators are available on the MSU Extension website (www.msue.msu.edu) and are used by about 200 media outlets each month.

“The beauty of Project GREEN is it allows me to be responsive to growers and the industry needs. We have new problems now that we didn’t have in the past. Without Project GREEN I wouldn’t have the resources needed to develop solutions needed to solve current issues the industry faces.”

MARY HAUSBECK, MSU DEPARTMENT OF PLANT, SOIL AND MICROBIAL SCIENCES



PROGRAM SUMMARIES

It takes strong research and outreach to keep up with the production of more than 300 agricultural commodities in the state. That’s why Project GREEN helps fund key programs that support the research agendas of growers throughout the Michigan. This ensures that entrepreneurs and others can tap into world-class research and outreach to help grow the economy and keep our land productive.

MSU Land Management Office

The MSU Land Management Office invests Project GREEN funds in key areas that help keep AgBioResearch research centers operating at full capacity. Farm managers invest Project GREEN infrastructure dollars in new equipment and skilled labor. In 2012-13, Project GREEN funds were used to close operating budget gaps for plant-based research centers and to buy a truck and a utility vehicle that workers use for travel to and between research plots.

Many research center projects have benefited from Project GREEN dollars in the past year. For example, the Northwest Michigan Horticultural Research Center near Traverse City had more than 60 projects on topics such as:

- Using native pollinators for fruit crops.
- Improving crop pollination in cherries and apples.
- Conducting multiple insecticide and fungicide effectiveness trials in cherries.

At the Clarksville Horticultural Research Center in Clarksville, Project GREEN were invested in operating expenses necessary to complete key research such as cherry breeding. The Center was able to breed new, superior sour cherry varieties that have improved fruit quality and disease resistance and should yield consistently for years. In addition, research at the Center will continue to seek new cherry variety candidates with the potential to become commercial cultivars in Michigan.

Field station researchers at the Trevor Nichols Research Center near Fennville conducted insecticide screening trials that provide baseline data to support MSU Extension application recommendations. A rainfall simulation chamber also allowed researchers to create new recommendations to fruit farmers for best practices in response to precipitation. Both sets of recommendations are available to producers in the *Michigan Fruit Management Guide* in the MSU Extension Bookstore (bookstore.msue.msu.edu).

Enviro-weather

Enviro-weather is a comprehensive network of weather stations strategically located throughout the state. The network, and programs developed using the data the network provides, help producer-users make management decisions about plant production and natural resources management. Since Enviro-weather’s inception in 2006, data requests and visitor hits have grown from less than 500 per day to an average of nearly 11,500 per day, an increase of more than 2,200 percent.

Given the high number of abnormal weather events in 2012, there was a surge in public and industry interest about climate variability and change. Operating dollars provided by Project GREEN allowed Enviro-weather codirector Jeff Andresen to give 34 presentations on climate trends and impacts in the Great Lakes Region, many of which included Enviro-weather data.

Project GREEN funds led to many accomplishments the Enviro-weather program probably wouldn’t have been able to achieve without it, including:

- Two new commodity-specific tools were added to the network. These additions filled “holes” in coverage for all commodities, especially for potatoes, sugarbeets and fruit.
- Enviro-weather offered its first premium service, called Frost Alarm, in 2012.
- In response to continued user feedback, Enviro-weather made a major investment (including hiring an outside programmer), to develop the ability to automatically replace any missing data with accurate and reliable estimates. This will help to vastly improve the accuracy and reliability of all models and tools on Enviro-weather.



Keeping it clean: MDARD partnership fuels Michigan economy by making way for trade

Mike Bryan isn't an economist, but he understands the financial implications of having a truckload of fruit left to rot at the border because the fruit grower or shipper lacked the paperwork to let the truck cross international trade lines. That's why he works diligently every day to ensure that Michigan-grown plant material is up to snuff and can be exported to other states and countries.

Bryan, nursery and export program specialist for MDARD, is charged with researching

the trade requirements of all 50 states and multiple countries and helping Michigan growers determine if they meet the requirements to sell food, ornamental and nursery plants across state and national lines.

"Basically, my job is facilitating the industry's access to foreign markets," Bryan explained. "We make sure that plant material that leaves Michigan doesn't contain pests or diseases that would harm plants, animals or people in another environment."



Bryan's job, and that of numerous colleagues, is part of MDARD's Phytosanitary Initiative—a Project GREENE-supported program that helps identify which pest surveys must be conducted to certify that commodities are being exported from pest-free zones and pest-free production sites to meet international standards for phytosanitary measures.

"In the world of trade, export to another country or state is good for your business," Bryan said. "Michigan producers do a good job of producing high quality products. The Phytosanitary Initiative keeps those avenues of trade open, and part of doing that is making sure that a product meets the requirements of its destination."

Bryan uses MDARD's work with apple growers as a prime example.

"Apple growers want to be able to ship to California," Bryan said. "My role is to work with California to ensure that we have a permit for our apple shippers. MDARD provides a list of shippers that are enrolled in this program. MDARD also provides training to those growers and shippers. They produce apples under certain conditions, and that allows them to ship apples to California after Sept. 1 each year. There's a pest there called plum curculio that, because of its life cycle, you don't see it in apples after the first of September, so apples harvested after that date can be shipped there, provided everyone adheres to the agreement."



THE MICHIGAN DEPARTMENT OF AGRICULTURE AND RURAL DEVELOPMENT (MDARD) works with industry to help facilitate export of commodities from Michigan. These commodities range from apples to cherries to lumber to grain—any plant-based product. MDARD keeps current with other countries' and states' requirements so that Michigan growers can continue to meet market requirements around the world. Keeping up-to-date with requirements and keeping MDARD staff members trained are parts of a project known as the Phytosanitary Initiative.

Project GREENE funding also allows MDARD to maintain a knowledgeable staff.

"If we didn't get Project GREENE funding, this responsibility would probably default to the USDA, and they just don't have the staff. We have 28 field staff members who are trained to issue phytosanitary certificates. I think the USDA has five, and they're concentrated in one area. They wouldn't be able to service the entire state very easily," Bryan said. "By training our staff and keeping them current, we can provide these services throughout the state."

Part of the benefit that MDARD and the Phytosanitary Initiative get from the partnership with Project GREENE is access to Michigan State University experts.

"We're linked to them very strongly," Bryan said. "We rely on them as our advisers. We've worked with several of them over the years to develop programs or procedures so that we could ship our products outside the state."

In the long run, the Phytosanitary Initiative saves the industry money. Expertise at the field level results in a minimal number of shipments held up, and programs open up markets to growers that they wouldn't normally pursue.

"That's the biggest benefit MDARD gets with partnering with Project GREENE and MSU. Industry comes first, we serve them," Bryan said. "We're here to facilitate their trade and keep the economy moving."



Plant Biotechnology Research and Outreach Center

The MSU Plant Biotechnology Research and Outreach Center (PBROC) offers research support to specialty crop producers in Michigan, as well as outreach programs that deal with molecular breeding and the environmental biosafety of genetically engineered crops. With funds from Project GREEN, the PBROC was able to:

- Serve Michigan Blueberry Growers Marketing/Berryblue LLC by performing micropropagation work on blueberries.
- Participate in research projects with multiple principal investigators and one Michigan blueberry grower.
- Collaborate on a USDA National Institute of Food and Agriculture Foundation-funded project with researchers from the MSU School of Packaging. This allowed researchers to investigate the impact of nanoparticles and nanoclays on six plant species.
- Train two graduate students in virus-induced gene silencing.
- Earn a high international rank in plant transformation technologies.

In addition, providing the PBROC with infrastructure dollars has benefitted the following projects:

- Genetically modifying blueberries for increased cold tolerance
- Modifying *Camptotheca* (*a tree genus*) to produce important pharmaceutical compounds.
- Transforming dry beans to improve yields and biotic and abiotic stress tolerance.
- Conducting functional analysis of gene expression in dry beans to develop cultivars with improved drought tolerance.
- Developing protocols for efficient genetic transformation and regeneration for apples improvement.
- Using sweet cherry micropropagation techniques for improved evaluation of new germ plasm and cultivars.
- Refining protocols for efficient genetic transformation and regeneration of soybeans for improved insect and virus resistance.

MSU Product Center, Food Ag Bio

The MSU Product Center provides business services to entrepreneurs to help them develop and commercialize high-value, consumer-responsive products and businesses in the agriculture, natural resources and bioeconomy sectors. The Product Center does this by using its network to counsel clients and provide a bridge between entrepreneurs and support services such as business, marketing, technical and scientific resources.

The MSU Product Center used its Project GREEN investment to collect data related to both third-party certification and local government finance and taxation and their implications for local producers. Without these funds, the Product Center would not have been able to conduct 36 counseling sessions with 20 clients, create or retain 130 jobs, assist three groups to incorporate cooperatives, and train 30 cooperative directors and managers about communications in cooperatives.

The Center invests Project GREEN funds to maintain Michigan Market Maker (mimarketmaker.msu.edu), a web-based resource that links those who want to buy food (such as processors, wholesalers, retailers, restaurant owners and food service providers) with those who sell food (such as producers, farmers' markets and consumers).

Granting Green

Looking Forward: 2013-14 Grants:

Project GREEN awarded \$1.8 million grant dollars to 35 new research and outreach projects for the 2013-14 fiscal year.



Apples for 21st century MI: Preventing early bloom
· STEVEN VANNOCKER

Assessment of multiple-fungicide resistance in small fruit pathogens in MI using a new well-plate assay
· ANNEMIEK SCHILDER

Bee attractants for improved pollination of Michigan apple, blueberry and cherry
· JULIANNA WILSON

Biochar amendments in sandy soils: evaluating effects on soil moisture, nutrient losses, and tree seedling growth
· JESSICA MIESEL

The birth, evolution, and death of pathogenicity: Alternative splicing as a mechanism of regulated virulence in plant pathogens
· BRAD DAY

Combating spotted wing drosophila in Michigan berry crops
· RUFUS ISAACS

Comparative evaluations of phytotoxicity and efficiency of new herbicides for grapes
· DIANE BROWN-RYTLEWSKI

Contamination and removal of engineered nanoparticles on fresh produce surfaces
· WEI ZHANG

Delivering IPM information to cherry and apple growers in a mobile world: a pilot project with application for all Michigan growers
· JOY LANDIS

Delivering tools to floriculture producers to combat a new downy mildew
· MARY HAUSBECK

Demonstration, education, and outreach to enhance Michigan's hops industry
· ROB SIRRINE

Developing a pocket guide for IPM scouting in strawberries
· ANNEMIEK SCHILDER

Developing methyl bromide alternatives for the fresh market vegetable industry
· MARY HAUSBECK

Developing strategies to reduce bacterial canker in MI cherry orchards
· GREGORY LANG

Development and delivery of effective entomopathogenic fungi and nematodes for managing high tunnel tree and small fruit insect pests
· MARK WHALON

Development of an IPM program for two celery insect pests in Michigan
· ZSOFIA SZENDREI

Development of genetic stocks for cucumber fruit resistance to Phytophthora capsici
· REBECCA GRUMET

Development of non-destructive technologies for rapid, early detection of emerald ash borer
· SOPHAN CHHIN

Drought recovery response of alfalfa to potassium and phosphorus
· KIMBERLY CASSIDA

Effects of drought and traffic stresses on physiological responses and use characteristics of creeping bentgrass and annual bluegrass
· EMILY MEREWITZ

Effects of higher polyamines on abiotic stress tolerance of creeping bentgrass
· EMILY MEREWITZ

Impact of field piling and the maus handling system on sugarbeet storability
· RANDOLPH BEAUDRY

Improve Michigan soybean for resistance to sudden death syndrome
· DECHUNG WANG

Improving productivity of urban gardens in three Michigan regions through education and outreach using information compiled through field and greenhouse research
· MARY HAUSBECK

Long-term management of glyphosate/ALS-resistant palmer amaranth in Michigan field crops
· CHRISTY SPRAGUE

Management of apple orchard floors to minimize pests and maximize beneficials
· MATTHEW GRIESHOP

MSU-conducted and coordinated industry wheat evaluations for wheat quality testing of advanced lines
· PERRY NG

Monitoring and management of spotted wing Drosophila in cherries
· LARRY GUT

Monitoring for brown marmorated stinkbug and other potential invasives
· LARRY GUT



New disease problems threaten the MI onion industry
· MARY HAUSBECK

Optimizing controlled atmospheric and air storage of Honeycrisp apples
· RANDOLPH BEAUDRY

Resuscitate your soil: identifying factors to improve plant production via soil health
· KURT STEINKE

The soil health initiative: crop rotations for enhancing soil health, plant health, and disease management in potato production
· WILLIAM KIRK

SNP marker identification for pre-harvest sprouting resistance in wheat
· RUSSELL FREED

Tactics for sustainable grape berry moth management in vineyards
· RUFUS ISAACS

Understanding factory that affect color retention of black dry edible beans
· CHRISTY SPRAGUE

Understanding the genetics and mechanism of scab resistance in potatoes
· RAY HAMMERSCHMIDT

Utilizing sulfur to improve the nitrogen use efficiency of corm production
· KURT STEINKE

Understanding environmental effects on fungicide uptake and efficacy in blueberries and grapes to optimize the cost/benefit ratio
· ANNEMIEK SCHILDER

Uptake of pharmaceuticals by corn from soils amended with biosolids
· HUI LI

Vineyard of the future
· TOM ZABADAL



Plant Coalition

Directors’ Action Team

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

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Industry Partners

Project GREEN is a grassroots-driven initiative that was endorsed by agriculture commodity groups when it was presented to Michigan legislators in 1998. Grower-led organizations continue to help direct Project GREEN activities by submitting their research and Extension priorities to address critical and emerging issues affecting their industries. Scientists submit competitive grant proposals that directly meet those needs.

- Celery Research Inc.
- Corn Marketing Program of Michigan and the Michigan Corn Growers’ Association
- Great Lakes Canola Association
- Growing U.P. Agricultural Association
- Michigan Apple Research 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

Special Thanks

NATASHA BERRYMAN, JACKIE DESANDER, BEV RIEDINGER
MSU AgBioResearch

PATTY ADAMS, ALYSSA BERNARDI, SARAH FINLEY, MALLORY FOURNIER, MINDY MAXWELL PRATT, AMANDA MITCHELL, BETH STUEVER
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