PENNSYLVANIA
VEGETABLE GROWERS

NEWS

March 2022 / Volume 45 Number 3

for the commercial vegetable, potato and berry grower

PVGA to Fund 13 Vegetable and Small Fruit Research Projects

This year, the Pennsylvania Vegetable Growers Association will contribute $42,823 towards vegetable research and $10,726 for small fruit research. The Board of Directors budgeted $44,000 from the Association's General Fund for vegetable research and $14,000 for small fruit research. They also asked Pennsylvania PVGA members to again consider making special donations to the Association to increase the amount of funding available for research. Members have responded by donating almost $2,600 to this research fund with $1,962.50 being designated for vegetable research and $277.50 for small fruit research. Because the projects selected for funding this year were less than the amount budgeted, the research donations will be carried over and added to the research funds available for next year. This year's contributions put PVGA's funding for research over the past 34 years at $1.36 million.

The following eleven vegetable projects are being funded in conjunction with the Vegetable Marketing and Research Program, which will contribute $26,000 towards the $68,823 total cost of the projects. The projects approved for funding with their objectives are listed below.

Impact of Management Practices on Soil Health Indicators in Conventional and Organic Vegetable Cropping Systems
(multiyear- Year 3)
Dr. Gladis Zinati, Rodale Institute
$5,000

- to assess soil chemical and biological properties in soil samples taken in 48 pots.
- to disseminate the results to growers using various educational venues. These activities include, but are not limited to, an annual field day, a web article posted on Rodale Institute's website, an article in a PVGA newsletter, and an online seminar in 2022.

Are Organic Herbicides Effective for Burndown Prior to Crop Establishment?
Dwight Lingenfelter and John Wallace, Penn State University
$1,867

- to examine various OMRI approved herbicides to determine their effectiveness on burndown weed control.
- to evaluate these herbicides compared to competitive, non-OMRI approved products.

Continued on page 4

NEWS

NEWS

PVGA Directors Visit Legislators, Hold Spring Meeting

The PVGA Board of Directors held their spring meeting in the state Capitol in Harrisburg on Monday, March 21. Prior to the meeting, members of the Board meet with Chris Ramsey in the office Sen. Lisa Baker to discuss the Association's concerns with stormwater fees that some municipalities are imposing on farmers. Sen. Baker has introduced SB 637 that provides for more reasonable stormwater fees for farms.

They also met with Sen. Scott Hutchinson who chairs the Senate Finance Committee. While they discussed all the Association's 2022 State Legislative Priorities, they especially noted the priority dealing with making Pennsylvania income tax laws consistent with federal tax regulations regarding Section 179 business deductions. Currently, the amount allowed for business equipment deductions is different for state and federal taxes, requiring business owners to maintain two depreciation schedules. They also discussed the Association's number one issue – seeking to eliminate the need for H-2A employers to pay state unemployment taxes. H-2A workers cannot collect unemployment benefits but employers are still required to pay state unemployment taxes on their wages. No federal unemployment taxes are due and PVGA is advocating that they be exempt from state unemployment taxes as well.

Additional visits with state representatives were also planned, but at the last minute the House leaders cancelled the House sessions for the week so those appointments were cancelled. The Directors did deliver copies of the Association's 2022 State Legislative Priorities to the offices of about 75 legislators in the Capitol. Copies are mailed to the rest of the legislators later in the week.

The Association's State Legislative Priorities adopted by the Board of Directors are as follows:

Unemployment Compensation for H-2A Labor – Unlike Pennsylvania, many states follow the Federal guidelines that clearly state H-2A employers are exempt from unemployment contributions for H-2A workers. The H-2A program is already very expensive and employers are required to provide a 75% guarantee of the workers' contracted wages. Moreover, the employees usually are not in the country long enough to collect any benefits. We strongly support exempting H-2A employers from making unemployment contributions on H-2A wages.

High Tunnel Stormwater Management Requirements – Recent exemptions for high tunnels from stormwater management plan requirements do not cover many farm situations because the farms currently have very limited amounts of impervious area.

Municipal Separate Storm Sewer System Regulations – Stormwater fees being imposed by local governments need to account for the water absorbing capacity of farmland and should be reduced accordingly for farmland.

Business Depreciation Deduction Limit (Section 179) – The state limit should be consistent with the federal limit so different depreciation tables are not needed.

Farmers' Market Nutrition Program - Both the Women, Infant and Children (WIC) and low-income senior citizens coupons have greatly increased farm market sales while providing nutrition to needy Pennsylvanians.

Penn State Agricultural Extension and Research Appropriations - Funding for Penn State Extension and Research is critical to maintain agriculture's cutting edge and should be continued at least at current levels. The vegetable and berry industries have given over $1.97 million to research in the past 31 years, but we need the extension and research infrastructure that is supported by state appropriations.

Broadband Internet Access – High-speed broadband internet access has become a necessary utility for small businesses like our members' farms to be competitive in today's marketplace. The state should make every effort to accurately identify those areas of the state that do not have general access to such high-speed service so that resources can be focused on alleviating this deficiency.

At their spring meeting the Directors discussed the following issues:

- approving the contract with Troxell Administrative Services for April 2022 to March 2023;
- advertising the Executive Director's position in preparation for Mr. Troxell's retirement
- using the Keystone Fund earnings designated for research in 2020 and 2021 to fund the General Fund research allocations;
- establishing a potato research line to potentially fund specialty potato variety trials
- establishing a Food Safety Committee and a Labor Committee to focus on these important areas of government regulation.

Since a quorum was not present at the meeting, the decisions at the meeting will need to be submitted to the other Directors for their approval.

PVGA Prepares for Transition and Retirement of Executive Director

With great appreciation for his leadership and vision, the Pennsylvania Vegetable Growers Association (PVGA) officially announces the planned retirement of its Executive Director, William Troxell. While Mr. Troxell's impending retirement has been publicly known for some time, no official announcement and job posting have been published previously. Mr. Troxell's plan to retire at the end of 2023 will complete a remarkable 40 years of service to PVGA.

Rita Resick, PVGA President, stated, "Family farms across Pennsylvania and surrounding states that grow vegetables, potatoes, and berries have benefited from Bill Troxell's leadership in keeping our issues and concerns before lawmakers, his involvement in supporting vegetable and berry research, and his efforts to keep us informed with his monthly newsletters and weekly email updates about all issues related to growing — legislative actions, grant opportunities, food safety and other training, best growing methods, and pest alerts and controls developed both at Penn State and by regional suppliers." Bill Reynolds, PVGA Secretary-Treasurer, added, "PVGA Board is especially grateful for Mr. Troxell's guidance that maintained membership and financial stability over the years despite the loss of farms to retirement and development and, over the past two years, during the pandemic."

Mr. Troxell devoted much of his time to the two events for which PVGA is known. In January at the Pennsylvania Farm Show in Harrisburg, he oversaw the planning, setup, management and teardown of the popular PVGA Food Booth staffed by over 200 members and friends. He is also a key player in co-producing one of the premier events designed for fruit and vegetable growers in eastern United States – the Mid Atlantic Fruit and Vegetable Growers Convention in late January or early February. PVGA co-sponsors this event with four other grower organizations. Working with Maureen Irvin, Executive Secretary of State Horticulture Association of Pennsylvania and the overall Convention Coordinator, these two executives work to fill the Hershey Lodge with over 2,000 attendees to learn about growing and marketing their products – from presentations of university experts from Penn State and across the country, from suppliers, buyers, and other growers. These events enable PVGA to not only support itself, but also to contribute over 1.3 million dollars to various vegetable and small fruit research over the past 33 years.

Continued on page 6

NEWS

PVGA to Fund 13 Vegetable and Small Fruit Research Projects *continued from page 1*

Potential Herbicide Programs to Control Problem Weeds in Pumpkin

Dwight Lingenfelter and John Wallace, Penn State University

$1,869

- to examine various pre and post herbicide programs in pumpkin (i.e., novel concepts vs. standards) to determine their effectiveness on weed control.
- to evaluate these herbicide programs on pumpkin injury and yield impact.

Improving Onion Center Rot Management Through More Precise Topping at Harvest

Beth K. Gugino and Jennie D. Mazzone, Penn State University

$3,000

- to develop a recommendation to help growers safeguard bulbs from bacterial disease through precision hand-topping at harvest.
- to develop a picture tool to help growers rapidly assess when to harvest based on disease severity and its proximity to the bulb.

Evaluating the Efficacy and Safety of Pyridate in Snap Beans

John Wallace and Dwight Lingenfelter, Penn State, University; Lynn Sosnoskie, Cornell University; Mark VanGessel, University of Delaware

$3,570

- to evaluate the efficacy and safety of pyridate for commercial snap bean production.
- to evaluate two formulations, Tough EC (an emulsifiable concentrate) and Lentagran WP (a wettable powder).

In-Row Cultivation Using Camera Guidance Technology in Snap Bean

John Wallace and Tosh Mazzone, Penn State University

$1,248

- to evaluate cultivation timing of in-row cultivation with finger-weeders and camera-based guidance to optimize weed control and minimize crop injury.

Assessing the Ability of Tomato Communities to Suppress Disease in a Transplant Setting

Kevin L. Hockett, Penn State University

$8,350

- to passage a natural community for 8-10 transfers to select for bacterial spot suppression.
- to evaluate the ability of the disease suppressive community developed in objective 1 to suppress bacterial spot in a tomato transplant production setting.

Evaluation of Rootstock-Scion Interaction and Yield Performance in Fresh-Market Tomato Grown in High-Tunnel

Timothy Elkner, Andrew Blunk and Francesco Di Gioia, Penn State Extension and University

$9,919

- to evaluate the performance of two fresh-market tomato varieties grafted onto four commercial rootstocks examining the rootstock-scion interaction effect on plant growth, nutrient uptake, yield, and fruit quality in a high tunnel under PA environmental conditions.

Keeping PA Vegetable Growers Profitable: Statewide Cultivar Trials

Elsa Sánchez, Robert Pollock, Timothy Elkner, Thomas Butzler, and Megan Chawner - Penn State University and Extension

$20,000

- to evaluate early maturing, determinate, large, red, slicing tomatoes.

Breeding Processing Tomatoes for Production in PA

Majid R. Foolad, Penn State University

$6,000

- to evaluate a total of 40 PROC tomato F1 hybrids with EB resistance.
- to evaluate 56 PROC tomato F1 hybrids with EB + LB resistance.
- to continue development and evaluation of elite inbred lines of PROC tomato with EB resistance.
- continue development and evaluation of elite inbred lines of PROC tomato with EB + LB resistance.
- to establish and continue a project to identify and map genes for bacterial canker resistance to be used for breeding purposes.

Continued on page 6

*The **Pennsylvania Vegetable Growers News** is the official monthly publication of the*
Pennsylvania Vegetable Growers Association, Inc.,
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Our Mission:

The Pennsylvania Vegetable Growers Association serves Pennsylvania's commercial vegetable, potato and berry growers through education, research, advocacy and promotion.

Our Vision:

The Pennsylvania Vegetable Growers Association will be the driving force in ensuring the future viability of the commercial vegetable, potato and berry industries in Pennsylvania.

Inquiries about membership, this publication or advertising rates should be directed to William Troxell, Executive Director, at the above address.

NEWS

PVGA to Fund 13 Vegetable and Small Fruit Research Projects

continued from page 4

Breeding Fresh-Market Tomatoes for Production in PA

Majid R. Foolad, Penn State University

$8,000

- to evaluate 95 FM large-size F1 hybrids with EB resistance.
- to evaluate 77 FM large size F1 hybrids with EB + LB resistance.
- to evaluate 90 FM grape tomato hybrids with EB and/or EB + FB resistance.
- to evaluate and develop elite large-size FM tomato breeding lines with EB resistance and other desirable characteristics.
- to evaluate and develop elite inbred lines of large-size FM tomato breeding lines with LB resistance and other desirable characteristics.
- to evaluate and develop elite inbred lines of FM grape tomatoes with various desirable characteristics.
- to establish and continue a project to identify and map genes for bacterial canker resistance to be used for breeding purposes.

PVGA will also be funding, on its own, the following two small fruit projects totaling $10, 726, at Penn State University:

Identifying Sources and virulence of Anthracnose Strains Found on Weeds in Strawberry Fields

Leah Fronk, Sara May, Kathleen Demchak, and Richard Marini, Penn State University and Extension and Mengjun Hu, University of Maryland.

$4,739

- to collect weed and fruit samples from four strawberry farms to further evaluate potential weed hosts and attempt to obtain more isolates from the main production season.
- to evaluate the relationship between the species of Colletotrichum isolated from the weeds in the fields and the species isolated from the strawberry plants and fruit.
- to determine whether the isolates obtained from weeds are capable of infecting strawberry fruit.
- to produce a duplicate set of isolates that can be sent to the University of Maryland for fungicide resistance screening.

Comparing Media and Fertilizer Types for Strawberry Fruit and Plug Plant Production

Kathleen Demchak, Timothy Elkner and Krystal Snyder, Penn State University and Extension

$5,987

- to identify media mix and fertilizer combinations that could produce higher yields even with high bicarbonate water sources, and
- to assess media types for production of strawberry plant plugs.

PVGA Prepares for Transition and Retirement of Executive Director

continued from page 3

PVGA's Board of Directors has appointed a Succession Planning Committee to plan for this transition and to organize the recruiting of Mr. Troxell's successor. To promote a smooth transition, PVGA plans for the successful candidate to serve for a transition period of six to twelve months working with Mr. Troxell. For those who may be interested, a job posting for the position is available at https://www.pvga.org/executive-director/.

National News Briefs

USDA Introduces Micro Farm Policy for Farmers Who Sell Locally

The USDA is rolling out a new Micro Farm policy designed specifically for agriculture producers with small farms who sell locally.

The new policy, which will be available beginning with the 2022 crop year, will simplify record keeping and cover post-production costs like washing and packaging commodities and value-added products. The Micro Farm policy is available to producers who have a farm operation that earns an average allowable revenue of $100,000 or less, or for carryover insureds, an average allowable revenue of $125,000 or less.

The Micro Farm policy builds on other RMA efforts to better serve specialty and organic crop growers, which includes Whole-Farm Revenue Protection (WFRP) that provides coverage for producers with larger operations that may not be eligible for the Micro Farm policy.

The Federal Crop Insurance Corporation approved the Micro Farm policy in September.

*From the **Penna. Agricultural Alliance Issues Update**, Penna. Farm Bureau, Februrary 2022.*

AFBF Applauds Supreme Court Decision to Hear Clean Water Act Case

The U.S. Supreme Court announced its decision to hear Sackett v. Environmental Protection Agency, which challenges the EPA's overreach of its Clean Water Act jurisdiction.

American Farm Bureau Federation (AFBF) president Zippy Duvall voiced his support of the announcement on Tuesday.

"AFBF is pleased that the Supreme Court has agreed to take up the important issue of what constitutes 'Waters of the U.S.' under the Clean Water Act," Duvall said in a statement. "Farmers and ranchers share the goal of protecting the resources they're entrusted with, but they shouldn't need a team of lawyers to farm their land. We hope this case will bring more clarity to water regulations.

"In light of today's decision, we call on EPA to push pause on its plan to write a new WOTUS rule until it has more guidance on which waters fall under federal jurisdiction. For the past 10 years, Farm Bureau has led the charge on elevating the issue of government overreach in water regulations. The goal is simple, clean water and clear rules."

The rule proposed back in November by the EPA and Department of the Army would repeal the Navigable Waters Protection Rule (NWPR) and return "waters of the United States" to its pre-2015 definition, which would reinstate the complicated and time-consuming nexus test.

The test determines whether the water in question, either alone or in combination with other similarly situated waters in the region significantly affects the chemical, physical or biological integrity of traditional navigable waters, interstate waters or the territorial seas.

Public hearings on the proposed rule wrapped up last week and a public comment period is now open and will close on Feb. 7. Those interested in submitting comments can do so through the EPA's website.

Read more on the EPA's revision of the definition of WOTUS.

*From the **Penna. Agricultural Alliance Issues Update**, Penna. Farm Bureau, Februrary 2022.*

State News Briefs

Pennsylvania Lawmakers Pass Broadband Bill

The Pennsylvania General Assembly passed House Bill 2071 this week, which will help bridge the digital divide when it comes to rural broadband in the state. The bill will establish the Pennsylvania Broadband Development Authority, that will address the lack of reliable broadband service in rural areas. The bill now heads to the governor for his expected approval.

The bill addresses the need for broadband expansion by creating an authoritative body that can implement a statewide broadband plan, and serve as a point of contact for entities that look to expand or start new services. The Broadband Development Authority will also oversee the allocation of federal dollars to these projects.

"We are very pleased to see this crucial bipartisan effort to address our lack of broadband access," said PFB President Rick Ebert. "Rural families and farm businesses have been under served, and the need to have access to high-speed internet is essential to compete and participate in the digital age."

The bill also puts in place safeguards to ensure that areas that have the slowest internet speeds or lack of access are prioritized, and that money and resources are being distributed to those areas first.

Pennsylvania Farm Bureau advocated for the passage of the bill.

*From the **Penna. Agricultural Alliance Issues Update**, Penna. Farm Bureau, Februrary 2022.*

Agriculture Secretary Announces AgriStress Helpline, Free Mental Health Services For PA Farm Families

Agriculture Secretary Russell Redding and Senator Elder Vogel, Chair of Senate Agriculture and Rural Affairs Committee announced Friday the opening of the AgriStress HelpLine for Pennsylvania, which is a free service available to Pennsylvania farmers and their families seeking mental health support.

The AgriStress HelpLine for Pennsylvania is available 24 hours a day, seven days a week. Farmers can call 833-897-AGRI (2474) to speak to a healthcare professional.

"The agricultural community faces unique challenges. Farmers often work alone, live where they work and encounter pressures of markets, weather, business transitions and legacy," Secretary Redding said. "Stressors can weigh heavily on individuals and families but know that you are not alone. The AgriStress HelpLine is a tool to connect farmers to mental health resources and healthcare professionals, and it emphasizes it is OK to ask for help."

The AgriStress HelpLine for Pennsylvania is supported by National Institute of Food and Agriculture Farm and Ranch Stress Assistance Network grant dollars awarded to the PA Department of Agriculture to carry out programs to address farmer stress and suicide. In addition to the Department's partnership with AgriSafe, these dollars support mental health resources available through the Center for Dairy Excellence, marketing to increase mental health awareness and reduce stigma, and regional collaboration with the National Young Farmers Coalition.

"While farmers are traditionally less likely to seek professional help, it is vital that we connect those in the agricultural community with the necessary resources for them to obtain the help they need when dealing with a mental health issue," Senator Vogel said. "The opening of the AgriStress HelpLine is a major step forward as we seek to provide access to care to a vital population that so often will bear their burdens in silence."

According to the American Farm Bureau Federation, financial challenges, farm or business problems and the fear of losing the

Continued on page 8

NEWS

State News Briefs *continued from page 7*

farm are top contributors to farmers' mental health. Cost, embarrassment, and stigma often prevent farmers from seeking help or treatment for a mental health condition.

"There can be a stigma around seeking help for mental health issues and we need to make farmers aware of all of the tools available to them," said Pennsylvania Farm Bureau President Rick Ebert. "This helpline will provide another resource for farmers to reach out to trained professionals and get the assistance they need."

The AgriSafe Network is a non-profit organization that strives to reduce health disparities in agricultural communities. AgriSafe supports a network of trained agricultural health and safety professionals to provide preventative services for farm families. The AgriStress Response Network seeks to eliminate the stigma around accessing support for mental health including stress, depression, anxiety and suicide.

For more information about the AgriStress HelpLine for Pennsylvania, visit agriculture.pa.gov.

*From the **Penna. Agricultural Alliance Issues Update**, Penna. Farm Bureau, Februrary 2022.*

USDA Announces Heidi Secord as Pa.'s FSA State Executive Director

USDA announced that Heidi Secord has been appointed as Farm Service Agency (FSA) State Executive Director for Pennsylvania. The news came as part of an announcement that introduced a total of eight new appointees to regional USDA positions around the country.

"As we work to build a better America, we need talented and experienced staff working in our state offices," said Agriculture Secretary Tom Vilsack. "We are thrilled to welcome these dedicated individuals to USDA at such an important time in the Biden-Harris administration."

Heidi Secord has over 26 years of farming and regenerative agriculture experience as the owner of the Josie Porter Farm in northeastern Pennsylvania. She currently serves as a farmer member on the Pennsylvania State Conservation Commission, which she was appointed to by Governor Tom Wolf. Secord previously served as the State President for the Pennsylvania Farmers Union and sat on the National Farmers Union Board of Directors. She has engaged in agricultural policy committee work with multiple organizations, including PASA Sustainable Agriculture Board, Pennsylvania State Council of Farm Organizations (PSCFO), All Together Now Pennsylvania, and the Monroe County Conservation District. Earlier in her career, Secord served as a Peace Corps volunteer for three years in Mali and Lesotho. She graduated with a degree in Business Management from the University of Rhode Island.

FSA State Executive Directors oversee Farm Service Agency operations and agricultural policy implementation in the state. Each State Executive Director works with the State Committee to administer FSA programs and County office operations, develops and maintains stakeholder relationships with customers and other agencies and governments.

*From the **Penna. Agricultural Alliance Issues Update**, Penna. Farm Bureau, Februrary 2022.*

Brubaker Farms Receives Pennsylvania Leopold Conservation Award

Brubaker Farms is the 2021 recipient of the Pennsylvania Leopold Conservation Award®.

Given in honor of renowned conservationist Aldo Leopold, the prestigious award recognizes farmers, ranchers and forestland owners who inspire others with their dedication to land, water and wildlife habitat resources in their care.

In Pennsylvania, the award is presented annually by Sand County Foundation, American Farmland Trust, The Heinz Endowments, and Pennsylvania Farm Bureau.

The Brubaker family was revealed as the award's recipients at the Pennsylvania Farm Show in Harrisburg. The dairy and poultry farmers from Mount Joy in Lancaster County receive $10,000 for being selected.

"The Brubaker family provides us with a comprehensive example of how farmers build upon their environmental stewardship successes. Luke, his sons Mike and Tony, and now Josh, have taken the lead in conservation practices and continue to serve as an example of environmentally and community-minded innovation," said Pennsylvania Farm Bureau President Rick Ebert. "The Brubaker's commitment to being good stewards and good neighbors shines through in the overall success of their dairy and poultry farm."

Brubaker Farms is a showcase for agricultural conservation amid more than a half million residents in Lancaster County.

With residential developments bordering its 1,800 acres, Brubaker Farms is where rural-urban interface occurs. Its neatly manicured farmstead is home to 1,300 dairy cows and 52,000 broiler chickens. Despite its size, the farm's public outreach and neighborly farming practices are a selling point when nearby homes are on the market.

Choosing conservation projects with dual economic and environmental benefits has defined the Brubaker's philosophy on land stewardship and growth.

Luke Brubaker and his sons, Mike and Tony, were early adopters of soil health and nutrient management practices, and energy-producing technologies. Their land ethic has been passed on to Josh Brubaker, who recently became the fourth generation with a stake in the farm's ownership.

"Were very humbled to be selected, because there are a lot of other farms that are doing really good things that deserve recognition," said Mike Brubaker. "We care. We care about the community we live in, we care about our team workers on our farm… and we care about healthy, happy animals."

Among the practices implemented on their farm, the Brubakers plant cover crops, practice no-till farming, planted 15 acres of riparian buffers, use an anerobic digester and dragline apply manure on 500 acres. They also produce enough energy on the farm to power 475 homes with their methane digester and solar panels.

"We care about the air quality, the soil quality and the water quality; the resources that we use to take care of our animals and to feed our families and to be a good part of the communities around us," Mike Brubaker said.

As a frequent site for tours on conservation, sustainability, animal welfare and modern farming practices, Pennsylvania's newest Leopold Conservation Award recipient shows the synergy between profit, people, production agriculture and the planet.

*From the **Penna. Agricultural Alliance Issues Update**, Penna. Farm Bureau, Februrary 2022.*

Pennsylvania Phasing in Ban of Invasive Callery Pear

The PA Department of Agriculture added Callery pear, commonly called Bradford Pear to a list of noxious weeds — plants that cannot be legally sold or cultivated in the state. The ban on sale and cultivation will take effect February 9, 2022, with enforcement phased in over two years.

Enforcement of the ban will be phased in over two years to allow time for nurseries and landscaping businesses to eliminate it from their stock and replace the trees with alternatives that pose less threat to the environment and agriculture. The department has established an exemption procedure for breeders who own the rights to varieties that have been researched and proven sterile and will consider exempting these varieties from the ban.

The timeline for the two-year rollout of the ban is as follows:

Winter 2021 – Callery pear added to Pennsylvania's Con-

State News Briefs *continued from page 8*

trolled plant and Noxious Weed list as a Class B weed. Class B weeds are those that are so prolific they cannot realistically be eradicated. These plants are targeted for control measures.

February 2022 – Nursery and landscape businesses will receive notice from the department, advising them to immediately begin adjusting propagation, ordering and planting of Callery Pear to decrease inventory.

February 2023 – The department will issue letters of warning to any plant merchant still selling Callery Pear, providing a date in February 2024 after which remaining inventory will be subject to a destruction order.

February 2024 – The department will issue Stop Sale and destruction orders to plant merchants selling or distributing Callery Pear.

Those with questions should contact ra-plant@pa.gov.

Property owners can find native alternatives and information on how to control the plant on the PA Department of Conservation and Natural Resources website, dcnr.pa.gov.

Find more information about Callery pear and other noxious, controlled and poisonous plants in Pennsylvania, visit agriculture.pa.gov. For comprehensive information about controlling all invasive species in Pennsylvania, visit the Governor's Invasive Species Council.

*From the **Penna. Agricultural Alliance Issues Update**, Penna. Farm Bureau, Februrary 2022.*

Susquehanna River Showing Improvements in Nutrient Pollution

The Susquehanna River is showing long-term reductions in nutrient pollution, according to data recently released by the U.S. Geological Survey and published by the Bay Journal.

According to the Bay Journal, the Chesapeake Bay's three largest rivers – the Susquehanna, Potomac and James – have each shown long-term improvements in nitrogen and phosphorus trends. USGS monitoring also shows short-term improvement covering the past 10 years in the Susquehanna.

The EPA identifies nitrogen and phosphorus loadings as a "regional water quality concern," with excessive levels negatively affecting aquatic life in the Bay. The Susquehanna contributes approximately 44% of the nitrogen load and 24% of the phosphorus load to the Bay, according to the USGS. Of the rivers flowing into the Bay, the Susquehanna drains the largest watershed, with the most farmland and most forest, and delivers more than half of the freshwater reaching the Chesapeake Bay, according to the USGS.

The improvements come as Pennsylvania and other Bay states face a heavy lift in meeting the federally mandated goals for reducing nutrient and sediment pollution in the Chesapeake Bay by 2025. Pennsylvania has developed a detailed Watershed Implementation Plan (WIP), which takes a ground-up approach with counties in the watershed establishing localized action plans for implementing farm conservation measures and other practices to meet water quality goals.

According to the Bay Journal, filling the reservoir behind Conowingo Dam has likely been a contributing factor, but scientists continue to examine data from river monitoring stations in attempts to explain the Susquehanna's improvements. The Conowingo Dam, located near the mouth of the Susquehanna River in northern Maryland, has historically played a role in trapping nutrients and sediment before they reach the bay, but research has since found that the dam is reaching its capacity to trap pollution.

*From the **Penna. Agricultural Alliance Issues Update**, Penna. Farm Bureau, Februrary 2022.*

NEWS

In Memory

Bruce A. Hollabaugh

PVGA member Bruce A. Hollabaugh, 41, of Biglerville passed away peacefully at Hershey Medical Center on Sunday, March 13, 2022, with his family by his side.

Born April 1, 1980, Bruce was the son of Kay and Brad Hollabaugh of Biglerville. Bruce is survived by his wife, Amanda, and their three children, Gabriel, Evangeline, and Fineas; his sister, Ellen Hollabaugh Vranich and her husband Erik and their two children, Cooper and Claire;

Bruce was a graduate of Biglerville High School and Penn State University, with degrees in horticulture and Spanish. Bruce's love of music led him to be involved in the prestigious PSU Concert Choir where he also met his wife, Amanda. Both hort and language skills served him very well as he was co-owner of Hollabaugh Bros. Inc. Fruit Farm and Market near Biglerville. There he held the key responsibility of managing all aspects of production and related personnel and machinery. He created an amazing team of workers who respected him immensely and who will help the family carry on.

Bruce loved horticulture and was very involved with industry organizations. He most enjoyed his service as the chair of the Research Committee of the State Horticultural Association of PA which guided key research for the fruit industry in the Mid-Atlantic region with an annual budget of over $200,000.

Education was always important to Bruce, not only for himself but for our community. He served on the Upper Adams School Board from 2019 until the time of his death. As a member of Trinity Evangelical Lutheran Church in Arendtsville, he also enjoyed music as a member of the church choir, served on the church council, was active in the youth activities of the congregation and in the creation of UACT (Upper Adams Christians Together).

Perhaps most of all, Bruce loved his family and his puppies. Like his wife, Amanda, he spent countless hours sharing his time and service to support the arts, sports, and scholastic activities of his children. In so doing, he also served so many others. Bruce loved to read (he was an expert at Wordle), play board games, hunt, fish, and shoot target and shared all those things with his children.

As an organ donor, Bruce was a hero even in death as his organs saved three other people.

The family requests that contributions in memory of Bruce be made to one of three areas: Endowment Fund of the State Horticultural Association of PA (designated for Research), c/o Maureen Irvin, 480 Mountain Road, Orrtanna, PA 17353; Adams County Community Foundation with the memo to "Canner Funds – Bruce Hollabaugh," 25 S. 4th St., Gettysburg, PA 17325; or Trinity Lutheran Church, 38 N. High St., Arendtsville, PA 17303.

Adapted from the Gettyburg Times, March 15, 2022.

Weekly Pest Management Teleconferences Begin April 20

On Wednesday, April 20 at 12:30 pm EST, Steve Bogash of Marrone Bio Innovations will be starting the third season of weekly pest management education teleconferences. These calls are for growers, retailers and crop consultants. The calls will last 30 minutes and will begin at 12:30 PM EST. The first 15 minutes will be reports on seasonal and active pest management challenges in vegetables and small fruit. Then, we will open the call to discussion and Q & A. The calls will be recorded and accessible thru the playback number below. Guest experts will often be on the calls with a schedule to follow soon.

Please note the call-in and recording numbers have changed for the 2022 season.

Call-In Number: 681-999-0224, Access Code: 832191

Playback Number: 757-841-1091, access code: 832191

All of the 2020 and 2021 recordings are still available. A directory of those recordings is available by contacting Steve Bogash at sbogash@marronebio.com or calling him at 717-877-7105.

This program is organized by Marrone Bio Innovations (MBI), a global supplier of bio-based plant health and pest management solutions. While MBI products may be mentioned, the teleconferences will be focused on pest management education and solutions.

Allium Leafminer Emerging Soon

Timothy Elkner and Shelby Fleischer

Allium leafminer is an invasive fly from Poland first detected in Lancaster County, Pennsylvania in December 2015.

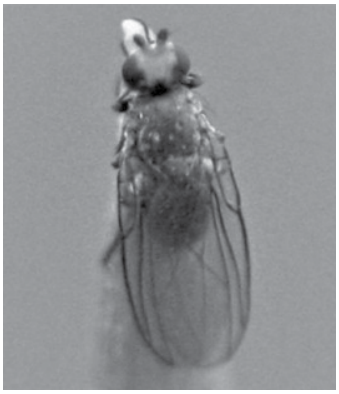


Figure 1. Allium leafminer on scallion leaf. Photo: T. Elkner / B. Lingbeek, Penn State

Allium leafminer (ALM) (Figure 1) attacks plants in the Allium genus including onion, garlic, leek, scallions, shallots, and chives. It overwinters as a pupa in leaf tissue or adjacent soil, emerges in the spring, and adult flight occurs over a 5–7-week period. Females puncture leaves with their ovipositor and both males and females feed on leaf sap. Oviposition results in a characteristic linear series of round wounds (Figure 2). Larval development progresses to the pupal stage but is then delayed as the pupa undergoes summer aestivation, and they do not emerge again until late September for another 5-7-week flight.

Figure 2. Oviposition and feeding scars. Photo: B. Lingbeek, Penn State

Knowing when adults start flying helps with ALM management. You can protect crops by applying netting prior to flight and removing it after the flight-period ends. Another option is to apply insecticides during the flight period, targeting adults and developing larvae. Systemics with an added surfactant tend to work best because the larvae are mining inside the leaf tissue. Since Allium leaves are very waxy, a surfactant is recommended whenever applying insecticides to allium crops. Results from our research trials found that the highest and most consistent control of ALM occurred using foliar applications of dinotefuran (Scorpion), cyantraniliprole (Exirel), spinetoram (Radiant), and spinosad (Entrust) among OMRI-labeled options. Those trials used weekly applications starting as soon oviposition/feeding marks were detected. More recent trials suggest that very good control can be achieved by waiting about two weeks after the first detection.

But when to start? With the support of PVGA and USDA, we developed a degree-day model. We estimate that spring ALM first emerge after 350°Celsius degree-days above a threshold of 1°C, starting from January 1. It's a statistical estimate from field data, a bit rougher than most phenology models, which use controlled lab work, but it's the best we've got because of knowledge gaps for rearing ALM (see Lingbeek et al 2021). In State College, this was when daffodils and forsythia had been blooming for a week, and ornamental pear was in bloom in urban areas.

You can use the Northeast Weather Association (NEWA) to estimate when this occurs for select weather stations.

- Go to https://newa.cornell.edu/, click 'Weather Tools', click 'Degree Day Calculator', pick a site, insert the start date of Jan 1 and end date of today, and insert the degree day type as 1°C. **This is important because you need to accumulate in °C instead of °F for the 350° threshold.** If you use °F, the conversion will mean we need ~650 degree-days (dd).
- You get a chart and below that a cumulative graph. Figure 3 is the graph for Biglerville on March 29, 2022. We are predicted to reach 305 dd by April 3—about 45 dd below 350 and accumulating at 10–15 dd per day. So, on April 3, we are about three days shy of the first emergence using the 15/day rate.
- Thus, emergence in Biglerville will potentially start around April 6-7. This is in the ballpark of when the first emergence occurred in past (Table 1) which has ranged from March 17 to April 27. Of course, this is just the best guess. In years with a warm winter, we saw some exceptionally early initial emergence, about 10

Continued on page 12

VEGETABLE PRODUCTION

Allium Leafminer Emerging Soon

continued from page 11

days before our prediction, but most of the population emerged much closer to our prediction.

Starting now in southeast PA, and within a few weeks in cooler areas, it is the time to start scouting your Allium crops and prepare for management. Finding adults is easiest in the cool temperatures of early morning—look at the tops of the leaves. Finding the feeding scars on leaves is often easier than finding adults, especially on onions, and when scouting during windy conditions. Most of our first detections were in wild garlic, or other weedy alliums, along fence lines or forested borders of farms. Among Allium species, we tend to find more ALM in early spring scallions and green onions, which is also a great place to search.

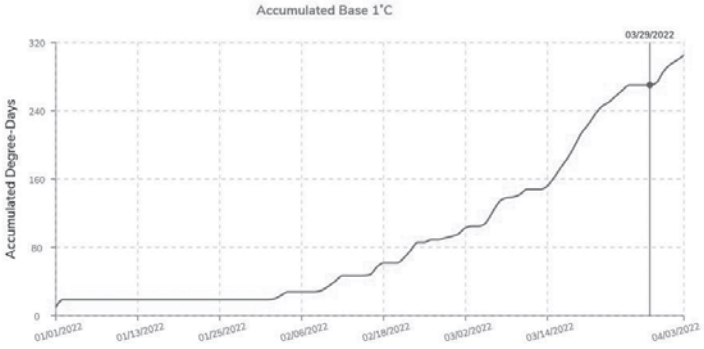


Figure 3: Accumulated Celsius degree days above a base threshold of 1°C, at Biglerville, PA. ALM emergence is predicted to start at 350°C degree days.

Table 1: Date of the first detection of ALM adults or feeding/oviposition wounds in 2019 and 2020.

Location	Date of First Detection
State College, PA	4/13/20
Landisville, PA	3/17/20
Landisburg, PA	3/18/20
York, PA	3/17/20
Hanover, PA	3/17/20
Rock Springs, PA	4/14/20
Millheim, PA	4/14/20
Aaronsburg, PA	4/14/20
Woodward, PA	4/14/20
Lawrenceville, NJ	3/24/20
Milford, PA	3/25/20
Hudson Valley, NY	4/8/20
Landisville, PA	4/18/19
Pottstown, PA	4/18/19
Landisburg, PA	4/16/19
Millheim, PA	4/27/19
Woodward, PA	4/27/19
Aaronsburg, PA	4/27/19
Aaronsburg, PA	4/27/19
Huntington, PA	4/24/19

Citation for Phenology

Lingbeek, B., D. Roberts, T. Elkner, M. Gates, and S. J. Fleischer. 2021. Phenology, development, and parasitism of Allium Leafminer (Diptera: Agromyzidae), a recent invasive species in the US. Environmental Entomology 50(4): 878-887.

Citations for Insecticide Management:

Nault, B. A., L. E. Iglesias, R. S. Harding, E. A. Grundberg, T. Rusinek, T. Elkner, B. Lingbeek and S. J. Fleischer. 2020. Managing Allium leafminer (Diptera: Agromyzidae): an emerging pest of allium crops in North America. J. Econ. Entomol. 113 (5): 2300-2309.

Nault, B. A., K. R. Sandhi, R. S. Harding, E. A. Grundberg, and T. Rusinek. 2022. Optimizing Spinosyn Insecticide Applications for Allium Leafminer (Diptera: Agromyzidae) Management in Allium Crops. J. Econ. Entomol. doi.org/10.1093/jee/toac016

Dr. Elkner is with Penn State Extension in Lancaster Co. and Dr. Fleischer is recently retired from the Department of Entomology at Penn State Univ. *From Penn State Extension, https://extension.psu.edu/2022-pest-alert-allium-leafminer-emerging-soon?, March 30, 2022.*

Shade Cloth for Lettuce Production

Emmalea Ernest

In Delaware, spring lettuce is planted in March and April. Head lettuce should be seeded in March and transplanted by mid-April. Leaf lettuce can be direct seeded in March and April. Lettuce is a cool season crop that grows best at temperatures of 59-68 °F. Temperatures of around 85 °F promote bolting (flower stalk formation) and development of bitter flavor. Some lettuce varieties are less prone to bolting and bitterness when exposed to heat. Heat tolerance information is listed in some seed catalogs and varieties that have shown heat tolerance in Mid-Atlantic trials are indicated in lettuce section of the Mid-Atlantic Commercial Vegetable Recommendations. Because of the high likelihood of temperatures in the 80s during the spring lettuce season, heat tolerant varieties are recommended for Delaware production, especially for later season plantings.

Besides heat tolerant varieties, shade cloth is another tool that can be used to protect lettuce crops from quality loss due to heat stress. In 2018 and 2019 shading experiments were conducted in spring-planted lettuce at the University of Delaware's research farm in Georgetown, DE. The trials were transplanted on April 12, 2018 and April 10, 2019 and shade was applied on May 4 in 2018 and on May 20 in 2019. These experiments were designed to answer several questions:

Can shading reduce bolting and bitterness in spring lettuce?

Overall, shading reduced bitter flavor in both years. Shade cloth effect on bolting was more complicated, with shade cloth increasing bolting in heat sensitive varieties.

Are certain shade cloth colors more effective?

Black 30% shade cloth was the most effective at reducing bitterness. The other shade cloth colors tested were blue 30%, red 30%, silver 30%, white 40%, and white 22%.

How does shading work in combination with heat tolerant varieties?

Four varieties were used for the experiment: two romaine varieties, Arroyo (heat tolerant) and Salvius, and two butterhead varieties, Skyphos (heat tolerant) and Alkindus. Shading was most impactful on the flavor of the heat tolerant romaine variety Arroyo. In both years Arroyo had a marketable bitterness rating with black 30 % shade and an unmarketable rating without shade. The other romaine variety did not have a marketable bitterness rating in any treatment in either year although shading did reduce the bitterness ratings in both years. For the butterhead varieties, Skyphos, the heat tolerant butterhead, had marketable bitterness ratings with and without shade and shade did not reduce the bitterness rating. The heat susceptible butterhead had slightly lower bitterness ratings with black 30% shade compared to no shade and the shade treatment averaged in the marketable range, whereas the no shade treatment averaged unmarketable.

Average 2018 and 2019 Bitterness Ratings for the 30% Black and No Shade Treatments*		
	30% Black	No Shade
Arroyo	1.6	2.8
Salvius	3.0	3.5
Skyphos	1.3	1.3
Alkindus	1.9	2.1

*Bitterness Ratings <2 are considered marketable.

How did shade impact soil and plant temperatures?

The soil and leaf temperatures were lower in the 30% back shade treatment on both hot days and on cooler days. Average soil and leaf temperatures for no shade and the 30% black shade treatments are shown in the table below.

	Soil Temp		Leaf Temp	
Weather Conditions Air Temp	Sunny Calm 90 °F	Sunny Breezy 71 °F	Sunny Calm 89 °F	Sunny Breezy 71 °F
30% Black Shade	82 °F	75 °F	78 °F	71 °F
No Shade	88 °F	82 °F	81 °F	81 °F

Shade Cloth Implementation

The lettuce shade experiments showed that shading can reduce bitterness and maintain marketable quality, especially in certain varieties. In a field setting, shade cloth can be applied over low tunnels or larger structures to create "shade houses". In the experiments described the shade cloth was draped over pepper stakes and secured to the ground with landscape staples. Shade cloth can also be used to cover high tunnels where heat sensitive crops are being produced.

The 2018 lettuce shade trial on May 16.

Ms. Ernest is a Vegetable & Fruit Scientist at the Univ. of Delaware.
*From the **Weekly Crop Update**, Univ. of Delaware Extension, Vol. 30, Issue 2, April 1, 2022.*

VEGETABLE PRODUCTION

Using Leaf Tissue Analysis for High Tunnel Tomato Nutrient Management

Elsa Sanchez and Thomas Ford

Growing tomatoes in high tunnels may require changing some of the management practices that you may employ when growing plants outdoors or in greenhouse environments.

Figure 1. Elevated soil pH can limit the uptake of iron by tomatoes in high tunnels resulting in deficiency. Photo: Tom Ford, Penn State

In this article, we will focus on using plant tissue analysis as part of your overall nutrient management plan or strategy. Nutrient management recommendations specifically for high tunnel tomatoes have not yet been developed and farmers will commonly adapt fertility recommendations that have been developed for outdoor growing.

Before planting, apply 30 to 60% of the nitrogen and all of the phosphorus and potassium recommended based on the crop and/or soil testing. Soon after planting, routinely submit leaf tissue for laboratory analysis. This can be done on a weekly or biweekly schedule. It may be tempting to wait until plants show symptoms of nutrient issues to submit tissue samples; however, when symptoms are seen, plant growth has already suffered. Proactive and routine tissue testing helps avoid deficiencies and toxicities.

Samples submitted for plant or tissue analysis should be composed of 25 to 100 leaves. Focus on collecting leaves that have recently expanded, also known as the most recently matured leaves. Avoid diseased or dead leaves and those damaged by insects or chemicals. Additionally, plant response to nutrient management varies by cultivar, stage of growth, and environmental conditions. The key is to collect a representative sample.

For example, if one area of the high tunnel stays wetter than another, collect samples from plants in that area separate from other areas. Or, if you are growing more than one cultivar in the tunnel, collect different samples for each cultivar being grown.

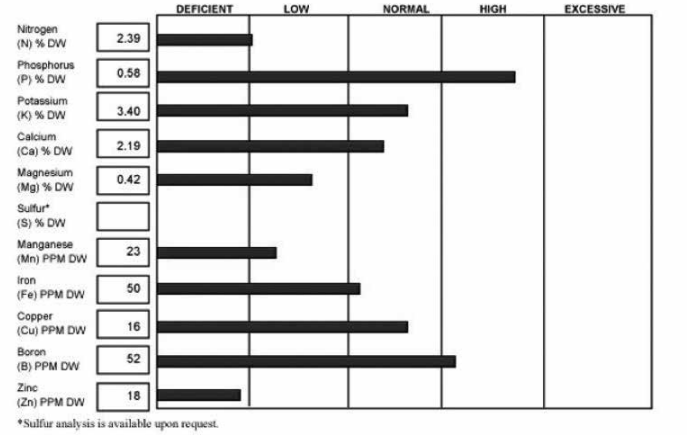
PENNSTATE

(814) 863-0841 Fax (814) 863-4540
Agricultural Analytical Services Laboratory
The Pennsylvania State University
University Park PA 16802

PLANT TISSUE ANALYSIS FOR:	ADDITIONAL COPY TO:
Jane Doe Doe Farms RR 1 Box 4 Wysox PA 11111	

KIT ID	LAB ID	FIELD NAME	HOUSE	BENCH	RECEIVED	COMPLETED	COUNTY
	PK15080	Garden			8/22/2011	9/5/2011	Adams

Crop: Tomato Variety: Any



*Sulfur analysis is available upon request.

Figure 2. An example tissue analysis report from Penn State University's Agricultural Analytical Services Laboratory.

Place your sample in a paper bag and send it to a lab for analysis. A mistake that is sometimes made is putting the sample in a plastic bag. Doing this can cause moisture to accumulate around the sample and it can start to degrade or rot. When this happens the sample may not be useable. The leaf tissue analysis interpretation provided here is from Penn State University's Agricultural Analytical Services Laboratory.

Nutrient concentrations are categorized as deficient, low, normal, high, or excessive.

KIT ID	LAB ID	FIELD NAME	HOUSE	BENCH	RECEIVED	COMPLETED	COUNTY
	PK15080	Garden			8/22/2011	9/5/2011	Adams

Crop: Tomato Variety: Any

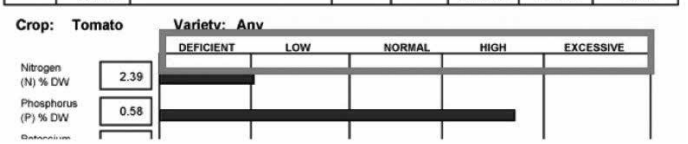


Figure 3. Nutrient concentration categories are deficient, low, normal, high, and excessive.

Normal means that the tissue has a sufficient concentration of the nutrient and no corrective action is needed. A high concentration usually does not affect plant growth or yield, but can lead to a problem if it reaches the excessive category. Monitor nutrient concentrations in the high category to avoid them moving into the excessive range. An excessive concentration means that the nutrient may have reached toxic levels where plant growth, yield, and quality are reduced. Review your nutrient management plan in this case and reduce the amount of the excessive nutrient applied. Deficient or low indicates that the nutrient is below sufficient concentrations and is likely limiting the crop's potential. Concentrations in the deficient category mean that crop response to adding the nutrient is high and in the low category crop response to adding the nutrient is medium.

The table below is from Plant Tissue Analysis and Interpretation for Vegetable Crops in Florida by G.J. Hochmuth, D. Maynard, C. Vavrina, E. Hanlon, and E. Simonne (https://edis.ifas.ufl.edu/publication/ep081) and provides a starting point for adding nutrients when tissue concentrations are in the deficient or low categories. Testing again in about 2 weeks can let you know if the actions you take now are working.

Figure 4. Magnesium deficiency is commonly observed on the lower leaves of tomatoes in high tunnels. Photo: Tom Ford, Penn State

Using Leaf Tissue Analysis for High Tunnel Tomato Nutrient Management

continued from page 14

Table 1. The starting point for adding nutrients when tissue concentrations are in the deficient or low categories.

Nutrient	Fertilizer	Method of Application	Rate (lb/acre)	Rate (lb/1000 ft2)
Nitrogen (N)	Ammonium nitrate	Topdress, sidedress, fertigation	30–40	0.69–0.92
Nitrogen (N)	Calcium nitrate	Topdress, sidedress, fertigation	31–40	0.69–0.93
Phosphorus (P2O5)	Ammonium phosphates	Topdress, sidedress, fertigation	20	0.46
Phosphorus (P2O5)	Triple, normal	Topdress, sidedress	20	0.46
Phosphorus (P2O5)	Phosphoric acid	Sidedress, fertigation	20	0.46
Potassium (K2O)	Potassium chloride	Topdress, sidedress, fertigation	30	0.69
Potassium (K2O)	Potassium nitrate	Topdress, sidedress, fertigation	30	0.69
Calcium (Ca)	Calcium nitrate	Topdress, sidedress, fertigation	30	0.69
Calcium (Ca)	Calcium chloride	Fertigation	30	0.69
Magnesium (Mg)	Magnesium sulfate	Topdress, sidedress, fertigation	20	0.46
Magnesium (Mg)	Magnesium nitrate	Fertigation	20	0.46
Magnesium (Mg)	Potassium magnesium sulfate	Topdress, sidedress	10	0.23
Boron (B)	Borax	Fertigation, foliar	0.1–0.2	0.0023–0.0046
Copper (Cu)	Copper sulfate	Fertigation, foliar	0.1–0.3	0.0023–0.0046
Iron (Fe)	Ferrous sulfate	Fertigation, foliar	0.2–0.5	0.0046–0.11
Iron (Fe)	Chelated iron	Fertigation, foliar	0.2–0.6	0.0046–0.11
Manganese (Mn)	Manganous sulfate	Fertigation, foliar	0.5–1.0	0.11–0.023
Molybdenum (Mo)	Sodium molybdate	Fertigation, foliar	0.01–0.05	0.0023–0.011
Zinc (Zn)	Zinc sulfate	Fertigation, foliar	0.1–0.2	0.0023–0.0046
Zinc (Zn)	Chelated zinc	Fertigation, foliar	0.1–0.3	0.0023–0.0047

HS964/EP081: Plant Tissue Analysis and Interpretation for Vegetable Crops in Florida (ufl.edu) see https://edis.ifas.ufl.edu/publication/ep081

VEGETABLE PRODUCTION

Expanding Suppressive Microbial Communities to Manage Bacterial Spot of Tomato

Kevin Hockett and Constanza Bartolomeo

Research Funded by PA Growers
PVGA
PA PRODUCE
PA Veg. Growers Assn.
PA Veg. Mktg. & Research Prog.

This project was initiated in the summer of 2021 with two objectives: 1) Acquire 6-12 microbial communities from Pennsylvania and 2) repeatedly transfer communities from objective 1 to select for those that suppress bacterial spot in a greenhouse setting.

We were successful in recovering 6 microbial communities each from both high tunnel and field grown tomatoes. Additionally, using a passaging approach, which we've previously employed for bacterial speck, we saw similar dynamics in that over successive passages, disease severity decreased. Additionally, we were able to show that disrupting the microbial community resulted in increased disease.

The results of this project show that the passaging approach are generally effective against different foliar bacterial diseases of tomato. This approach may also be effective against other foliar diseases, as well.

Results:

Objective 1 | Acquire 6 – 12 distinct microbial communities from different tomato sources in Pennsylvania and New York.

We initially wanted to acquire microbial communities from both Pennsylvania and New York, however it was only feasible to acquire communities from Pennsylvania. We were able to acquire 6 communities from field grown tomatoes and 6 communities from high tunnel grown tomatoes.

Objective 2 | Repeatedly transfer communities from objective 1 to select for those that suppress bacterial spot in a greenhouse setting.

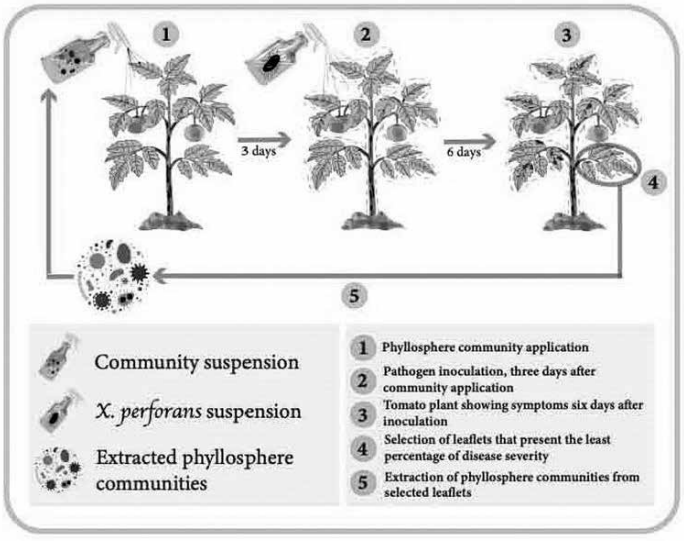


Figure 1. Passaging approach to select for disease suppressive communities.

Our approach of community passaging (Figure 1) showed similar results to our previous work with bacterial speck of tomato, though not exactly the same. In the case of bacterial speck, disease increased considerably over the first ~4 cycles of passaging, before declining and remaining low over the remaining passages. For bacterial spot, this was different in that the disease levels never increased significantly Figure 1. Passaging approach to select for disease suppressive communities over the early passages. Beginning with passage 6, however, the disease for the passaged treatments did decline compared to the pathogen only treatment (Figure 2). This was in addition to and overall decline in disease for the pathogen only treatment as well. Although we were happy to see these trends, because they indicate that the passaging does result in reduced disease, the overall level of disease was very low. We think this is because we did not have the right conditions that were conducive for bacterial spot (maybe not warm enough in the greenhouse) and our passaging cycle, which was developed for bacterial speck, was maybe too short for bacterial spot, which takes a little longer to develop.

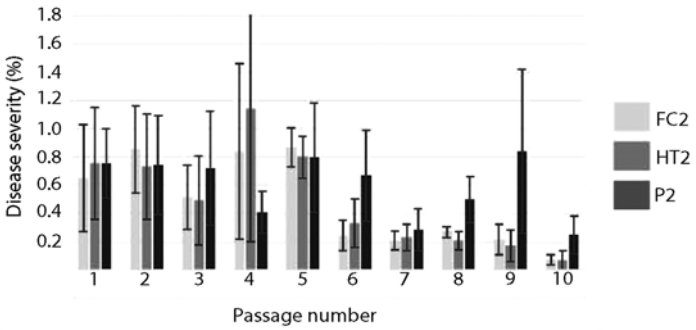


Figure 2. Average disease severity of bacterial spot on tomato leaves at each passage. From passage 6 onward, the average disease for the pathogen only (P2, green bars) control is higher than either the field tomato community (FC2, yellow bars) or high tunnel tomato community (HT2, orange bars).

In addition to having a lower disease severity on leaves that showed some disease symptoms, we also observed that at later passages, the number of leaflets that showed any symptoms decreased for the passaged treatments compared to the pathogen only control, as well (Figure 3). In total, there was an average reduction in disease severity by ~60% from passage 6 on for the community-treated compared to the pathogen only control. Additionally, there was an average reduction of ~20% for the total number of leaves affected for passage 6 on for the community-treated compared to the pathogen only control.

To confirm that the disease suppression was the result of the microbial community, we heat killed the community and tested whether the disease suppression was reduced. Figure 4 shows that heat killing the communities results in disease severity that is greater than the untreated communities.

Expanding Supressive Microbial Communities to Manage Bacterial Spot of Tomato

continued from page 16

Dr. Hockett and Ms. Bartolomeo are with the Department of Plant Pathology and Environmental Microbiology at Penn State Univ. *This research project was funded by PVGA and the PA Vegetable Marketing and Research Program.*

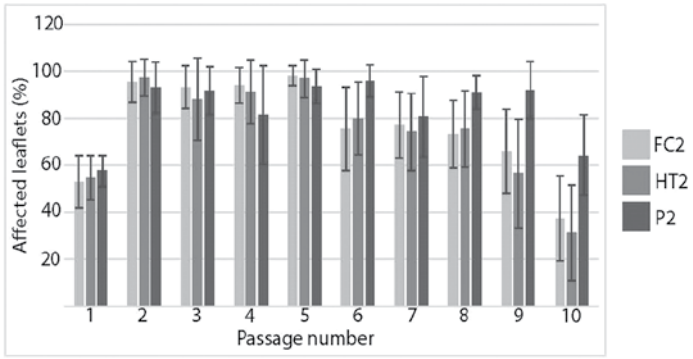


Figure 3. Average number of tomato leaflets showing disease symptoms. From passage 6 onward, the average number of affected leaflets for the pathogen only (P2, blue bars) control is higher than either the field tomato community (FC2, yellow bars) or high tunnel tomato community (HT2, orange bars).

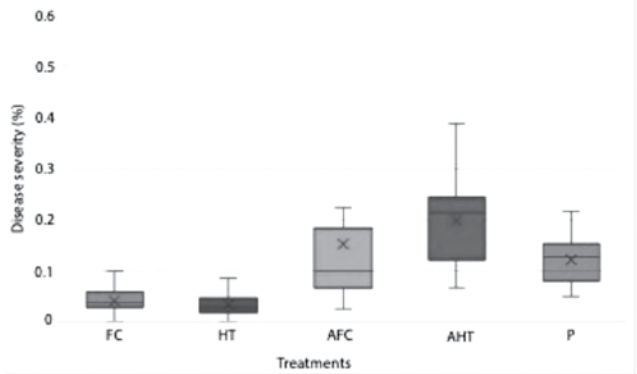


Figure 4. Average disease severity for tomato leaves treated with either a passaged field tomato community (FC), a passaged high tunnel community (HT), an autoclaved (heat killed) field community (AFC), an autoclaved high tunnel community (AHT), or the pathogen only. Both the field community and high tunnel community treatments resulted in lower disease, than the other three treatments.

Conclusions

Our results show that our passaging approach results in microbial communities that are able to suppress both bacterial speck (previous research) and bacterial spot (this research) of tomato.

A limitation of our findings is the low overall level of disease that we achieved throughout the project. As noted above there are likely several reasons for this (greenhouse conditions weren't conducive to disease and not giving the plants long enough to develop disease), which will be addressed in future research.

Now that we've shown as proof-of-concept that the passaging approach can successfully result in disease suppressive communities, we plan to assess whether they may be effective in a tomato transplant setting, where the plants are more dense and the plants are top watered. We believe both conditions will help promote disease development and will make it easier to assess the potential value of our approach to stakeholders.

We submitted a proposal to follow up on this research to the USDA NIFA in 2021. Although the proposal was rated as high priority, it was ultimately unfunded. These results will be included a revised USDA NIFA proposal that will be submitted in October 2022.

VEGETABLE PRODUCTION

Economics of Winter Spinach: Three Case Studies

Genevieve Higgins

Local winter greens have become staples in farm stores, farmers' markets, and grocery stores throughout New England over the past several years, and demand from consumers seems to be nearly limitless. Growers producing winter greens in high tunnels have adopted a wide range of production systems – from low-tech hand-powered systems to highly mecha¬nized and specialized operations. With the amount of winter high tunnel production on farms increasing every year, we realized that growers might benefit from seeing the range of production systems, and how profitable they might be.

To this end, over the winter of 2020-21, we asked three farms to track their winter high tunnel spinach yields and associ¬ated labor for one tunnel on their farm. We used the labor and yield data, along with growing practice information, to compile a case study of each farm and compare production across the three farms. This report will briefly outline produc¬tion on these farms, as well as some take-home spinach production tips that we have learned from this project. We'd like to say a huge thank you to our case study farms, for all of the work they put in tracking labor and yields!

Farm 1

Farm 1 was the least mechanized of the three case study farms. They turn over their soil by hand or with a walk-behind BCS, seed with a walk-behind Planet Junior Seeder, and harvest by hand, leaf-by-leaf. They market their spinach solely through a $50 spinach add-on to their winter CSA. Farm 1 used chicken manure and other OMRI-listed blended fertilizers for a fairly simple fertility plan, and did not cover their spinach with row cover. Given all of these factors, Farm 1 had the lowest production material costs, but the highest labor costs of all three farms, and because their spinach was marketed through a CSA, Farm 1 also had the lowest price per pound of all three farms.


Farm 1's tunnel on November 16, 2020 (left), and harvesting leaf-by-leaf at Farm 1 (right). Photos: G. Higgins

Farm 2

Farm 2 was significantly more mechanized than Farm 1 – their tunnel allows for tractor access, and beds are prepped using a disc harrow. Notably, this was the only farm out of our three case studies that transplants spinach, in order to keep their summer tunnel crops going as late as possible and still have spinach to harvest in November. Farm 2 had high production materials costs, as they applied compost in the tunnel prior to planting, used row cover, and had significant costs associated with producing the spinach transplants. This farm also harvested by hand, harvesting off the larger leaves of each plant with a knife and leaving the smaller leaves untouched. Unfortunately, one variety of spinach at this farm developed spinach downy mildew in late fall, and the disease later spread to second variety. However, because of their se¬lective harvesting method, they were able to continue harvesting around the affected leaves through March. Farm 2 ended up being the most profitable of the three farms, partially because of yield losses at Farm 3 but also because they are able to sell their spinach at a high price per pound through wholesale and retail markets.


Farm 2's tunnel on March 3, 2021 (left), and row cover covering spinach and lettuce in Farm 2's tunnel. Photos: G. Higgins

Farm 3

Farm 3 is highly mechanized and specializes in growing winter greens. All of the tunnel preparation, weed management, and harvesting is done by tractor. Because of this, Farm 3 had significantly higher equipment costs than the other two farms, but had very low labor costs. This production system would have been the most profitable of the three, but several disease outbreaks reduced their yield by about half. In the fall, a nearby field of 'Auroch' spinach developed downy mildew, prompting the farm to till in the case study tunnel which was also seeded with 'Auroch' and reseed with 'Kolibri', which later developed significant Cladosporium leaf spot.



Farm 3: Seeding with the tractor-mounted seeder (top left), the case study tunnel on March 3, 2021 (top right) and harvesting with the mechanical harvester (left). Photos: G. Higgins

Economics of Winter Spinach: Three Case Studies

continued from page 18

	Farm 1	Farm 2	Farm 3
Marketing	CSA	75% wholesale, 25% retail	Mostly wholesale
Seeding date	September 21	Seeded early September Transplanted early October	October 12 Re-seeded October 25
Harvest period	December 3 – April 16 (19 weeks)	November 2 – March 22 (20 weeks)	January 24 – March 13 (7 weeks)
Tunnel size	1,350 ft^2	3,000 ft^2	6,000 ft^2
Equipment cost*	$0	$55,350	$75,140
Plant density	80 plants /ft^2	2.8 plants /ft^2	140 plants /ft^2
Planting speed	45 ft^2/min	0.26 ft^2/min	100 ft^2/min
Harvest speed	0.08 lbs/min	0.375 lbs/min	11.67 lbs/min
Total labor time	89.5 hrs	63.4 hrs	18.5 hrs
Total labor cost	$1,745 ($1.29/ft^2)	$1,267 ($0.42/ft^2)	$286 ($0.05/ft^2)
Yield from tunnel	468 lbs (0.34 lbs/ft^2)	805 lbs (0.27 lbs/ft^2)	1,150 lbs (0.19 lbs/ft^2)
Sales from tunnel	$3,000 ($2.22/ft^2)	$8,251 ($2.75/ft^2)	$9,200 ($1.53/ft^2)
Average price per pound	$6.41	$10.25	$9.75
Production materials cost	$68 ($0.05/ft^2)	$2,298 ($0.77/ft^2)	$484 ($0.08/ft^2)
Profit per ft^2*	$0.88	$1.56	$1.40

*This value does not include the cost of production equipment or post-harvest equipment, labor, or materials

Continued on page 20

VEGETABLE PRODUCTION

Economics of Winter Spinach: Three Case Studies

continued from page 19

Recommendations for Improving Winter High Tunnel Spinach Production

Variety Selection:

- **Plant varieties with the latest, broadest downy mildew resistance (1-19):** In our most recent variety trial (see https://ag.umass.edu/sites/ag.umass.edu/files/newsletters/may_6_2021_vegetable_notes.pdf), Dallas, Crosstrek, Nembus (all 1-17 varieties), Patton (1-15, 17), and Responder (1-12, 14-16) all performed well. Races 18 and 19 are newly identified as of spring 2021, and while varieties with resistance to these two varieties do exist, they may not yet be available in Northeast markets.
- **Plant multiple varieties** so that all gaps in resistance are covered, and to maximize protection against novel strains.

Bed and Tunnel Preparation:

- **Keep soil pH above 6.**
- **Prepare uniform beds:** We have found that spinach stand is very sensitive to soil compaction and moisture, so efforts to make uniform, slightly raised beds can improve stand.
- **Set up uniform irrigation:** Spinach seedlings are sensitive to damping off in cold soil, so ensuring that there are no wet spots in your tunnel can help reduce damping off and improve stand.

Seeding & Production:

- **Increase planting density:** We use a rate of 69 seeds/ft2; growers we've surveyed have used up to 140 seeds/ft2.
- **Use PSNTs to time sidedressing:** Pre-sidedress nitrate tests measure the available nitrate in the soil at the time of sampling. Nitrate moves quickly through soil, and it's not fully known how it behaves in cold high tunnel soil in the winter months when the crop is growing slowly. When nitrate levels drop below 30 ppm, it's recommended to sidedress. In our research trials, we sidedress through overhead irrigation, using OMRI-listed water-soluble calcium nitrate. PSNTs can be taken monthly to monitor soil nitrate levels.
- **Use row cover to speed up growth but not to keep plants alive:** Spinach is very cold-tolerant and won't be harmed by cold temperatures as long as the leaves aren't disturbed while frozen. Row cover may speed up growth slightly but also adds labor, and can increase leaf wetness and disease, so don't use it to simply keep the plants alive.

Harvesting & Sales:

- **Harvest by clear cutting:** From what we have seen, winter markets tend to be forgiving of the cut leaves that can occur in regrowth after clear cutting. Clear cutting, either mechanically or by hand, is a huge time/labor saver. We have seen different varieties respond differently to clear cutting as well – some varieties have a growth habit where the developing leaves remain uncut within the growing point. In our trials, Patton, Responder, and Crosstrek all had "uncut" regrowth after being clearcut.
- **Harvest larger than babyleaf:** If your markets will allow it, this is an easy way to increase yields.
- **Increase price/lb:** Get a fair price! We've seen people charge anywhere from $5-14/lb and customers seem willing to pay premium prices for winter greens.

Ms. Higgins is with the Univ. of Massachusetts Extension Vegetable Program. *From the **Vegetable Notes for Vegetable Farmers in Massachusetts**, Univ. of Mass. Extension, Vol. 34, No. 3, March 17, 2022.*

BERRY PRODUCTION

Pollination of Blueberry Crops in Pennsylvania

Margarita Lopez-Uribe, Kathleen Demchak, Shelby Fleischer, Sydney Bird, Isabella Petita and Nash Turley

Blueberry (Vaccinium spp.) is a high-value and economically important fruit crop native to Pennsylvania and Eastern North America. Nationally, the total value of the blueberry crop was $797 million in 2018 (USDA NASS).

Photo: Margarita M. López-Uribe, Penn State

Demand for blueberries in Pennsylvania is also high; prices range from $2-5 a pint (USDA NASS). There are four native blueberry species to Pennsylvania: Low sweet blueberry (Vaccinium angustifolium), lowbush blueberry (*V. pallidum*), sour-top blueberry (*V. myrtilloides*), and the highbush blueberry V. corymbosum, which is the most often cultivated species on commercial production farms. Common varieties of *V. corymbosum* in Pennsylvania include Duke, Patriot, Bluecrop, Jersey, and Elliott, among others. While these different varieties vary in their capacity to self-pollinate, sufficient pollination is crucial for maximum yield. This article provides information about the pollination biology and requirements of blueberries and general recommendations for improving blueberry pollination in Pennsylvania.

Pollination biology and requirements

Highbush blueberries produce small bell-shaped pendulous flowers with short anthers hidden inside the white or pink corolla and a stigma that sticks out near the opening (Figure 1). In order to set fruit, a sufficient number of viable pollen grains must be transferred from the anther to the stigma of the same variety (self-pollination) or a different variety (cross-pollination). After pollination is complete, corollas often drop off leaving only the stigma and sepal attached to the ovary that will develop into the fruit (Figure 1). Needs for cross-pollination vary across varieties. Some such as Duke and Bluejay do not need cross-pollination, while Elliott, Bluecrop, and Legacy benefit from cross-pollination but can set fruit with pollen from the same variety.

Blueberry flowers have poricidal anthers (i.e., the pollen is released through pores) that require sonication or "buzzing". This behavior is necessary for the pollen to be released from the flower and become available to be picked up by a pollinator and transported to a different flower. Blueberry pollen is sticky and is not easily transported by the wind. Because of these traits of blueberry flowers, the most efficient pollinators of this crop are wild bees, many of which can perform buzz pollination and transport the pollen on their hairy bodies. Honey bees are not able to perform buzz pollination. As a result, pollination efficiency by wild bees is three times higher than pollination by honey bees. On average, when

Pollination of Blueberry Crops in Pennsylvania

continued from page 20

pollinating blueberries, honey bees transfer 11 pollen grains to the stigma per flower visit, compared to ~45 pollen grains transferred by wild bees (e.g., bumble bees and mining bees) (Javorek et. al., 2002). Despite their inability to buzz pollinate, honey bees are still crucial pollinators to commercial blueberry farms where large acreage of blueberry bushes require pollination and low abundance of wild bees may be available. However, pollination by honey bees alone is not enough to achieve maximum yield. Therefore, in all cases wild bees are helpful, or even necessary, to get the best results (Reilly et al 2020).

Pollinators of Blueberry

Since Pennsylvania lies within the native range of the blueberry, there is a great diversity of native bees that provide pollination services to blueberry farms. Observations performed in three small diversified farms with Bluecrop plantings in central Pennsylvania revealed that the smallest non-commercial planting had the greatest diversity of pollinators. While managed honey bee colonies were present at all sites, they were not commonly observed pollinating blueberries, compared to other wild bees such as bumble bees. For about every honey bee visiting blueberry flowers, we observed about 3 bumblebee queens (Figure 2). Mining bees in the genus *Andrena* were also a major group of wild bees observed at all sites (Figure 2). Both bumble bee queens and mining bees are active in the spring when blueberry flowers begin to bloom. At least 11 different species of Andrena have been observed pollinating blueberries in central Pennsylvania, often clinging to flowers during their visits.

Note that one of the most important pollinators of blueberries in the southeast region of the US is *Habropoda laboriosa,* commonly known as the Southeastern blueberry bee. While this bee has been recorded in Pennsylvania, it has not been observed in any of our study sites in central Pennsylvania. Table 1 shows a complete list of bee species that were observed pollinating highbush blueberry across three different sites recorded over two years.

Signs and Causes of Poor Pollination

Insufficient pollination may happen when there are too few pollinators to visit and pollinate every flower. In addition to the low abundance of pollinators, other causes of poor pollination include that the available bee species may be unable to perform sonication (e.g., honey bees) and/or the weather may be cold or windy and not conducive to bee foraging. Lack of sufficient bee-mediated pollination may result in blueberry bushes relying on self-pollination, which often develop into lower-weight fruit. To quantify crop pollen limitation, berry weights and numbers are compared between flowers that were hand-pollinated and flowers that received natural pollination (a.k.a. open pollination). In our study from sites in central Pennsylvania, we did not observe severe signs of pollination limitation.

The number of berries from the open-pollinated flowers was not different from those in the hand-pollinated flowers. However, at one site, we found a 17% decrease in the average weight of berries in the open compared to the hand-pollinated flowers. Reductions in berry weight are one sign of pollen limitation, so our

Continued on page 22

BERRY PRODUCTION

Pollination of Blueberry Crops in Pennsylvania

continued from page 21

results suggest there is potential to maximize pollination at these sites in central Pennsylvania. Other signs of poor pollination in blueberry crops include: later ripening berries, decreased berry size, and reduced number of viable seeds in each berry (Benjamin and Winfree, 2014).

Supporting More and Healthier Bee Pollinators

Several studies and our own observations indicate that higher pollinator abundance is correlated with increased berry weight. This highlights the importance of enhancing wild pollinators to increase crop yields. Therefore, growers in Pennsylvania should be aware of the critical importance of wild bees for the production of blueberries. In order to reach maximum crop yield, growers should follow best practices to support and enhance a diverse array of wild pollinators. Some of these recommendations include:

1. Do not apply insecticides during bloom. If fungicide applications are necessary during bloom, choose effective products with the lowest toxicity ratings possible, as indicated on the pesticide label.
2. Keep in mind that flowering weeds around crops can become important routes of pesticide exposure for bees. Therefore, it is recommended to remove blooming weeds such as dandelion or white clover before pesticide sprays rather than afterward.
3. Help maintain nesting habitat for wild bees by preserving natural forest habitat surrounding the blueberry field. Maintaining nesting habitat may also include refraining from tilling the soil surrounding the blueberry field if possible. Soil disturbance from tilling disrupts the habitat for many ground-nesting bees.
4. While it is common practice to supplement pollination with commercial honey bee colonies, growers can also consider purchasing commercial bumble bees to maximize pollination. However, introducing managed bees for pollination can facilitate the transmission of pathogens from managed to wild bees. Therefore, it is recommended to limit the introduction of managed pollinators when possible. Some additional management practices that can be considered to decrease pathogen transmission include: renting honey bee colonies that have low levels of varroa mites and placing managed colonies in the center of the plantations where wild bee abundance is lower than at the edge of the fields.
5. Consider integrating other plants or crops near blueberry fields that bloom both before and after blueberries in order to provide wild bees with sustained resources throughout their active season and incentivize them to maintain nests nearby. To help support early-emerging bees like mining bees try planting native spring-flowering trees like willow, red maple, serviceberry, cherry, and redbud. Native perennial wildflowers such as milkweeds, black-eyed Susan, mountain mint, Joe Pye weed, coneflower, sunflowers, and beebalm will help support bumble bees and a wide variety of other pollinators.

Summary

It is clear that adequate pollination is necessary for achieving maximum yield from blueberry crops. While signs of pollination limitation appear to be weak at farms in Pennsylvania, growers should be aware of this possibility and are encouraged to implement recommendations to sustain and enhance wild pollinators in their farms. If signs of pollen limitation are present, such as low fruit set, smaller than average berries, and late-ripening berries, growers should consider changing management practices. Actions such as enhancing habitat to encourage wild bees near the farms or supplementing farms with managed pollinators can promote blueberry pollination.

Table 1. Common managed and wild bee pollinators of blueberry in central Pennsylvania

Common Name	Family	*Genus*	*Species*
Mining bees	Andrenidae	*Andrena*	*canadensis*
	Andrenidae	*Andrena*	*carlini*
	Andrenidae	*Andrena*	*carolina*
	Andrenidae	*Andrena*	*cressonii*
	Andrenidae	*Andrena*	*dunningi*
	Andrenidae	*Andrena*	*frigida*
	Andrenidae	*Andrena*	*imitatrix*
	Andrenidae	*Andrena*	*miserabilis*
	Andrenidae	*Andrena*	*nasonii*
	Andrenidae	*Andrena*	*perplexa*
	Andrenidae	*Andrena*	*pruni*
	Andrenidae	*Andrena*	*rugosa*
	Andrenidae	*Andrena*	*tridens*
	Andrenidae	*Andrena*	*vicina*
	Andrenidae	*Andrena*	*wilmattae*
Honey bee*	Apidae	*Apis*	*mellifera*
Bumble bees	Apidae	*Bombus*	*bimaculatus*
	Apidae	*Bombus*	*fernaldae*
	Apidae	*Bombus*	*griseocollis*
	Apidae	*Bombus*	*impatiens*
	Apidae	*Bombus*	*sandersoni*
Small carpenter bees	Apidae	*Ceratina*	*dupla*
	Apidae	*Ceratina*	*mikmaqi*
Cellophane bees	Colletidae	*Colletes*	*inaequalis*
	Colletidae	*Colletes*	*thoracicus*
Sweat bees	Halictidae	*Augochlorella*	*aurata*
	Halictidae	*Lasioglossum*	*pilosum*
Mason bees	Megachilidae	*Osmia*	*lignaria*
	Megachilidae	*Osmia*	*bucephala*
	Megachilidae	*Osmia*	*cornifrons*
Large carpenter bee	Apidae	*Xylocopa*	*virginica*

** Asterisk indicates managed bee species*

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Pollination of Blueberry Crops in Pennsylvania

continued from page 22

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Figure 1. The shape of blueberry flowers. Before pollination (left), the white or pink corolla covers the anthers and stigma. After pollination (right), the corolla drops off and the stigma of the flower gets exposed. The presence of corollas on the ground is generally a sign that pollination has occurred. Photos: Nash Turley, Penn State

Figure 2. The common wild bees pollinating blueberry crops in central Pennsylvania. Both bumble bee queens (left) and mining bees (right) are active in early spring and are abundant pollinators of blueberries. Photos by Margarita López-Uribe and Nash Turley, Penn State.

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