PENNSYLVANIA
VEGETABLE GROWERS

NEWS

May 2018 / Volume 40 Number 5

for the commercial vegetable, potato and berry grower

Vegetable Equipment Demonstrations Coming to 2018 Ag Progress Days

Vegetable production is becoming big business in Pennsylvania and the numbers seem to back it up. According to the latest USDA National Agricultural Statistics Service numbers, the commonwealth ranks top 10 in the US for several crops (bell peppers, cantaloupes, pumpkins, and snap beans). Sixteen auctions (16) are scattered throughout the state to sell fresh produce to road-side stands and grocery stores. Numerous processors move crops such as potatoes, tomatoes, and sweet corn from the field into the store isles in cans and frozen foods.

And then there is the anecdotal evidence. Look no further than the 4-day Mid-Atlantic Fruit and Vegetable Conference held in Hershey in late January/early February. Almost every session has attendees spilling out into the hallways as growers look to educate themselves on the latest innovations and marketing ideas.

3-point hitch plastic mulch layers are utilized on many Pennsylvania vegetable farms to take advantage of raised beds to provide warmer better drained soil. In addition, crops stay off ground and can be easier to pick.

Now the vegetable industry will be showcasing technology at Penn State's Ag Progress Days (APD). Held over the course of three days in August (14 -16, 2018), APD is one of the nation's largest outdoor agricultural exposition. Typically, the event is heavy on traditional agricultural endeavors; row crops and animal production. But with the increase in interest over the decades, equipment specifically for vegetable growers will get their share of the spotlight.

During the three days, attendees will get a chance to observe how beds are pulled and covered with plastic. Of course, the equipment will also demonstrate how that plastic is removed at the end of the growing season. But there is a lot of activity that goes on in vegetable production between laying and removal of plastic. Equipment will show how transplants are inserted into the raised beds and how they are maintained throughout the growing season to address pest issues.

Remove - Plastic mulch should be removed after the growing season (unless trying to get another year of use) and can be difficult to accomplish by hand. Equipment, such as mulch lifters and wrappers make this task much easier.

Vegetables are composed of mostly water, for example, tomato and cantaloupe are 94% and 91% water respectively. Getting water to these plants has become high tech and some of this equipment will also be showcased during APD and the demonstrations.

The demonstration of equipment will occur at the western edge along Demo Alley, where West 9th, 10th, 11th, and 12th Street end. Beyond the demo area, equipment can be viewed throughout the APD site with various vendors.

For more information or questions, contact Jesse Darlington, jmd137@psu.edu or 814-865-2081.

NEWS

Growing Asparagus at D. A. Smiarowski

K. Campbell-Nelson and G. Higgins

Tom uses an old asparagus buncher and a hacksaw to make perfect bunches. Photo: K. CampbellNelson

Asparagus harvest is upon us, and one UMass Extension employee, Tom Smiarowski, Risk Management Educator, is our local expert. From age 7, when he would sleep in the pick-up truck at 5am while his parent's harvested, Tom has been in the business a long time now. His brother Dan manages the 15 acres of asparagus now, but Tom still helps out as buncher-in-chief while others are at their day jobs. We met up with Tom to scout his fields and learn what we could to share with you here.

Establishment

Non-hybrid varieties used to be grown, but they are more susceptible to the pathogen Fusarium moniliforme, which causes crown rot and can survive in a field for many years without a host. Therefore, modern hybrids, such as Jersey and Millenium, with some resistance are now more common. Site preparation should begin at least 1 year prior to planting in order to properly adjust soil pH, fertility, and eliminate serious perennial weed problems. At D.A. Smiarowski Farm, crowns are buried about 12" deep, with 12" apart in rows about 30-32" apart. The New England Vegetable Management Guide suggests planting in furrows 8" deep with crowns 12" apart and rows 54-60" apart. At establishment, 30 lbs P/A is placed at the bottom of the furrow, and crowns are sidedressed with 50 lbs N/A, 0-150 lbs P/A and 0-200lbs K/A, depending on soil test results. More soil is mounded over the crowns about 4 weeks after planting, as the crowns begin to sprout. The year after planting, the asparagus should receive fertilizer in the early spring and late summer. Some growers have experimented with laying drip tape for each row of asparagus planted for greater yields. At D.A. Smiarowski Farm, they have never had to irrigate, and actually experienced higher yields in 2016 during the drought.

(continued on page 12)

Johnstown Marketing Opportunity

Penn State Extension educator Thomas Ford is working with a variant of the traditional farmers market called a co-op grocery in The Galleria Mall in Johnstown. In this model. growers/producers set-up/stock their stand each morning. All produce items go through a common shared register. Farmers/produce growers receive payment for any of their items that are sold or are scanned through the common register (paid by scan) less a 10-15% commission. The farmer sets their own price and must rotate their items and remove distressed produce. Unlike traditional farmers markets where farmers have to staff the stand, the grower/producer role is that of a merchandiser who can stock the shelves in their stand prior to the store opening or during the day while the market is in operation. The co-op grocery model will be open year round and it will be augmented by other farm produced items like meat, cheeses, baked goods, etc. The organizers are looking for a few more vegetable growers. Their goal is to open the co-op grocery by July 1.

*The **Pennsylvania Vegetable Growers News** is the official monthly publication of the Pennsylvania Vegetable Growers Association, Inc., 815 Middle Road, Richfield, PA 17086-9205*
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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 furture 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 Secretary, at the above addresses.

National News Briefs

Farm Bill Vote Fails in House

The U.S. House's first attempt at passing the 2018 Farm Bill fell short today as lawmakers voted down the critical agriculture legislation. While there's still time for Congress to act, the 193 to 213 vote marks a setback as advocates, including Farm Bureau, push to have the 2018 Farm Bill in place before the current farm bill expires at the end of September. Adopting a new farm bill by that deadline is vital to continuing essential risk management programs, including crop insurance and Title I commodity programs, as well as making improvements to programs that help dairy producers manage their risk. House leaders must now return to the drawing board to determine how to build broader support for the legislation. The bill drew opposition from all Democrats, who objected to changes to nutrition programs, as well as 30 Republicans, who withheld support due to a separate disagreement over immigration. "We are already starting to hear from farmers across the nation, many of whom are perplexed and outraged at this morning's vote," American Farm Bureau Federation President Zippy Duvall said. "They are facing very real financial challenges. We call on all members of Congress not to use farmers and ranchers as pawns in a political game." It is vital that farmers continue to contact their representatives in Congress to urge them to pass the farm bill and explain why the legislation is critical to the future of agriculture and our nation's food security. Pennsylvania Farm Bureau thanks the members of our state's delegation who voted for the bill. They are: Reps. Lou Barletta, Ryan Costello, Mike Kelly, Tom Marino, Lloyd Smucker, Bill Shuster, and Glenn "G.T." Thompson.

*From **Farm Bureau Express,** Penna. Farm Bureau, May 18, 2018.*

Let the U.S. Trade Representative Know Your Opinion on Tariffs

With commodity prices already low and a trade dispute with China threatening to drive prices down even further, U.S. trade officials need to hear from farmers why opening markets and reducing barriers to trade are critical for the future of American agriculture. China retaliated with tariffs on U.S. pork, wine and fruit after President Donald Trump recently announced tariffs on steel and aluminum imports. In addition, China has threatened to impose tariffs on dozens of other agricultural products, including soybeans and beef, if Trump follows through on his threat to tax imports of additional Chinese items. Additional tariffs on U.S. agricultural products could be devastating for Pennsylvania farmers. China ranks fifth for Pennsylvania's top agricultural export markets, and second for the U.S. It is important-especially in this difficult agricultural economy-that we have lower tariffs and open trade. And it is crucial that national leaders understand how important trade is to agriculture.

*From **Farm Bureau Express,** Penna. Farm Bureau, May 18, 2018.*

USDA Reminds Farmers to Complete Census

The U.S. Department of Agriculture's National Agricultural Statistics Service is reminding farmers who have not responded to the 2017 Census of Agriculture to do so as soon as possible to avoid phone and in-person follow ups.

Questionnaires for the census were mailed to producers at the end of last year and were due back in February. So far, the agency has received close to 41,000 completed surveys from Pennsylvania. But both the national and Pennsylvania return rates are lower than at this point in the 2012 Census.

"NASS is grateful for the response from producers to date, but it is important that the others who received a Census questionnaire join their neighbors, colleagues, friends, and family in being part of the Census count," said Northeastern Regional Director King Whetstone.

The agency has already started to conduct follow ups to remind farmers to complete the Census and to provide an opportunity to answer questions.

The data from the Census will be released next year and is used by farmers and agribusinesses for planning and by legislators and policy makers for developing agriculture policy, such as the farm bill, and designing programs that help farmers and other residents of rural areas.

Federal law requires farmers to respond to the Census and also mandates that individual information be kept confidential.

For more information or assistance with the questionnaire, visit www.agcensus.usda.gov or call 888.424.7828.

*From **Pennsylvania Agricultural Alliance Issues Update,** Penna. Farm Bureau, May 2018.*

Gene Editing Utilized to Develop High-Oleic Soybeans for Health-Conscious Market

A new soybean variety has been developed that extends the shelf life of the soybean oil, eliminates unhealthy trans fats and lowers saturated fatty acids, producing nutritional benefits like olive oil.

The high-oleic soybeans were created by a Minneapolis-based company, Calyxt, using the new gene-editing technology which rearranges genes within the plant's DNA without introducing any outside genetic material. The high-oleic soybeans will be grown on about 16,000 acres in the upper Midwest in the United States this season. The USDA has stated it does not plan to regulate new plant innovations that implement gene-editing techniques.

*From **Pennsylvania Agricultural Alliance Issues Update,** Penna. Farm Bureau, May 2018.*

Corn Growers Can Apply for Payments from Syngenta Settlement

Farmers who planted corn between 2013 and 2017 can apply to receive a piece of the settlement Swiss seed company Syngenta has agreed to pay in a class action lawsuit over marketing practices that disrupted U.S. corn exports in 2013 and caused prices to plunge.

A federal judge provisionally approved the $1.5 billion settlement, clearing the way for growers and processors to seek payments.

Farmers who are eligible to receive a piece of the settlement will begin receiving notices by mail this month and will have until Oct. 12, 2018 to submit a claim. How much each farmer with an eligible claim will receive will depend on a variety of factors, including how much of the settlement is taken out for legal fees and how many farmers submit claims. Growers who planted certain varieties of Syngenta seed will receive lower payments than those who did not.

The lawsuit stems from Syngenta's marketing of a strain of genetically engineered corn prior to China approving that strain for importing. That resulted in China halting U.S. corn for about a year and grain prices plunged as a result.

For more information, visit www.cornseedsettlement.com or call 833-567-CORN.

*From **Pennsylvania Agricultural Alliance Issues Update,** Penna. Farm Bureau, May 2018.*

NEWS

State News Briefs

Urge Senators to Enact Commonsense Protections for Agritourism

State senators are considering legislation that would help protect farmers who engage in agritourism from frivolous lawsuits. It is critical that they hear directly from farmers why this commonsense reform is needed to protect farm families and ensure that agritourism remains a viable option for diversification. Senate Bill 820, sponsored by Sen. Ryan Aument, would protect farmers in lawsuits over injuries that can occur from participating in agritourism activities. The bill would require that farmers post multiple signs around their businesses warning visitors of the inherent risks. Many other states already have similar laws on the books. Farmers cannot take away every potential hazard, such as trips and falls in fields, or the fact that animals can be unpredictable. However, under current law, those circumstances open farmers up to frivolous lawsuits. The bill is being considered by the Senate Judiciary Committee, the first step in the legislative process, and has already drawn opposition from the powerful trial lawyers' lobby. It's vital that farmers show their support. Please contact your state senator by phone or by letter.

*From **Farm Bureau Express,** Penna. Farm Bureau, May 4, 2018.*

Governor Signs Bill Extending Safe Harbor to Local Taxes

Farm and other businesses will soon have an easier time estimating local tax payments. Gov. Tom Wolf recently signed House Bill 866, sponsored by Rep. George Dunbar of Westmoreland County, into law.

Previously, the state and federal governments allowed farms and other businesses to estimate tax payments based on the previous year's tax liability but local taxing bodies did not give those same "safe harbor" provisions. The new law extends those provisions to local taxes.

Pennsylvania Farm Bureau supported the bill and believes farmers should be allowed to estimate based on the previous tax year given the difficulty in predicting farm income, which varies widely from year to year and is influenced by market forces, commodity prices and input costs.

*From **Pennsylvania Agricultural Alliance Issues Update,** Penna. Farm Bureau, May 2018.*

Hunting-Related Trespass Bill Clears Committee but Fate Uncertain

A bill that would strengthen Pennsylvania's hunting-related trespass laws to deter hunting on private land without permission has cleared its first hurdle in the General Assembly. House Bill 1603, sponsored by Rep. Brett Miller of Lancaster County, was advanced by the House Game and Fisheries Committee and now heads to the full chamber for consideration. Currently, hunting-related trespass is a secondary offense, which means a hunter must be found in violation of another offense before a Game Warden or other law enforcement officer can cite him or her for it. This bill would make hunting-related trespass a primary offense, enabling officers to cite hunters who are caught hunting on private land without permission regardless of whether another violation occurred. In addition, repeat offenders would face the suspension of their hunting privileges. Pennsylvania Farm Bureau supports the bill in its current form and believes it would make the law an actual deterrent to trespassing. However, after the bill cleared committee, several House lawmakers offered amendments to the bill that would give the Game Commission authority to establish Sunday hunting. Because of those proposed amendments, future progress on the bill is likely stalled. Pennsylvania Farm Bureau believes that legislation dealing with hunting-related trespassing should be considered on its own merits and outside of a debate over Sunday hunting.

*From **Farm Bureau Express,** Penna. Farm Bureau, May 4, 2018.*

Rural Broadband Bill Advances in General Assembly

A bill that would direct the state to determine whether state-owned property and other assets could be leveraged to help expand access to high-speed internet in rural areas has cleared its first hurdle in the state House.

House Bill 1642, sponsored by Rep. Kristin Phillips-Hill of York County, passed the House State Government Committee and now heads to the full chamber for consideration. The committee's vote came the same day that Pennsylvania Farm Bureau held a news conference with members and lawmakers calling for measures to expand access to broadband internet.

PFB supports the bill and believes it is one of many steps that state government needs to take in order to expand broadband services to rural areas. Many rural families face few, if any, choices for high speed internet and have to make do with often more-expensive, less-reliable and lower-quality service than many urban and suburban residents. At the same time, a high-speed connection is becoming more and more important to success in agriculture, business and family life.

*From **Pennsylvania Agricultural Alliance Issues Update,** Penna. Farm Bureau, May 2018.*

Hoffman, Cotner Re-elected to Penn State Trustees

Farmers Chris Hoffman and Donald Cotner have been re-elected to the Penn State Board of Trustees as delegates for agricultural societies. Hoffman, of Juniata County, will serve a second term and Cotner, of Northumberland County, will serve his third term on the board.

Hoffman owns and operates Lazy Hog Farm, a 1,400-sow farrow to wean 4,800-head nursery barn, and 4,400-head finishing barn, as well as Lazy Chick Farm, which raises 250,000 chickens annually. He was elected to Pennsylvania Farm Bureau's State Board of Directors in 2006 and has served as the organization's Vice President since 2014. Cotner is a 1971 graduate of Penn State with a B.S. in education. He is a partner in Cotner Farms Inc., a family owned and operated egg layer, grain production and feed mill farm, and is also a partner in Don Cotner Farms, LP and Boyd Station, LLC, a soybean processor. He is a Northumberland County Farm Bureau member.

*From **Pennsylvania Agricultural Alliance Issues Update,** Penna. Farm Bureau, May 2018.*

Penn State to Administer Agricultural Mediation Program

Penn State Law's Center for Agricultural and Shale Law will take over the administration of a program that mediates disputes involving U.S. Department of Agriculture rulings.

(continued on page 6)

NEWS

State News Briefs (continued from page 4)

The Pennsylvania Agricultural Mediation Program had previously been run by the state Department of Agriculture. The program is funded through USDA.

"We are very appreciative of the work that the Department of Agriculture has done in establishing and operating the Pennsylvania Agricultural Mediation Program, and we look forward to having the Center for Agricultural and Shale Law continue the development of this important program," said Ross Pifer, the center's director. "This program will provide another opportunity for the center to serve Pennsylvania's agricultural community consistent with Penn State's land-grant mission."

When there is a dispute over a ruling, the farmer may use mediation to reach a solution rather than file an appeal with USDA. The program is free for eligible producers and can be used to settle disputes over matters such as wetland determinations, compliance with farm and conservation programs, agricultural loans made or guaranteed by USDA, rural water loan programs, pesticides and more.

For more information, visit pennstatelaw.psu.edu/pennsylvania-agricultural-mediation-program or contact Gaby Gilbeau, program coordinator, at 814-863-6441 or agmediation@pennstatelaw.psu.edu.

*From **Pennsylvania Agricultural Alliance Issues Update,** Penna. Farm Bureau, May 2018.*

Community Efforts Needed to Control the Spread of the Spotted Lanternfly

Community efforts in conjunction with orchardists, nursery owners, grape growers and others in southeastern Pennsylvania may be key to controlling the spread of the Spotted Lanternfly in 2018. The pest is particularly destructive to grapes, tree-fruit, hardwoods and nursery plants threatening $18 billion of agricultural commodities grown in the state each year.

The Pennsylvania Department of Agriculture urges residents to "look before you leave" and inspect vehicles and other items before leaving the quarantined area that encompasses 13 southeastern counties. Residents need to recognize egg masses which can then be destroyed. Nymphs and adults may be swatted or vacuumed. Killing one female eliminates 100 eggs. Penn State Extension is prepared to provide information on systemic and contact pesticides that provide effective control of Spotted Lanternfly infestations.

*From **Pennsylvania Agricultural Alliance Issues Update,** Penna. Farm Bureau, May 2018.*

Help Us Spread the Word: Educator's Ag Institute

The Pennsylvania Friends of Agriculture Foundation is committed to growing agriculture literacy. And one way the foundation achieves that goal is by helping educators develop lesson plans based on agriculture.

The foundation, a charitable organization supported by Pennsylvania Farm Bureau, is hosting the Educator's Ag Institute this summer at Penn State. This year's institute, planned for July 8-12, will give teachers an up close and personal look at farming practices, and how they can use agriculture as the basis for lesson plans.

While at the conference, educators will tour a number of Penn State's agriculture facilities, participate in hands-on lessons and leave with a host of materials for use in their classrooms.

The Educator's Ag Institute is open to new educators, along with those who have previously attended our Ag in the Classroom workshop. Participants will also tour several area farms and hear from farmers about how they grow food, care for and feed their animals, and how the farm is run. Educators will receive Act 48 credits and/or can register for continuing education credits through Penn State.

Please consider sharing information about this valuable workshop with educators in your area. For more information, contact the foundation at 717.731.3556 or www.pfb.com/aginstitute.

*From **Pennsylvania Agricultural Alliance Issues Update,** Penna. Farm Bureau, May 2018.*

Register Now for Friends of Ag Golf Tournament

The Pennsylvania Friends of Agriculture Foundation's major fundraising initiative is returning for its 26th year.

The 26th Annual Richard Prether Golf Classic will take place Monday, June 18 at the Hershey Country Club, West Course. The outing is sponsored by the foundation and Nationwide Insurance.

The golf outing proceeds help support agriculture education outreach through the foundation's many programs including the Mobile Ag Ed Science Lab, Ag on the Go, Educator's Ag Institute, Ag Literacy Week, our Scholarship programs, and other ag literacy outreach events we attend throughout the year.

The foundation tournament will be conducted as a four-person scramble and will be held on its scheduled date, rain or shine. The cost of the golfing package is $150 per person and includes greens fees and cart, driving range privileges, lunch and refreshments on the golf course, golf contests and prizes, gifts, dinner and a chance for door prizes.

Registration begins at 10 a.m. The driving range will be open at 10 a.m. and there will be a putting contest from 10 a.m. to 11:30 a.m. Lunch will take place from 11:00 a.m. to 12:15 p.m. with a tournament shotgun start at 12:30 p.m. Dinner is scheduled for 6 p.m.

The deadline for reservations is June 1. Be sure to reserve your foursome early since space is limited to 144 golfers. To make your reservation or to learn more about sponsorship opportunities please contact the coordinator, Natalie Slembarski:

Pennsylvania Friends of Ag Foundation
c/o Natalie Slembarski
P.O. Box 8736, Camp Hill, PA 17001-8736
Phone: 717.761.3555
NASlembarski@pfb.com

*From **Pennsylvania Agricultural Alliance Issues Update,** Penna. Farm Bureau, May 2018.*

NEWS

PIDA Loans Available to Ag Businesses

Administered through the Pennsylvania Department of Community and Economic Development (DCED), the Pennsylvania Industrial Development Authority (PIDA) loan program provides low-interest loans and lines of credit to Pennsylvania businesses, including agricultural businesses, that commit to creating and retaining full-time jobs within the commonwealth, as well as for the development of industrial parks and multi-tenant facilities. Loan applications are packaged and underwritten by a network of certified economic development organizations (CEDOs) that partner with PIDA.

Eligibility and Use

PIDA financing can be used for:

- Land and building acquisitions
- Construction and renovation costs
- Machinery and equipment purchases
- Working capital and accounts receivable lines of credit
- Working capital term loans

Funding and Participation

PIDA's maximum participation amount for a project is determined by the proposed use of PIDA funds, the amount of matching financing from sources outside of PIDA, and the number of full-time jobs to be created or retained. Generally, a 50 percent match is required however, some exceptions do apply.

Lending Amounts

Listed below are the maximum lending amounts through PIDA. Please note the lending limits vary based on the type of business being financed:

- Real estate loans up to $2.250,000
- Machinery and equipment loans up to $1.500,000
- Working capital term loans and lines of credit up to $100,000.

Interest Rates and Fees

The interest rates and fees charged by PIDA are very competitive. Rates are typically 1 to 2 percent below the industry standard. Contact PIDA for current rates:

- Interest rate options for real estate loans include fixed and variable reset rates.
- Machinery and equipment and working capital rates are fixed over the life of the loan.
- A 1 percent commitment fee is charged for loans greater than $400,000.
- Borrowers are also responsible for applicable closing costs and associated fees charged by the CEDO.

Loan Terms and Renewals

- Up to 15 years: Land and building acquisitions; construction and renovation costs. Qualifying projects are also eligible for a 10 year term with a 20 year amortization period whereas a balloon payment is due at the end of the 10 year period.
- Up to 10 years: Machinery & equipment purchases.
- Up to 3 years: Working capital term loans.
- Line of credit maturities are 12 months and can be renewed on an annual basis up to a maximum of 6 years.

Collateral

Collateral is required and is based on the asset being financed. The project cash-flow, credit, and collateral loan to value are taken into consideration when determining the overall collateral package for a project. In general:

- For real estate financing, a mortgage on the project property being financed is required. For real estate loans over $400,000, a mortgage in no less than a second position is required.
- Machinery and equipment loans are secured by no less than a second lien on either the equipment being financed or by a blanket lien on all equipment/business assets owned by the company.
- Working capital term loans and lines of credit are generally secured by a fir st lien on the inventory and receivables of the company.
- Personal guarantees are generally required by the principal owners, which typically is limited to individuals with 20 percent or more ownership in the operating entity.

How to Apply

PIDA partners with a network of nonprofit organizations called certified economic development organizations (CEDOs) to administer the PIDA loan program. Generally, the CEDOs service a one county area or a multicounty region, and work directly with the applicant company to package and underwrite the loan application. The loan application is submitted to the PIDA Office by the CEDO for final approval by PIDA.

You can determine which CEDO(s) serve your business's county and view additional information about the PIDA program at dced.pa.gov/PIDA.

GENERAL

Understanding FSMA: The Produce Safety Rule

Luke La Borde

Editor's Note: This is the second in a series of articles on FSMA that will appear in the Penna. Vegetable Growers News. Dr. La Borde at the Department of Food Science at Penn State University prepared this summary which we have divided into segments to be published in the newsletter. The entire article is at https://extension.psu.edu/understanding-fsma-the-produce-safety-rule.

Key Requirements in the Produce Safety Rule

(continued)

Agricultural Water for Pre- and Postharvest Uses

Water is used extensively in farming operations. Preharvest uses include irrigation, chemical crop sprays, cooling, and frost control. Postharvest uses include washing or cooling harvested produce or cleaning food-contact surfaces. Handwashing and drinking water are also important uses of water on the farm. In the Produce Safety Rule, FDA only regulates the safety of pre- and postharvest "agricultural water," a term FDA has defined as water that is intended to, or likely to, contact the harvestable part of the growing crop, the harvested produce, or surfaces that can come into contact with the product.

The source from which agricultural water is obtained is strongly associated with its potential to become contaminated. Surface water has the highest level of risk because it is a shared resource that may be subject to sudden and unexpected contamination from animal intrusion, manure runoff from neighboring livestock operations, or wastewater septic tank discharge. Groundwater is considered safer, although shallow, improperly constructed or located wells may be subject to surface water contamination from runoff or during flooding events. Municipal water is the safest because it is regularly monitored and usually treated to eliminate harmful bacteria. Indirect irrigation methods, such as drip systems, are considered to have the lowest risk for produce contamination because the water is unlikely to contact the harvestable part of the crop. On the other hand, overhead spray systems are at a higher risk because the water will likely contact the harvestable part of the crop.

"Only water that is intended to, or likely to, contact the harvestable part of the crop is regulated."

Microbiological Testing Requirements

Frequency of testing. FDA requires growers to periodically monitor the quality of pre- and postharvest agricultural water through microbiological testing. The frequency of agricultural water testing is based on its source. For surface water, FDA requires farms to do an initial survey using a minimum of 20 samples collected as close as practicable to harvest over the course of two to four years. For untreated groundwater, FDA requires farms to do an initial survey using a minimum of four samples during the growing season or over a period of one year. There is no requirement to test agricultural water that is received from public water systems.

"The frequency of water testing required under the rule varies depending on the source of the water."

Microbiological criteria for agricultural water. Microbial limits established for agricultural water are based on levels of *E. coli* bacteria. *E. coli* is a common inhabitant of the intestinal tract of humans and animals and thus is a widely accepted indicator of fecal contamination and therefore the presence of human pathogens. See the FDA website for a list of several laboratory methods that are approved for this test. Growers are required to make two calculations from the *E. coli* data obtained during testing: the geometric mean (GM) and the statistical threshold value (STV).

The GM represents a type of average value for the amount of generic *E. coli* in a water sample. Multiple *E. coli* values determined over time are transformed into logarithmic (log) values. Then the average of the log values is determined, and this

(continued on page 10)

NEWS

April Hired Workers Down 4%, Wage Rates Increase 4%

Workers hired directly by farm operators numbered 648,000 for the reference week of April 8-14, 2018, down 4 percent from the April 2017 reference week. There were 534,000 workers hired directly by farm operators on the Nation's farms and ranches during the week of January 7 - 13, 2018, up slightly from the January 2017 reference week.

Farm operators paid their hired workers an average wage of $13.72 per hour during the April 2018 reference week, up 4 percent from April 2017. Field workers received an average of $12.72 per hour, up 4 percent. Livestock workers earned $12.78, up 2 percent from the previous year. The field and livestock worker combined wage rate, at $12.74 per hour, was up 3 percent from the 2017 reference week. Hired laborers worked an average of 40.2 hours during the April 2018 reference week, down slightly from the hours worked during the April 2017 reference week.

Farm operators paid their hired workers an average wage of $14.08 per hour during the January 2018 reference week, up 5 percent from the January 2017 reference week. Field workers received an average of $12.84 per hour, up 6 percent, while livestock workers earned $12.89 per hour, up 2 percent from the previous year. The field and livestock worker combined wage rate, at $12.86 per hour, was up 4 percent from January 2017 reference week. Hired laborers worked an average of 38.0 hours during the January 2018 reference week, equaling the hours worked during the January 2017 reference week.

In the Northeast Region II (Delaware, Maryland, New Jersey, and Pennsylvania) there were 27,000 workers hired directly by farms during the week of January 7-13, 2018. Hired workers worked an average of 35.0 hours during the survey week. The average wage rate for all hired workers was $14.19 per hour. Field workers earned an average of $13.57 per hour and livestock worker averaged $12.88 per hour. Field & livestock workers combined earned an average of $13.25 per hour.

There were 33,000 workers hired directly by farms during the week of April 8-14, 2018. Hired workers worked an average of 36.5 hours during the survey week. The average wage rate for all hired workers was $13.89 per hour. Field workers earned an average of $13.37 per hour and livestock worker averaged $12.68 per hour. Field & livestock combined earned an average of $13.10 per hour.

From the Northeastern Region Farm Labor Report, National Agricultural Statistics Service, USDA.

GENERAL

Understanding FSMA... *(continued from page 9)*

value is transformed back to the non-log form. It is called a rolling average because once a new test result is obtained, an older one within a defined interval is removed. For surface water, the number of samples in the rolling average is 20. For groundwater, the number of samples is four. The maximum allowable rolling GM value for water that contacts the harvestable part of the crop is 126 cells of *E. coli* per 100-milliliter sample. FDA recognizes that any *E. coli* that is present on the surface of fresh produce will rapidly begin to die immediately after direct water application. Therefore, growers are permitted to adjust their laboratory-obtained values downward by 0.5 log unit (about a two-thirds reduction) for each day between when the water was applied and harvested for a maximumof four days.

The STV reflects the level of variability in *E. coli* levels among the samples such as could happen when sporadic rain showers wash waste into rivers and creeks. It can be thought of as the microbial level at which 90 percent of the samples are below the value. The maximum allowable STV for water that contacts the harvestable part of the crop is 410 cells of *E. coli* per 100-milliliter sample.

If the GM or STV values exceed the limits during the baseline sampling, then the cause of the deviation must be determined and corrective actions taken. A new baseline study as described above must then be conducted. If the results are at or below the GM and STV limits, the number of samples taken each year can be reduced to five or one for surface water or groundwater, respectively.

In addition to testing, you must conduct an annual inspection of your entire water system to determine any conditions that might lead to a contaminated water supply.

FDA allows growers to treat agricultural water with EPA and FDA-approved chemical sanitizers as long as the product is labeled for crop contact and used according to label directions. Other treatments such as ozone or UV irradiation can be used as long as scientific evidence that proves its effectiveness is presented. Microbial testing of treated water is not required, although treatment variables (e.g., concentration, pH, and application method) must be monitored and documented for each use.

The agricultural water standards are among the more controversial sections of the Produce Safety Rule. FDA anticipated that growers would need extra time to learn how to take samples, do the necessary calculations, and take corrective actions if the water supply were found to be noncompliant. FDA therefore allowed an additional two years beyond the compliance date for the regulation before water requirements would be enforced.

However, the negative reaction to these standards was more than FDA had expected. Many growers and commodity groups have expressed that the sampling and testing requirements are overly burdensome and the required calculations too complex for most to carry out, document, and interpret. In response, FDA has indicated their intent to simplify the requirements for agricultural water, and has also proposed an additional two years beyond the original deadline before compliance will be enforced while they evaluate the practicability and scientific basis for policies and procedures written in the regulation.

In the meantime, growers are advised to continue testing their agricultural water during the growing season to help them understand seasonal trends and potential sources of contamination.

To be continued next month.

NEWS

Video Series Answers Questions About Sanitizers in Wash Water

Luke LaBorde and Lee Stivers

A Penn State Extension farm food safety video series is available for fruit and vegetable growers seeking more detailed information on farm food safety of harvested crops.

The use of a triple sink wash system in combination with a sanitizer can help reduce the risk of pathogen contamination in fresh fruits and vegetable.

The "Using Sanitizers in Wash Water" series was designed for farmers and others involved in the post-harvest handling and cleaning of fresh produce. The three short educational videos recommend best practices so that postharvest handlers of produce understand the potential risks and how to minimize those risks through proper washing and use of wash water sanitizers.

Developed by Dr. Luke LaBorde, Associate Professor of Food Science, and Lee Stivers, Extension Educator in Horticulture, the videos address food safety considerations for complying with the Food Safety Modernization Act (FSMA) and Good Agricultural Practices (GAPs) standards.

The first video, "Reasons for Washing Fresh Produce," provides an overview of food safety considerations addressed in the series, focusing on the conditions under which growers should was produce postharvest and the steps for proper washing. The second video, "Types of Washing Systems" reviews the various wash systems and which systems require a sanitizer. The third video, "Correct Use of Sanitizers" addresses technical considerations in selecting the appropriate sanitizer, and how to efffectively and safely apply the product.

Using Sanitizers in Wash Water Series

Part 1: Reasons for Washing Fresh Produce
https://extension.psu.edu/resolveuid/3535dfb6bec94170a267e3fb73aa8d24

Part 2: Types of Wash Systems
https://extension.psu.edu/resolveuid/fa85347b0ea24b2ba9c18f4579334c8b

Part 3: Correct Use of Sanitizers
https://extension.psu.edu/resolveuid/ce5d892418bf4cc6bc21819421042c20

Also available in Spanish:

Dr. Laborde is with the Department of Food Science at Penn State Univ. and Ms. Stivers is with Penn State Extension in Washington Co. From Penn State Extension, https://extension.psu.edu/video-series-answers-questions-about-sanitizers-in-wash-water, May 24, 2018.

NEWS

Growing Asparagus... *(continued from page 2)*

Cultural Practices

After establishment, an asparagus crop is fertilized annually by topdressing in June after harvest. A crop is usually harvested in its 3rd spring and a field can remain viable for 15-20 years, although yields may begin declining after about 15 years. For organic growers, it may be harder to achieve this long-term harvest due to the establishment of perennial weeds. In late March or early April, when soils are dry enough, fields are flail mowed to break down last year's ferns, a pre-emergent herbicide applied, and the field is lightly disked. Rather than mowing, some growers burn their fields to help manage asparagus rust and crop residues. Fields do not need much maintenance during harvest usually from about May 1st until mid-late June. At D.A. Smiarowski Farm, they aim for Father's Day as the last harvest, giving them about 7 weeks of harvest, but some growers will harvest even until July 4th. With daily temperatures around 70°F, asparagus can grow 3-6" per day, therefore daily harvest is critical. In June, with hot and humid days, the spear tips become seedy and flavor diminishes. During the harvest period, a frost of 20°F or below can be devastating, as it can harm the crowns, but with a frost around 30°F, only the growing tips of the asparagus are harmed, and a crew can go through the field, harvest all the spears, and allow another flush to return 3-5 days later. After harvest is over, the field is flail mowed again, a contact herbicide is applied, and a lime or woodash application is made to maintain the field at a pH of 6.8-7. At this time, based on soil test results, 75 lbs N/A, 0-150 lbs P/A, and 0-300 lbs K/A may be broadcast and lightly incorporated with the lime. For soils low in boron, apply 1-2 lbs per acre of actual boron every 3 years to asparagus plantings. Good winter snow cover indicates a good harvest the following year.

Pest Management

Common Asparagus Beetle: While common asparagus beetle emerges in Smiarowski's fields each year, he has never treated for this pest because in his estimation, the adults are only actively feeding for 2-3 days in each generation. We observed beetles during our visit, and noted that they were almost exclusively present on the thinnest spears, which would not be harvestable anyway. Not many insecticides have a zero-days-to-harvest interval after application so many growers avoid using insecticides entirely. If an infestation of common asparagus beetle larvae is particularly heavy (greater than 50% of spears infested), an insecticide treatment at the end of harvest while larvae are still present can be helpful to prevent them from pupating in the soil and re-emerging in July.

Bindweed. Photo: A. Flynn

Weeds: As mentioned above, weeds are typically managed in the spring before harvest and in the early summer right after harvest. Pesky perennial weeds such as bindweed can be difficult to manage and crews sometimes cull the rhizomes out while harvesting to try and keep the pressure down. Gramoxone or Roundup can be applied to kill emerged weeds following harvest. Neither of these will provide residual control and a clean cut is required before application. After ferns emerge, 2,4-D may also be an option although it must be directed to the base of the plants, as over-the-top applications will injure the ferns. For residual control after harvest, options include Karmex, Solicam, Sandea, Callisto, and Sinbar. Flame weeding can also be used at this time but is impractical if weeds are very large. When flaming, avoid early morning because extra BTUs will be needed to evaporate the dew before the weeds will be impacted.

Harvest

While mechanical bunchers and even harvesters exist, asparagus production is still relatively un-mechanized in Massachusetts. At D.A. Smiarowski Farm, about 8 people work for a few hours in the morning harvesting all of the asparagus fields, bringing in 30-40 crates which they bunch in the afternoon. The asparagus is usually sold the day it is picked. On hot days, cold storage is needed, and D.A. Smiarowski Farm has a simple Coolbot cooler made from an air conditioner in an old refrigerated truck body which they keep at 38-40°F. This year, despite the cool April, the first harvest date was not much later than normal, according to Smiarowski's farm record. Their first harvest dates over the last 5 years, beginning with this current year, have been May 3, April 28, April 27, May 5, May 5, and May 1.

Asparagus harvesters use a special asparagus knife. photo: K. Campbell-Nelson

Sales

Direct retail sales from roadside stands in Massachusetts are $4 to $5 per bunch. For wholesale, a bunch goes for about $3.13. Smiarowski averages about 70-75 crates per acre, sold at $75 each wholesale, but he prefers selling from the road-side stand. At Smiarowski Farm, the target bunch weight at the time of sale is 1 pound. If bunches will be stored overnight standing in water, they are bunched at ~0.95-1 pounds to account for slight weight increase due to water uptake. If bunches will be sold immediately, they are bunched at ~1.1-1.2 pounds to account for some moisture loss in transport. Smiarowski estimates that most asparagus produced in Massachusetts is sold within a 20-mile radius of where it was grown, and the largest farms are only about 15-20 acres; a true local delicacy!

The authors are with the Univ. of Massachusetts Extension Vegetable Program. From ***Vegetable Notes for Vegetable Farmers in Massachusetts****, Univ. of Mass. Extension, Vol. 30, No. 7, May 24, 2018.*

Fresh Market Tomato Variety Trial – Year 2

Timothy Elkner

Fresh market tomatoes are a very important crop in Pennsylvania. According to the USDA, in 2015 total harvested acreage was 2,200 with a crop value of over $33.2 million. Since there had been no evaluation of newly released varieties in the state in a replicated trial in recent years, this study was initiated in 2016 and repeated again in 2017.

Materials and Methods

Thirty-two round red tomato varieties (named and advanced selections) were evaluated using plasticulture and drip irrigation. In addition, ten advanced selections from the Penn State tomato breeding program were also included. Seeds were started on April 6 and transplants were set in the field on May 17. There were four 6-plant replications per variety with an in-row spacing of 1.5 ft. Fertilizer was applied preplant according to soil test results and standard fertility and pest management practices were used during the growing season as found in the Commercial Vegetable Production Guide. Harvest started on July 21 and ended on September 11. Fruit were graded into #1, #2 and cull and each group was counted and weighed.

Results and Discussion

Mountain Fresh Plus was used as the standard variety in this trial. Yields of #1 fruit and total marketable fruit (#1 + #2) were 1.6 and 4.7 lbs. per plant. In 2017 there was a severe bacterial infection in the entire planting that started early in the season which resulted in decreased yields compared to the 2016 trial where Mountain Fresh Plus had 6.5 and 12.0 lbs per plant of #1 fruit and total marketable fruit (data not presented). Varieties with weights of #1 fruit 0.5 lbs. or more than Mountain Fresh Plus were Grand Marshall, Primo Red, Red Bounty, Red Morning, Red Mountain, Rutgers 250, Tribute and Volante (Table 1). Numbered varieties with better yields of #1 fruit 0.5 lbs. or more were 17X03, 17X07, XTM2255, XTM 2261, 16-11 and 16-13 (Tables 1 & 2). 17X03 had a much higher yield of #1 fruit per plant but the fruit size was too small (0.21 lbs.) for this class of tomato.

Varieties with a total marketable yield 1.5 lbs per plant (or more) greater than Mountain Fresh Plus were Grand Marshall, Primo Red, Red Morning, Red Mountain, Rutgers 250, Tribute and Volante (Table 3). Rutgers 250 had an average marketable fruit size of 0.50 lbs. which is probably smaller than acceptable for this class of tomato. Numbered varieties with a total marketable yield 1.5 lbs per plant (or more) greater than Mountain Fresh Plus were17X03, 17X07, XTM2255 and XTM 2261. Most of the Penn State selections had total marketable yields comparable to Mountain Fresh Plus (Table 4).

Mountain Fresh Plus had a value of 42% for total marketable percent of harvested fruit (compared to 80% in 2016). Varieties with greater than 50% total marketable percent of all fruit were Grand Marshall, Primo Red, Red Mountain, Rutgers 250 and Tribute (Table 6). Numbered varieties with at least 50% total marketable percent of all fruit were 17X03, 17X07, XTM1134, XTM2255 and almost all of the Penn State selections (Tables 5 & 6).

Average marketable fruit size for Mountain Fresh Plus was 0.66 lbs.; only Mountain Merit, Rutgers 250 and Tribute had fruit size below 0.6 lbs. All of the Rutgers advanced selections averaged below 0.6 lbs. while most of the Sakata selections were above 0.7 lbs. No consistent differences in flavor were noted with informal tastings on selected harvests.

(continued on page 14)

Fresh Market Tomato... *(continued from page 13)*

Table 1. Yields of #1 and #2 fruit for 22 named varieties and 10 advanced selections of round red tomato. All numbers are averages from four replications and are reported on a per-plant basis.

Variety	Number #1	Weight #1(lbs)	Number #2	Weight #2(lbs)
Bella Rosa	1.2	0.8	6.7	4.5
BHN 589	1.8	1.3	5.2	3.1
Camaro	1.8	1.3	4.9	3.7
Grand Marshall	5.1	3.3	8.5	5.5
Mountain Fresh Plus	2.3	1.6	4.8	3.1
Mountain Majesty	2.3	1.5	4.7	3.7
Mountain Merit	2.9	1.5	5.4	2.9
Primo Red	5.5	3.9	5.5	4.3
Red Bounty	3.4	2.1	6.0	3.9
Red Delight	1.6	1.2	4.4	3.0
Red Deuce	2.0	1.6	4.3	3.4
Red Morning	3.8	3.1	4.9	4.0
Red Mountain	8.4	5.0	7.1	4.5
Red Rave	2.5	1.3	3.7	2.3
Redline	1.8	1.1	3.8	2.5
Resolute	3.2	1.8	6.2	4.1
Rocky Top	3.0	2.0	4.7	3.1
Rutgers 250	5.3	2.5	8.0	4.1
Scarlet Red	1.5	1.0	3.7	2.1
Summerpick	2.0	1.3	4.5	3.1
Tribute	3.9	2.2	8.5	6.1
Volante	3.3	2.4	6.0	4.5
STM 8005	2.4	1.7	5.7	4.1
TFW6017X03	43.2	8.6	14.2	3.7
TFW6017X05	1.2	0.5	2.8	1.5
TFW6017X07	5.2	2.5	9.3	4.7
TFW6017X09	2.0	1.0	3.5	1.8
XTM0004	1.3	1.0	4.2	3.0
XTM1134	1.8	1.4	4.6	3.8
XTM1135	2.8	1.7	5.6	3.7
XTM2255	3.0	2.4	6.0	5.0
XTM2261	3.7	2.7	5.3	3.9

Table 2. Yields of #1 and #2 fruit for 10 advanced selections of round red tomato from the Penn State tomato breeding program. All numbers are averages from four replications and are reported on a per-plant basis.

Variety	Number #1	Weight #1(lbs)	Number #2	Weight #2(lbs)
PSFH 16-2	3.1	1.9	3.9	2.3
PSFH 16-7	3.3	1.6	5.1	2.7
PSFH 16-8	3.6	1.9	5.7	2.9
PSFH 16-10	2.6	1.7	4.3	2.7
PSFH 16-11	4.1	2.4	4.5	2.7
PSFH 16-13	3.3	2.1	4.0	2.4
PSFH 16-14	2.4	1.5	3.7	2.3
PSFH 16-18	2.0	1.2	4.6	2.8
PSFH 16-118	0.9	0.5	3.3	2.2
PSFH 16-124	3.4	1.9	5.1	3.1

Table 3. Total # and weight of marketable fruit, average weight and # culls for 22 named varieties and 10 advanced selections of round red tomato. All numbers are averages from four replications and are reported on a per-plant basis.

Variety	Number Marketable	Marketable Wt.(lbs)	Marketable Wt.(lbs)	Number Culls
Bella Rosa	7.9	5.3	0.67	11.2
BHN 589	7.0	5.1	0.73	12.0
Camaro	6.7	5.0	0.74	14.5
Grand Marshall	13.6	8.8	0.65	9.4
Mountain Fresh Plus	7.1	4.7	0.66	10.0
Mountain Majesty	6.9	5.2	0.76	10.7
Mountain Merit	8.3	4.4	0.54	13.5
Primo Red	11.0	8.2	0.74	10.0
Red Bounty	9.4	5.9	0.63	11.2
Red Delight	6.0	4.2	0.70	10.1
Red Deuce	6.3	4.5	0.79	12.4
Red Morning	8.9	7.1	0.82	10.6
Red Mountain	15.5	9.5	0.61	11.2
Red Rave	6.2	3.6	0.58	9.3
Redline	5.5	3.6	0.65	10.6
Resolute	9.4	5.9	0.62	11.3
Rocky Top	7.7	5.1	0.66	8.4
Rutgers 250	13.2	6.6	0.50	11.4
Scarlet Red	5.2	3.7	0.70	9.6
Summerpick	6.4	4.4	0.68	11.4
Tribute	12.5	7.1	0.57	13.0
Volante	9.3	6.9	0.74	10.5
STM 8005	8.1	5.8	0.72	8.6
TFW6017X03	57.5	12.3	0.21	16.8
TFW6017X05	3.9	2.0	0.52	17.3
TFW6017X07	14.5	7.2	0.50	13.2
TFW6017X09	5.4	2.8	0.51	14.0
XTM0004	5.5	3.9	0.71	11.8
XTM1134	6.4	5.3	0.82	7.7
XTM1135	8.4	5.4	0.64	11.0
XTM2255	9.0	7.5	0.82	8.0
XTM2261	9.0	6.5	0.72	10.4

(continued on page 15)

Fresh Market Tomato... *(continued from page 14)*

Table 4. Total # and weight of marketable fruit, average weight and # culls for 10 advanced selections of round red tomato from the Penn State tomato breeding program. All numbers are averages from four and are reported on a per-plant basis.

Variety	Total Number Marketable	Total Marketable Wt.(lbs)	Average Marketable Wt.(lbs)	Number Culls
PSFH 16-2	6.8	4.2	0.62	7.6
PSFH 16-7	8.4	4.2	0.50	6.9
PSFH 16-8	9.3	4.8	0.52	7.0
PSFH 16-10	6.6	4.4	0.67	6.6
PSFH 16-11	8.6	5.1	0.59	5.6
PSFH 16-13	7.3	4.5	0.62	6.1
PSFH 16-14	6.1	3.7	0.61	6.7
PSFH 16-18	6.6	3.9	0.59	5.2
PSFH 16-118	4.3	2.8	0.65	7.9
PSFH 16-124	8.5	4.9	0.58	6.1

Variety	Total Number Harvested	Total Weight Harv.(lbs)	Percent Marketable	Seed Source
PSFH 16-2	14.3	8.6	49	PSU
PSFH 16-7	15.4	7.6	56	PSU
PSFH 16-8	16.3	8.2	59	PSU
PSFH 16-10	13.2	8.6	51	PSU
PSFH 16-11	14.3	7.8	65	PSU
PSFH 16-13	13.5	8.3	55	PSU
PSFH 16-14	12.4	6.9	54	PSU
PSFH 16-18	11.8	6.7	59	PSU
PSFH 16-118	12.2	7.8	35	PSU
PSFH 16-124	14.7	8.1	61	PSU
PSU = Dr. Majid Foolad, Penn State				

Table 5. Total # and weight of harvested fruit, percent marketable fruit for 10 advanced selections of round red tomato from the Penn State tomato breeding program. All numbers are averages from four replications and are reported on a per-plant basis.

(continued on page 16)

Fresh Market Tomato... *(continued from page 15)*

Table 6. Total # and weight of harvested fruit, percent marketable and seed source for 22 named varieties and 10 advanced selections of round red tomato. All numbers are averages from four replications and are reported on a per-plant basis.

Variety	Total Number Harvested	Total Weight Harv.(lbs)	Percent Marketable	Seed Source
Bella Rosa	19.0	12.4	43	CS
BHN 589	18.9	13.5	38	SW
Camaro	21.2	15.4	32	SK
Grand Marshall	23.0	16.9	52	SK
Mountain Fresh Plus	17.1	11.2	42	HM
Mountain Majesty	16.9	12.2	43	HM
Mountain Merit	21.8	12.2	36	SW
Primo Red	20.9	15.3	53	HM
Red Bounty	20.5	12.9	46	HM
Red Delight	16.1	11.4	37	CS
Red Deuce	18.7	15.1	33	HM
Red Morning	19.3	15.7	45	HM
Red Mountain	26.7	15.7	60	HM
Red Rave	15.5	9.3	39	SW
Redline	16.1	10.3	35	CS
Resolute	20.7	12.9	45	SW
Rocky Top	16.1	10.8	47	SW
Rutgers 250	24.6	11.9	55	RU
Scarlet Red	14.8	10.5	35	SW
Summerpick	17.8	11.6	38	CS
Tribute	25.5	14.0	51	CS
Volante	19.8	14.4	48	CS
STM 8005	16.7	11.9	49	CS
TFW6017X03	78.1	17.0	72	RU
TFW6017X05	21.3	11.0	19	RU
TFW6017X07	27.7	14.6	50	RU
TFW6017X09	19.4	10.1	28	RU
XTM0004	17.3	12.2	32	SK
XTM1134	14.1	10.5	50	SK
XTM1135	19.4	12.3	43	SK
XTM2255	17.1	13.1	57	SK
XTM2261	19.4	13.4	49	SK____

CS = Clifton Seed, HM = Harris Moran, RU= Rutgers, SK = Sakata, SW = SeedWay

Dr. Elkner is with Penn State Extension in Lancaster Co. *This research project was funded by PVGA and the Pennsylvania Vegetable Marketing and Research Program.*

Impact of Insectary Strips to Control Cucumber Beetles

Gladis Zinati and Andrew Smith

Striped cucumber beetle is a major pest of Cucurbitaceae crops across the Northeast. Larvae and adult growth stages cause economic damage directly by feeding on plant roots, stems, flowers, leaves and fruits, and indirectly through the transmission of bacterial wilt, which can result in up to 80% yield loss. Cucumber and muskmelon are highly susceptible to bacterial wilt while squash and pumpkin are moderately susceptible. No curative control measures exist once plants are infected, and transmission rates increase as beetle densities increase. Current insecticides used to control cucumber beetles temporarily reduce cucumber beetle populations but have a detrimental effect on beneficial insect populations such as predators, parasitoids, and pollinators.

In addition, insecticide use can endanger the health of farm workers, birds and other ecosystem service providers.

At Rodale Institute, a field trial was conducted in 2016 to assess the use of insectary strips as a biological tactic to attract beneficial insects and control cucumber beetles in organic cucumber beds. Preliminary data from 2016 suggest that insectary strips aid in increasing populations of beneficial insects and could play an important role in improving parasitism and predation as cucumber beetle population increases.

Beneficial insects can attack adult, eggs, and larvae of cucumber beetles on plants or on the soil surface. Predators such as wolf spiders have been shown to feed heavily on cucumber beetles (Snyder and Wise 1999). Also, it has been shown that cucumber beetles avoid feeding on the crop when spiders are around (Williams and Wise 2003). Ground beetles (predator arthropod) also feed on adult cucumber beetles (Snyder and Wise 1999), thus a biodiverse community of predators may be important for biological control of cucumber beetles rather than relying on any single predator species. The goal of this study was to repeat the trial in 2017 and expand on the preliminary data already gained and measure striped cucumber beetle densities, parasitism rates, and beneficial insects' counts over more sampling dates. The objectives of this project were to:

1) Monitor the populations of striped cucumber beetles, beneficial insects, and ground beetles attracted to insectary strips and cucurbit beds using yellow sticky cards and pitfall traps, and 2) Assess percent parasitism by parasitoids from field collected striped cucumber beetles.

Materials and Methods

A field experiment was established with insectary strips and two cover crop mixtures at Rodale Institute Farm, Kutztown, PA in fall 2016 to assess the impact of flowering insectary strips on beneficial insects, number of striped cucumber beetles, and cucumber yield. In a randomized complete block design with four replications, cucumber beds were either bordered with insectary strips (30 ft x 5 ft) or strips of ryegrass (no insectary strip) that were kept mowed throughout the cucumber growing season. The cover crop mixtures were rye/hairy vetch (R/HV) and rye/field peas (R/P). Organic 'Ministro' slicing cucumber (F1 hybrid) seedlings were established in a greenhouse at Rodale Institute and were transplanted into beds (30 ft x 5 ft) covered with either black plastic or rolled cover crop mulch in early June 2017. One row of cucumber seedlings (two plants per hole) were spaced 18 inches in row. Row covers were deployed immediately after transplanting until first sign of flowering, to ensure protection of young seedlings from early feeding damage that can be caused by striped cucumber beetles.

Insectary strips included alfalfa as a base plant, fava bean, peas, dill, calendula, sunflower, sacred basil, lemon balm, sweet alyssum, and marigold. All plants were established in the greenhouse and transplanted into insectary strips – one row per plant species- between April and May 2017 except for fava bean and peas that were directly seeded in March 2017.

Monitoring of striped cucumber beetles and beneficial insects was done in cucumber beds and insectary strips on a weekly basis using yellow sticky cards. One sticky card per treatment was placed in the middle of the bed or the insectary strip and replaced on a weekly basis.

Pitfall traps: Each pitfall trap consists of two 16 oz. plastic cups, placed tightly in a hole in the ground and covered with plastic lids to prevent entry of rain. These pitfall traps were placed in the insectary strips, cucumber beds, and in the perimeter around the cucumber experimental plots (photo 1a). On Monday morning (between 8:00 am and 10:00 am) of each sampling week the lids were raised 2 inches from the soil surface (enough space to allow arthropod predators fall into the trap). Forty eight hours later, trapped predators (spiders and ground beetles) were identified and numbers of predators per species were recorded before releasing the predators and closing the lids.

Parasitism: Live striped cucumber beetles from cucumber plots were collected on four dates in 2017. Five to 10 striped cucumber beetles per bed were collected and placed in a glass jar and taken to the laboratory for incubation at 24 oC and 16 D:8N. The jars were then covered with mesh (photo 1b) to allow air entry and incubated for 21 days (maximum life cycle of parasitoid).

(continued on page 18)

Impact of Insectary... *(continued from page 17)*

Each week during the incubation period fresh cucumber leaves and cotton soaked with water were placed in jars for cucumber beetles. At the end of 21 days the number of dead and live striped cucumber beetles were counted, number of parasitoid (tachinid fly and pupae) were also counted (photo 1c). The collected pupae and emerging parasitoids were kept in small petri dishes for identification.

Yield: Cucumber fruits were collected twice a week for four weeks. Total and marketable cucumber yields were recorded at each harvest.

Results

a. Cucumber yield: Average marketable cucumber yield was 63,500 lb/acre in R/HV plastic treatment versus 18,900 lb/acre in R/HV mulch, whereas, it was 47,500 lb/acre in R/P plastic versus 7,300 lb/acre in R/P mulch treatment. The integration of insectary strips increased marketable cucumber yield in the R/HV rolled mulch treatment.

b. Striped Cucumber beetles, Lady bugs, and minute pirate bugs: The average number of striped cucumber beetle per trap in all beds was 0.8/trap and <0.3/trap in the insectary strips. These numbers were much lower than those of 2016. Striped cucumber beetle number peaked on July 29, 2017 and continued to decline after that date.

Average count of striped cucumber beetle per trap did not differ among mulch type as well as with and without insectary strips. However, the average number of lady beetles was higher in cucumber beds with and without insectary strips (1.2/trap to 1.3/trap) than within the insectary strips themselves (averaged 0.9/trap). The average number of lady beetle per trap was 9 times higher than those of striped cucumber beetle. The number of minute pirate bug was highest in the insectary strips averaging 1.3/trap versus 0.9/trap in cucumber beds with or without insectary strips.

c. Ground beetle count and species and spiders: Over the cucumber growing season we collected a total of 693 ground beetles, 395 from cucumber beds and 298 in perimeter and insectary strips. The number of ground beetles was higher in cucumber beds with insectary strips (216) compared to beds without insectary strips (179). Average ground beetle count in cucumber beds with insectary was 2.68/trap and was higher than those in the cucumber beds without insectary (2.22/trap). However, average ground beetle count was always greater in cucumber beds with plastic mulch than those in rolled mulch with or without insectary strips. Average ground beetle population was highest in the insectary strips (2.8/trap) than in grass perimeter (1.3/trap). The dominant ground beetle species with average number per trap included Chlaenius tricolor (0.55), Scarites subterraneous (0.23), Poecilus chalcites (0.07), P. lucublandus (0.05), and Harpalus pensylvanicus (0.04). Total number of wolf spiders and other spiders was 264 and 49, respectively. Wolf spider population was highest in in cucumber beds with insectary strips (106) followed by beds without insectary strips (78), insectary strips themselves (42), and perimeter grassy areas (38).

d. Parasitism: There was high variation between replicates and dates which resulted in no difference in parasitism between treatments (Figure 1). The mean percent parasitism of cucumber beetles collected in plots with insectaries was 13.96% and without insectaries was 12%. Parasitism spiked on July 29th at the same time that cucumber beetles reached the highest densities. On the first date of beetle collection (July 13th), parasitism was 19% in plots with insectaries and 1.5% in plots with no insectaries but did not differ significantly on the three later collection dates.

Outreach

The researchers showcased the project during the Rodale Institute's field day in July 2017 (photo 2a) and demonstrated the various ground beetle species that were collected from that study (2b). The results were also presented in a power point presentation at the American Society of Entomology Conference on November 8, 2017 at Denver, CO. A web article is in process and will be posted on Rodale's Institute website.

Discussion

In this study, we provided cucurbit growers with scientific-based information on uses of insectary strips for enhancing number of natural enemies and control of striped cucumber beetle count. Ground beetles, wolf spiders and minute pirate bugs responded positively to inclusion of alfalfa-based floral insectary strips, suggesting that the addition of flowering resources to agroecosystem can positively enhance biological control of striped cucumber beetle. Number of striped cucumber beetles was greater in cucumber beds without insectary strips and similarly the number of lady beetle. The low number of striped cucumber beetle population in 2017 may have impacted our ability to detect differences in parasitism between treatments. However, parasitism was higher in plots with insectaries on the first collection date where it was virtually zero in plots without insectaries. It is important to note that we did not observe any wilting of cucumber plants due to bacterial wilt disease during the 2017 and 2016 trials. Cucurbit growers may adopt these tactics on a variety of cucurbit crops to reduce damage injury on fruits by cucumber beetles, eliminate or reduce pesticide use, increase flower pollination, and continuously provide beneficial insects with source of food and shelter.

Literature Citation

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Dr. Zinati and Dr. Smith are with the Rodale Institute. *This research project was funded by PVGA and the Pennsylvania Vegetable Marketing and Research Program.*

Celeriac Production Issues in Pennsylvania

Thomas Ford

In an effort to determine the size and scope of celeriac production issues in Pennsylvania, I need your assistance.

Is boron deficiency the cause of this internal browning discoloration in celeriac? Photo: Jennifer Glenister

Recently two celeriac growers reached out to Penn State Extension after observing brown discoloration and hollow heart in the internal flesh of celeriac roots last summer. While the growers and I suspect that boron deficiency is the issue, our evidence is anecdotal rather than research-based at this time.

If you grow celeriac and have dealt with brown discoloration and/or hollow heart could you send me an email (tgf2@psu.edu) or note that provides me with the following:

- Celeriac varieties grown (please note the severity of symptoms noticed in specific varieties)
- Soil test results, specifically pH, calcium, potassium, zinc, and boron levels.
- Irrigation rates (some growers report providing up to 2 inches of water per acre per week to celeriac). *Moisture stress limits nutrient uptake so irrigation rates are important.

Send to: Tom Ford, Penn State Extension, Cambria County Office, 401 Candlelight Drive, Suite 220, Ebensburg, PA 15931

Celeriac, which is also sometimes called "Knob Celery" is considered a minor crop on many Pennsylvania vegetable farms, but to some direct marketers it is becoming a staple in their late summer and winter markets. Celeriac has a similar taste profile as the more traditional celery and has been used as a food crop since the 1600's. The bulbous root has a pearly white flesh and it can be stored for 3-4 months under ideal conditions. As a minor crop there has been very little research on celeriac so when a cropping issue arises it is difficult to obtain the research-based information needed to manage the crop.

In the interim, I have found literature from the Netherlands that suggests that celeriac requires a boron soil test level of 1.4 ppm. Growers with fields testing below the 1.4 ppm boron level were more likely to observe boron deficiency in their celeriac. This data also suggests that fields with a soil pH over 7.0 will limit boron availability and increase the likelihood of boron deficiency in celeriac. High soil calcium levels and high zinc levels

(continued on page 20)

VEGETABLE PRODUCTION

Revisiting Compost for Vegetable Production

Gordon Johnson

Each year I field questions from vegetable growers on the use of compost for their production systems. The availability of commercial compost has fluctuated over the years based on the companies operating in the region. With the entry of Perdue AgriRecycle into the compost field another quality compost is now available for use by growers on Delmarva.

In the composting process, organic stock material sources such as yard wastes, manure and litter, wood waste, food scraps and garbage, paper, hatchery waste, or other waste materials are combined in a proper mix to create a carbon to nitrogen ratio that will promote the growth of microorganisms that then decompose the materials, producing a dark, humus-rich end-product. In addition, in the composting process, the compost piles will heat up to between 130-170° F, killing pathogens of concern in the materials. A properly produced compost can be used for vegetable production without concerns for transferring plant pathogens or human pathogens.

Compost will contain plant nutrients, the level of which depends largely upon the stock materials used. Nitrogen content may be significant; however, much of the nitrogen will be in organic form and will be slowly available over several years. Most of the potassium will be readily available while phosphorus availability is more variable.

While compost does contain plant nutrients, the more important benefit that it provides is stable organic matter. Because it has already been decomposed, the organic component contains humus-like materials that will decompose very slowly when added to the soil. This means that compost will immediately raise the organic matter of the soil. This in turn will increase the cation exchange capacity (CEC) of the soil, improve soil moisture holding capacity, and improve soil physical characteristics (reduced compaction, improved aeration, decreased crusting).

Research has also shown that certain composts can reduce the incidence of soil borne diseases and pests. This is most likely because the organic addition promotes more diversity in soil microorganisms that can compete with pathogens and the improved physical properties of the soil (such as reduced compaction) that limits the impact of certain pathogens. Newly finished compost also contains beneficial microorganisms that directly affect plant pathogens by antibiosis or hyperparasitism. Some composts have also been shown to induce resistance to pathogens in crop plants.

When using compost, growers should first receive an analysis of the material. From this analysis you should look at the following:

Compost Maturity and Stability – Only use mature compost that has finished the composting process and that is stable. Immature compost will continue to decompose, and can cause soil imbalances in some cases.

Nutrient Content – As previously stated, compost has a base nutrient content. You need to account for available nutrients in the nutrient management plan for the crop the compost will be used on. Much of the nitrogen will be in organic form and only a portion will be available for the growing season.

Electrical Conductivity (EC or salts levels) – Composts that use manure or poultry litter as part of the stock materials can accumulate salts (particularly potassium) at elevated levels. The elevated salt content must be accounted for when determining application rates so that salt injury does not occur with crops.

Calcium Carbonate Equivalent (lime value) – Lime is generally not added in the composting process; however, high pH materials such as hatchery waste sometimes are composted. This means that certain composts may have more liming value.

Moisture Content and Physical Condition – Compost will be partly water. With higher moisture composts, you will be paying for more water and less of the humus material and nutrients. In addition, higher moisture composts do not spread as well. Compost should be adequately screened so that the product spreads well.

In research at the University of Delaware with several compost materials, a rate of 5-7 tons per acre showed yield benefits on sandy soils in the first year with several vegetable crops. However, specific effects on a grower's farm will depend on soil type, existing organic matter, existing soil health, and compost source; therefore, rates should be adjusted accordingly.

The decision to use compost is also an economic one. Compost can cost anywhere from $15.00 to $50.00 per ton depending upon the source and distance for transport. Growers need to consider the soil improving and nutrient value of the compost and evaluate that against other soil improvement programs such as cover cropping and green manure crops.

Dr. Johnson is the Extension Vegetable and Fruit Specialist at the University of Delaware. From the ***Weekly Crop Update****, Univ. of Delaware Extension, Issue 26:2,* April *6, 2018*

Celeriac Production... *(continued from page 19)*

in the soil can also lessen boron uptake by many crops and in one case the grower reported both elevated calcium and zinc levels in the soils where celeriac internal browning symptoms were observed. Data on celery also suggests that elevated soil potassium levels will increase the incidence of boron deficiency so it is possible that a similar scenario could be observed in celeriac as well.

According to some older research data from the Netherlands there appears to be varietal sensitivities to boron deficiency and symptom expression in celeriac. The variety Oderdorfer was considered highly susceptible to boron deficiency while the varieties Roka, Magdeburger, and Markt only displayed symptoms occasionally. Varieties Dippes, Invictus, Hilds Neckarland, and Wiener Markt typically did not express any symptoms according to the Dutch study. So far, our Pennsylvania growers have noted internal browning in the varieties Mars and Brilliant.

If you are growing celeriac and have enjoyed good success please consider sharing your data with me so we can help our celeriac growing community in Pennsylvania.

Mr. Ford is with Penn State Extension in Cambria Co. From Penn State Extension, https://extension.psu.edu/celeriac-production-issues-in-pennsylvania, March 24, 2018.

Poor Stands and Plant Vigor in Early Planted Fresh Market Sweet Corn

Gordon Johnson

Growers are reporting issues with stands and vigor in sweet corn fields in 2018, especially in early planted fields. There can be many causes for stand loss and weak seedlings: surface compaction and crusting, birds, soil insects, slugs, cold soils that delay emergence, soil diseases affecting seeds or seedlings, wet soils, fertilizer injury, deep planting, and herbicide injury are just a few examples.

When checking sweet corn fields with vigor and stand problems, it is important to dig up seeds and affected plants and examine the seed remnants, roots, and mesocotyl (stem that pushes the seed leaf to emerge above the ground). Corn seedling survival and early vigor is directly tied to a healthy seed kernel and mesocotyl from planting through the six-leaf stage. Any damage to the seed or mesocotyl during this period can lead to stunted or weak seedlings, and in severe cases, seedling death. This is because the corn seedling depends on the seed for food to grow for several weeks after emergence until sufficient leaf area has been produced and nodal roots have become established. The seed kernel provides the means for early roots to grow and these food reserves are also mobilized and transported through the mesocotyl to grow the first stalk and leaf tissue. The mesocotyl also serves to transport water and mineral nutrients from the seedling roots.

Sweet corn is more susceptible to stand loss and poor vigor problems than field corn because the seed has less food reserves. Shrunken types (supersweet, sugary enhanced, augmented shrunken, synergistic varieties) have even less stored food than "normal" types and therefore are more susceptible to stand problems.

I have looked at sweet corn fields with stand loss and vigor problems (uneven growth) over the years. Often, when digging up the seedlings and examining the seed remnants and mesocotyls, the kernels will be disintegrated and there will be darkening at the mesocotyl attachment. This means that the seeds deteriorated prematurely and the full content of the food reserves in the seed were not available for seedling development, leading to the stand and vigor issues. Premature seed deterioration and/or poor vigor seedlings can be due to diseases that cause seed rots, seedling blights and/or root rots. Soil insects can cause seed deterioration by feeding on seed contents or creating entrance wounds for disease organisms. In addition, certain soil insects and slugs can feed on the mesocotyl causing seedlings to collapse. Sweet corn that takes more than 10 days to emerge is at great risk of injury due to insects and diseases as seed treatments dissipate.

Cold stress and cold soils are common stress factors leading to poor stands. Often growers are pushing the limits and are planting sweet corn very early. In 2018 we had a cool April which further stressed early sweet corn. While field corn will start to germinate at 50°F, many types of sweet corn need much warmer soils. This is especially true of supersweet varieties and other shrunken types, which perform best at higher soil temper-

(continued on page 22)

VEGETABLE PRODUCTION

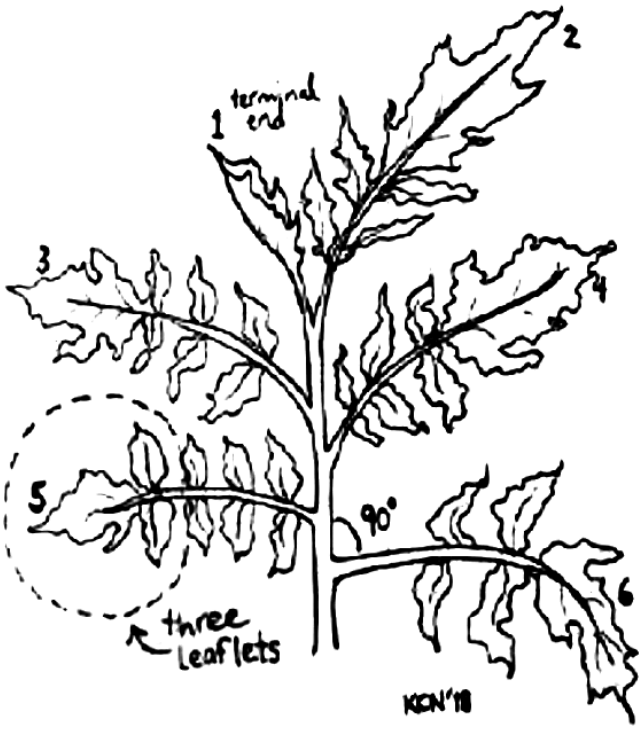
Fruit Set is the Time for a High Tunnel Tomato Tissue Test

Katie Campbell-Nelson and Andy Radin

High Tunnel tomatoes have been trellised and are beginning to set fruit in their first clusters and nutrient demand for calcium and potassium is increased at this time.

Many are thinking of the importance of calcium (Ca) at this stage in order to avoid blossom end rot (BER) later in the season. However, BER is more an imbalance of calcium within tomato plants themselves rather than lack of Ca availability, and more often than not, is related to soil moisture fluctuation, heat stress, and sometimes, excessive nitrogen. Potassium (K) deficiency on the other hand, in concert with excessive heat, can be an even greater problem for quality fruit production, resulting in blotchy ripening, yellow shoulders, and grey wall. Indeterminate varieties in tunnels and greenhouses continuously carry heavy loads of fruit so potassium demand remains high from early summer onward. Now is the time to take a tomato tissue test and then to boost potassium through fertigation or top-dressing if needed. According to Steve Bogash at PennState, K should be 3% of the leaf tissue by dry weight. In trials Andy Radin conducted in RI, he found that K% varied greatly by variety and he could not find a correlation with yield or fruit quality, however, a minimum target of 3% K by dry matter is not a bad goal.

For conventional growers, soluble fertilizers with a K to N ratio of somewhere around 2:1 can help, according to research from Michigan. More N may be required for season-long production on indeterminate vines. For organic growers, you can top-dress sulfate of potash, as long as your irrigation moisture is able to reach it so it can dissolve, or, it can be dissolved in hot water for fertigation. For more information, read Steve Bogash's excellent article from Penn State: http://extension.psu.edu/plants/vegetable-fruit/fact-sheets/new-vegetable-grower-factsheets/refining-tomato-nutrition-better-nutrition-forimproved-packouts.



How to take a Tomato tissue sample: It's a very good idea to sample your tomato leaves a few times during the season to make sure that plants are taking up sufficient potassium, as well as other nutrients. At the very least, taking a sample at the onset of fruit is a good time to ensure that nutrients are adjusted for a long and productive season. Here are the steps for taking an accurate tissue sample: • When sampling leaves, take whole leaves (petioles + leaflets) from 24 plants. If plants are too small, or you wish to reduce damage to plants, take 3 leaflets from the tips of 30 leaves. • Take the most expanded leaf below the first blooming flower cluster, which often is about 5 leaves down from the terminal. The 6th leaf is usually at a 90° angle to the stem (picture). • Sample in the hour before or after noon (this is usually the peak uptake of nutrients for the day) • Collect a representative sample of the planting from at least 15 plants of a single variety • If there is spray residue on the leaves, briefly rinse them and pat dry • When sending to a lab, pack in paper bags, not plastic, so the material does not begin to rot • If you are trying to diagnose a nutrient deficiency on some of your plants, send samples of both "healthy looking" plants as well as afflicted ones –

Ms. Campbell-Nelson is with the Univ. of Massachusetts Extension Vegetable Program, and Mr. Radin, is with the Univ. of Rhode Island Extension. From ***Vegetable Notes for Vegetable Farmers in Massachusetts****, Univ. of Mass. Extension, Vol. 30, No. 7, May 24, 2018.*

Poor Stands and... *(continued from page 21)*

atures (above 60°F). When soil temperatures are below 55°F, germination is greatly extended. Food nutrients are mobilized in the seed but are not being utilized rapidly by the plant. The seed then becomes a perfect food source for many soil microorganisms. On a positive note, many of the newer sweet corn varieties have much more cold tolerance and emerge more rapidly in cold soils.

Stand issues are often related to the inherent poor vigor of sweet corn. Work with seed suppliers to obtain their best lots for early plantings with the largest seed sizes. Obtain varieties that perform better under cold stress. When possible, obtain reports from early planted sweet corn trials to assess which varieties are the most cold tolerant. Request seed treatment information and select treatments with the best protection potential for early plantings. There are in-furrow fungicide options; however, research is limited with sweet corn in our region.

Growers often face the decision on whether or not to keep plantings with poor stands. This is most often a marketing decision based on the need for and value of early sweet corn for that farm. An estimate of potential marketable ears will be based on stand counts of full vigor plants from 20-40 sites throughout the field. This stand count information then can be used to estimate the value of the field as is versus the value of a later planted full stand crop.

Dr. Johnson is the Extension Vegetable and Fruit Specialist at the University of Delaware. From the ***Weekly Crop Update****, Univ. of Delaware Extension, Issue 26:8, May 8, 2018.*

Managing Powdery Mildew in Protected Tomatoes

Margaret McGrath

Powdery mildew on tomato causes white spots on foliage and can cover leaves and plants quickly under the right conditions. Photo by S. Scheufele.

Fungicides are the primary management tool for managing powdery mildew, the most common disease in high tunnel and greenhouse tomatoes. Micronized sulfur (e.g. Microthiol Disperss) and mineral oil (JMS Stylet-oil) are the most effective products for organic production based on comments from growers. They are also good choices for conventionally-produced crops. Sulfur is recommended applied at its lowest label rate because plants grown in protected culture tend to be more sensitive to phytotoxicity than field-grown plants. Also, without rain or overhead irrigation, fungicide residue will remain longer on plant tissue. As stated on the labels for these fungicides, there needs to be a gap of 2 or 3 weeks between applications of these products because oil can move sulfur into the leaf resulting in damage. Applications of sulfur especially during the harvest period may leave visible residue on fruit. It can be easily wiped off. An option to minimize visible residue is to use sulfur for the first applications until fruit start to mature, switch to another product for an application or two, then start applying oil. Other organic-approved products that are not oils include MilStop and Cease (these 2 recommended used together), Double Nickel, M-Pede (apply at ¾ rate to avoid phytotoxicity), and Regalia. Conventional fungicides labeled for powdery mildew and permitted used in protected culture include Inspire Super (difenoconazole + cyprodinil), Switch (fludioxonil + cyprodinil), Revus Top (difenoconazole + mandipropamid), and Vivando (metrafenone). Cultural practices to add to the powdery mildew management program include using wide within row and between row spacing of plants and removing lower leaves. These will help reduce humidity and also improve spray coverage. Also promote air movement to reduce humidity by opening sides or vents on warm days and using fans. These practices will help manage other foliar diseases including Botrytis gray mold and leaf mold.

Dr. McGrath is with Cornell Cooperative Extension on Long Island. From ***Vegetable Notes for Vegetable Farmers in Massachusetts****, Univ. of Mass. Extension, Vol. 30, No. 7, May 24, 2018.*

BERRY PRODUCTION

Who Pollinates Pennsylvania Blueberry Plants?

Margarita López-Uribe, Shelby Fleischer, Kristal Watrous and Nolan Amon

Blueberries (genus *Vaccinium*) are a high-value crop in Pennsylvania and the United States, with an estimated value of at least $825 million to the US economy in 2014.

Photo 1. Blueberry blossom showing the characteristic flowers of this plant. Note that the flowers are closed, bell-shaped and pendant. Photo credit: Nicole Castle, contributed to Plant Village.

Blueberries are native to eastern North America, unlike many of the other crops cultivated in this region. In the northeastern United States, both cultivated and wild plants coexist. Wild and semi-wild blueberry species, which are in the "lowbush" category, are smaller in stature (ranging from 14 to 24 in) and produce smaller fruit with a sweeter taste. Cultivated species belong to the "highbush" category, with bushes that range in height between 6.6 to 9.8 ft produce larger fruit and account for most of the large-scale commercial production. Common cultivars include Rubel, Weymouth, Bluecrop, Elliot, and Jersey (see Blueberry Variety Selection in the Home Fruit Planting at https://extension.psu.edu/ blueberry-variety-selection-in-the-home-fruit-planting for an extended list of varieties).

Blueberry plants require pollination by bees. Flowers are closed, bell-shaped, pendant, and have anthers that are shorter than their stigma, which discourages self-pollination via wind or gravity (Photo 1). Therefore, bees need to move the pollen within or between flowers to achieve fruit development and plant reproduction. In addition, the pollen is hidden in the anthers and is only accessible through "buzz pollination" (also known as flower sonication). This means that for blueberry plants to reproduce, bee flower visitors must hold the stamens and rapidly vibrate their flight muscles to liberate the pollen grains through a small pore at the tip of the anthers.

Honey bee (*Apis mellifera*) colonies are regularly rented to achieve optimal pollination in commercial blueberry farms. However, honey bees cannot perform buzz pollination, making them ineffective pollinators for blueberry. On average, honey bees only deposit 11 pollen grains on the stigma of the flowers that they visit, while wild bees, such as mining bees and bumble bees (Photo 2), deposit on average 49 and 43 pollen grains per visit, respectively. Optimal pollination is therefore achieved by the joint visitation of wild bees and honey bees through an ecological process called complementarity. Many wild bees that are capable of buzz pollinating flowers free up pollen during their floral visits and these loose pollen grains can be later picked up by honey bees.

Even though honey bees are less effective at transferring pollen every time they visit a flower, there are many more individual honey bees than wild bees because of two reasons:

First, honey bees live in colonies that are much larger than the other species; there are usually thousands to tens of thousands of individuals in every colony.

Second, the high numbers of rented colonies brought to blueberry fields during bloom significantly increase the abundance of honey bees visiting blueberry flowers.

Although wild social bees such as bumble bees will build colonies that grow during the season, at the time of blueberry bloom colonies are just getting started. Therefore, both honey bees and wild bees work as a team to pollinate blueberries and are essential to maximize yields in this crop.

Because Pennsylvania is located within the native range of blueberry plants, the wild bee community that visits blueberry flowers comprises a large number of species, some of which specialize in blueberry pollination. Among the native wild blueberry specialists, there are two species of mining bees (*Andrena carolina* and *Andrena bradleyi*; Photo 2A) and the southeastern blueberry bee (*Habropoda laboriosa*; Photo 2B). Other native bees that commonly visit blueberry flowers include bumble bees (*Bombus spp.*; Photo 2C), mason bees (*Osmia spp.*), sweat bees (*Lasioglossum spp.*), carpenter bees (*Xylocopa virginica*) and a large number of other mining bee species (*Andrena spp.*).

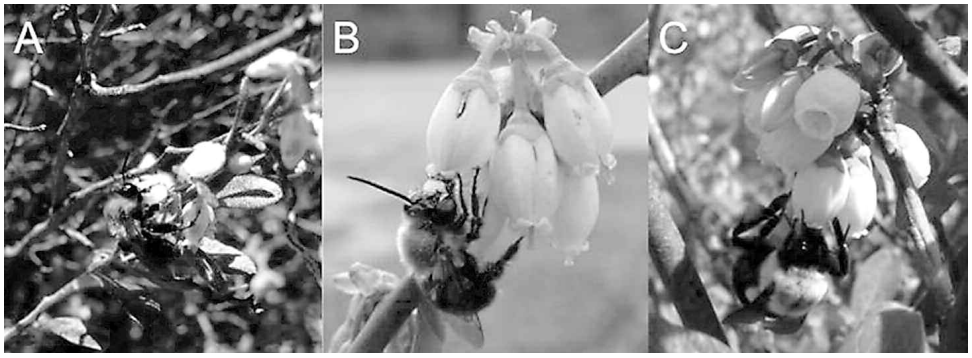


Photo 2. Common wild bees visiting blueberry flowers include (A) mining bees in the genus Andrena (photo credit Anthony Vaudo), (B) the southeastern blueberry bee Habropoda laboriosa (photo credit Elsa Youngsteadt), and (C) bumble bees in the genus Bombus (photo credit Kristal Watrous).

In a recent survey of bees visiting wild and cultivated blueberries in Central Pennsylvania, we observed at least 14 and 8 wild bee species visiting cultivated and wild blueberry species, respectively (Table 1). The most diverse groups of bees visiting blueberries in Pennsylvania were mining bees (6 species) and bumble bees (5 species). Notably, the specialist southeastern blueberry bee was not observed during these surveys. Pennsylvania is part of the native range of this specialist bee, and it has been registered in southeastern and central counties of the state (Adams, Bucks, York, Huntingdon, and Lycoming).

Each blueberry plant produces thousands of flowers every season. Each flower must be visited by multiple bee species to achieve optimal pollination that will translate into larger and more marketable fruit. For Pennsylvania, it is recommended to supplement high stocking densities of honey bees with surrounding natural habitat that supports other spring native bees species. The combination of large numbers of honey bees and

(continued on page 25)

Who Pollinates... *(continued from page 24)*

Table 1. List of bee visitors to cultivated and wild blueberry plants in central Pennsylvania. An asterisk (*) indicates bee species that are not native to eastern North America.

Bee Species	Cultivated Blueberry	Wild Blueberry or Relatives
Andrena bradleyi		X
Andrena canadensis	X	
Andrena carlini	X	X
Andrena carolina	X	X
Andrena wilmattae	X	
*Apis mellifera**	X	
Augochlorella aurata		X
Bombus bimaculatus	X	
Bombus fernaldae	X	X
Bombus griseocollis	X	
Bombus impatiens	X	
Bombus sandersoni	X	
*Lasioglossum spp.*1	X	X
Osmia bucephala	X	
*Osmia cornifrons**	X	X
*Nomada spp.*2	X	X
Xylocopa virginica	X	

native bees will guarantee optimal pollination for cultivated blueberries. Future research could help improve our understanding of wild bees providing the ecosystem service of pollination to our valuable blueberry crop in Pennsylvania.

An enjoyable 1-hour webinar summary of this type of research from current conditions in Michigan and British Columbia is available to watch at http://icpbees.org/home/videos/#Webinars (scroll down to the webinar on blueberries).

Further Readings

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Dr. Lopez-Uribe, Dr. Fleischer and Mr. Amon are with the Department of Entomology at Penn State Univ. Ms. Watrous is with the Department of Entomology at the Univ. of California at Riverside. From Penn State Extension, https://extension.psu.edu/who-pollinates-pennsylvania-blueberry-plants?

Bramble Growers Asked to Participate in Price Survey

Researchers at the University of Arkansas, in collaboration with the North American Raspberry & Blackberry Association (NARBA), and the University of Vermont, are conducting a survey to learn more about caneberry pricing and retail strategies for 2018. The survey should only take around 10 minutes to complete. Your participation is completely voluntary. Responses will be recorded anonymously and no identifying personal information will be collected within the survey. You are free to refuse to participate in the research and to stop completing the survey at any time.

Information collected in the survey will be used to gain a better understanding of the marketing, pricing, and sales strategies currently being used by caneberry producers across the United States and Canada. Results will be aggregated and published in the June issue of the North American Raspberry and Blackberry Association's member newsletter. A report will also be emailed to all participants requesting this option.

To access the survey please click the following link:
http://uark.qualtrics.com/jfe/form/SV_djzmC8tUnEirkyh

If you have any questions about this survey itself, please contact Jennie Popp by email or phone at jhpopp@uark.edu or 479-575-7381. You may also contact NARBA by email at raspberryblackberry@gmail.com, or by phone at 919-542-4037.

Strawberry Symposium Set for February 2019

We cordially invite you to the 9th North American Strawberry Symposium (NASS), a meeting of strawberry growers, researchers, and other industry members from around the globe, to be held in conjunction with the annual NASGA conference, Feb. 3-6, 2019 in Orlando, Florida, USA. Florida is the US leader in winter strawberry production and features a strong partnership between Florida strawberry producers and the University of Florida. This partnership is reflective of the purpose of this conference, which brings together growers and scientists from around the globe to spur innovation.

The Symposium will include two and a half days of workshops, reception, research presentations, marketing presentations, poster sessions and an award luncheon, and will be followed by a post-conference tour on February 6. The tour will feature a 600-acre strawberry farm, a robotic harvester demonstration, and field research at the University of Florida Gulf Coast Research and Education Center. The Program Committee is committed to making this a world-class research symposium for growers and scientists, and we look forward to seeing you in Orlando at the peak of the strawberry season.

Look for further on the NASGA website: http://www.nasga.org/ in July 2018.

GREENHOUSE PRODUCTION

Protecting Pollinators: What Role Can the Greenhouse Industry Play?

Margarita Lopez-Uribe and Lee Stivers

The Center for Pollinator Research at Penn State University recently released the Pennsylvania Pollinator Protection Plan.

Female cuckoo bee, Triepeolus remigatus. Photo by Alex Surcică, Penn State

Pennsylvania Pollinator Protection Plan, also known as P4, was developed with input from twenty-eight state and national organizations and stakeholder groups. P4 provides recommendations for best practices and resources to support and expand pollinator populations. While focused on the situation in Pennsylvania, P4 is a useful plan far beyond Pennsylvania's borders. And a close look at recommended best practices reveals that the greenhouse industry can play several very important roles in the broader efforts to protect pollinators.

The term 'pollinator' refers not just to domesticated honey bees, but also to the hundreds of other species of native bees, butterflies, moths, flies and beetles that pollinate cultivated and wild plants. Pennsylvania alone is home to more than 430 bee species, most of which are solitary and live underground. Pollinators pack a powerful economic punch. In the US, pollinators contribute approximately $25 billion to agriculture. In Pennsylvania, their economic services to producers have an estimated economic value of $250 million.

Populations of both wild and domesticated pollinators have been in decline in recent years. According to P4, the most important challenges pollinators face in Pennsylvania include:

- Habitat loss, degradation and fragmentation
- Pesticide use
- Pests and pathogens
- Forage and Habitat

Pollinators need a number of things from the landscape in order to survive and thrive. Pollinators need places to nest and reproduce; abundant and high quality food; a consistent supply of water; and minimal exposure to pesticides as they forage. Landscapes that are pollinator-friendly provide these through elements such as soil surfaces, shrubs with pithy stems, and dead branches for nesting; a variety of plants that flower throughout the season for foraging; and water.

Nest boxes containing stacks of hollow tubes encourage nesting of mason bees, an important native pollinator in Pennsylvania. Mason bee (female provisioning nesting tube): Photo by Maryann Frazier, Penn State

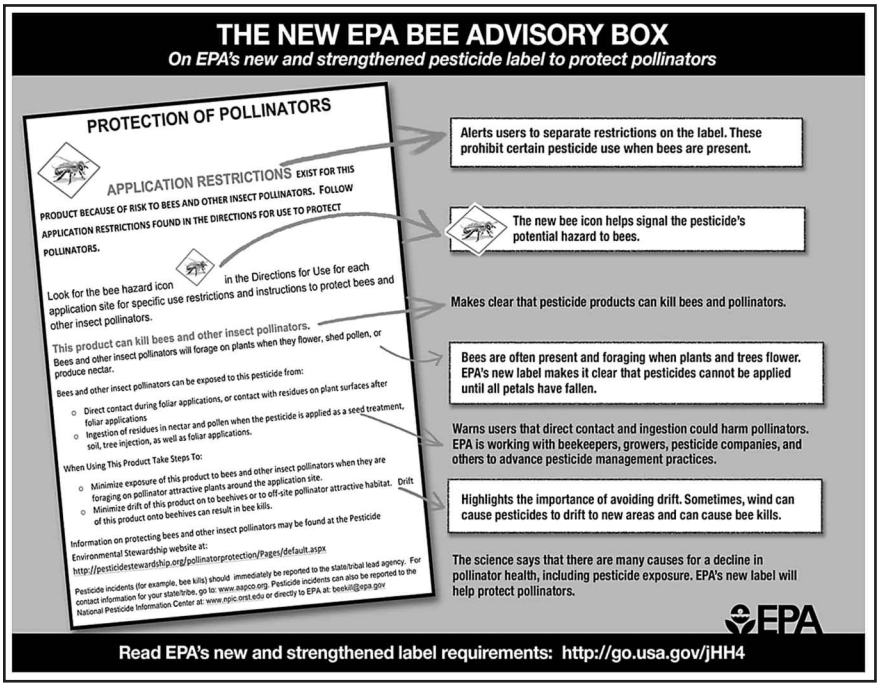
Pesticides

Pesticides used in both agricultural and urban/suburban landscapes, have been implicated as factors contributing to pollinator decline. These include insecticides, herbicides and fungicides. The impacts of pesticide use on pollinator populations are complex; pesticides can cause acute mortality or more subtle sublethal effects. Pollinators are often exposed to multiple pesticides which can act synergistically or additively, further diminishing pollinator health.

The greenhouse industry's role in improving forage and habitat

- Be knowledgeable about pollinator-friendly plants, including native plants, and practices.
- Offer and promote plants that support pollinators.

(continued on page 27)



Protecting Pollinators...

(continued from page 26)

Pollinators need an abundant, varied, and high quality supply of food throughout the season. Does your product line help customers make their gardens and landscapes more pollinator-friendly? Drone fly, Eristalis tenax. Photo by Alex Surcică, Penn State

- Educate retail customers about the benefits of pollinator-friendly gardening.
- Collaborate with Master Gardeners and others who are educating the general public about pollinators and pollinator-friendly gardening.
- Promote and demonstrate bee-friendly practices such as high mowing of lawn areas, use of naturalized landscapes, and delaying winter clean-up in the landscape.

The greenhouse industry's role in reducing the impacts of pesticides

- Use best practices in and around the greenhouse to reduce off-target impacts (e.g. IPM; biocontrols; cautious use of neonicotinoids; avoiding tank mixes)
- Look for the 'bee box' on pesticide labels for additional information about how to protect bees when using particular products.
- Educate customers about proper, safe and appropriate pesticide use.
- Know where bee hives are located close to you; communicate with proprietors when applying pesticides.

The 2013 EPA Bee Advisory Box (see page 26) is added to pesticide labels to better protect bees by being clearer and more precise in their directions for pesticide application.

Where to Find More Information:

The Pennsylvania Pollinator Protection Plan (P4)
http://ento.psu.edu/pollinators/research/the-pennsylvania-pollinator-protection-plan-p4

Penn State Center for Pollinator Research
http://ento.psu.edu/pollinators

Neonicotinoids, Native Pollinators, and Greenhouse Production - Tina Smith, UMass Extension. A very useful discussion on the use of neonicotinoids in greenhouse floriculture. https://ag.umass.edu/sites/ag.umass.edu/files/pdf-doc-ppt/16neonicpollinatorsgh.pdf

EPA: Protecting

Dr. Lopez-Uribe is with the Department of Entomology at Penn State Univ. and Ms. Stivers is with Penn State Extension in Washington Co. From Penn State Extension, https://extension.psu.edu/protecting-pollinators-what-role-can-the-greenhouse-industry-play, May 24, 2018.

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