PENNSYLVANIA
VEGETABLE GROWERS
NEWS
PVGA
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for the commercial vegetable, potato and berry grower

Don't Miss the 2022 Mid-Atlantic Fruit and Vegetable Convention

The 2023 Mid-Atlantic Fruit and Vegetable Convention will be held at the Hershey Lodge from January 31 to February 2. Multiple concurrent educational sessions will be featured all three days along with a large industry trade show. Michael Kilpatrick with Growing Farmers will be this year's keynote speaker. An Adams County bus tour and several pre-convention workshops will be offered on January 30, 2023.

Convention Keynote - Thriving in Uncertain Times

**General Keynote Speaker Michael Kilpatrick and his family*

Michael Kilpatrick is a farmer, presenter, host, inventor, and online entrepreneur who lives to help entrepreneurs apply business principles and practical, proven solutions to grow their businesses and simplify their lives. His keynote topic will be "Thriving in Uncertain Times". He is the owner of Growing Farmers, an online farmer education platform, host of the top-rated Thriving Farmer Podcast; and host of the Thriving Farmer Summit series, which has been viewed by over a quarter million farmers. He has managed large farms and businesses, consulted for industry experts worldwide, and spoken at dozens of conferences. Michael believes anyone can build a profitable farm by following the proprietary RIPEN system that he teaches in the Small Farm University, his company's educational platform and community for thriving farmers. Michael lives in an 1890s brick house on his 8-acre urban Farm on Central in Southwest Ohio with his wife and 3 kids.

Special Urban Ag Session

Urban farmer, Kafi Dixon, will present at the first-ever urban agriculture session at the Mid-Atlantic Fruit and Vegetable Convention.

Urban agriculture has a big impact globally. Recently, scientists have placed the annual value of food production, nitrogen sequestration, energy savings, and stormwater runoff avoidance

Urban Ag Keynote Speaker Kafi Dixon on her Boston farm. Photo: Lost Nation Pictures (https://lostnationpictures.com/)

Continued on page 8

NEWS

Directors Meet in State College

The PVGA Board of Directors held their "fall" meeting on Tuesday, December 6, at Toftrees Resort in State College. This meeting is preceded by meetings of the various PVGA committees which make recommendations to the Board for the Association's activities for the coming year.

For several years these committee meetings were held in-person the day before the Director's meeting but like the last two years, this year the committee meetings were all held virtually in the two weeks before Board meeting. In 2021 they were held virtually due to concerns about the pandemic, but this year and last year the Board decided to hold the committee meetings virtually simply to save money. Since the Association pays the mileage for the Committee members and the two-day format requires the Board members to stay overnight in State College. It becomes a considerable expense for the Association.

While in-person meetings always an advantage in personl interaction, the virtual meetings do make it much more convenient for committee members who are not Board members to participate in the meetings. One of the main goals of the system of committees is to involve non-Board members in reviewing the past year's activities and discussing the direction of the Association in the coming year. The committees that meet prior to the meeting are the Executive, Leadership and Recognition, Administrative, Educational, Government Affairs, Farm Show Booth, Potato and Berry. The Simply Sweet Onion, Vegetable Research and Vegetable Marketing also met earlier in November. All the Committees except the Executive Committee involve one or more non-Board members. Members who would be interested in participating in a committee should contact the Association at 717-694-3596 or pvga@pvga.org.

Dr. Richard Roush, Dean of Penn State's College of Agricultural Sciences, attended part of the meeting. He shared that the increase in state funding for agricultural research and extension this year was a major plus for the College, enabling it to regain some ground lost to previous budget cuts and several years of level funding that resulted in staff cuts. Dr. Gary Felton, head of the Department of Entomology also attended the meeting and announced that applications will soon be reviewed for the vegetable entomology position formerly held by Dr. Shelby Fleischer, who retired early this year. Filling the vegetable entomology position was a priority for PVGA. The Dean also mentioned that the College is seeking to fill the potato research position currently filled by Michael Peck, who is retiring. The PVGA Potato Committee discussed this situation at great length at their committee meeting prior to the Board meeting, as this position is critical to maintaining a potato research program for Pennsylvania. Mary Wirth, director of college relations and communication attended the meeting as well.

The Association's financial reports showed that income should exceed the budget and expenses are projected to be lower than expected for the year. The 2022 budget included a $47,000 deficit but the Association may end the year with more than a $25,000 surplus. As of November 30, the General Fund balance value was $213,570, the Keystone Fund balance value was $207,413 and the Simply Sweet Onion Committee balance was $17,144.

The Board reviewed the contract offer the Executive Committee was putting forth for a candidate for the Executive Director. The Executive Committee had met with the candidate the date before the meeting. Since the candidate was not able to attend the Board meeting, a virtual meeting will be scheduled later with the candidate.

The Leadership and Recognition Committee announced that the nominees for the five Director positions up for election by the members will be five of the incumbent Directors: Christopher Harner, Rita Resick, John Shenk, Jeffrey Stoltzfus, and Joel Weaver plus James Reiff and Robert Erlemeier. The Committee also made recommendations for the Annual Award and Life Memberships which will be announced at the Mid-Atlantic Convention. Nominees for various other awards were also reported. The Board discussed different ways to increase the diversity of the Board membership in terms of ethnic groups and geographic areas – particularly urban agriculture representatives. There was discussion about urging PVGA members to consider giving a membership to a neighboring grower who is not a member. It would really be a two-year membership if the new member had never been

Continued on page 4

*The **Pennsylvania Vegetable Growers News** is the official monthly publication of the Pennsylvania Vegetable Growers Association, Inc.,*
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Phone and fax: 717-694-3596 • Email: pvga@pvga.org • Website: www.pvga.org

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

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

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

NEWS

PVGA Annual Meeting

The Annual Meeting of the General Membership of the Pennsylvania Vegetable Growers Association will be held on Wednesday, February 1, 2023 at 11:30 p.m. in the Crystal Room of the Hershey Lodge in Hershey, Pennsylvania, during the Mid-Atlantic Fruit and Vegetable Convention. All members are invited and encouraged to participate in the meeting.

The results of the mail balloting for the Board of Directors will be announced at the meeting. The members will also receive reports on membership, finances, and the other activities of the Association. The following additions to the Association's policy resolutions are being proposed for adoption by the members at the Annual Meeting. The underlined text is to be added to the resolutions.

The Association is on record as:

Federal Resolutions

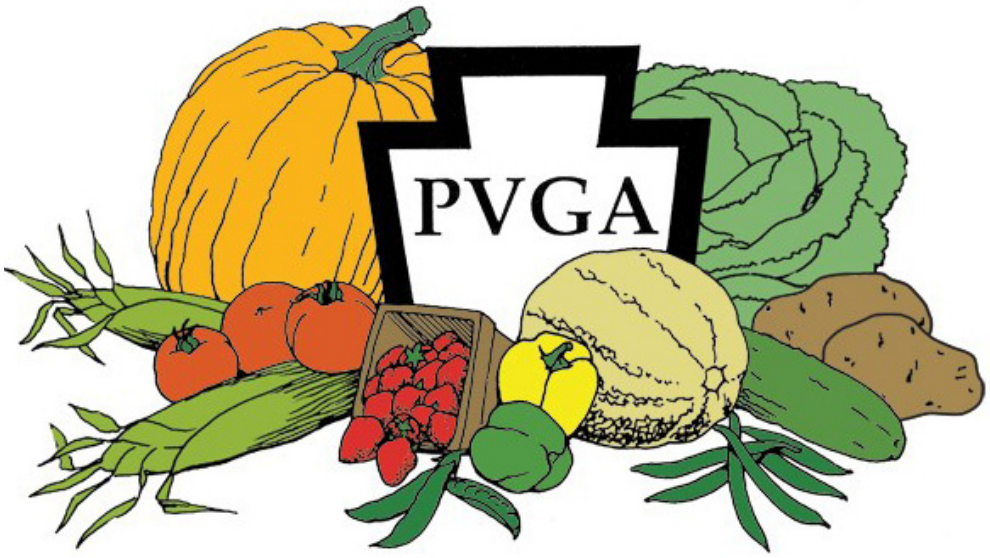
1. Supporting changes to permitting requirements for conservation projects to allow projects less than $100,000 to be certified by a design professional.
2. Supporting the continuation of USDA's Emergency Food Assistance Program (TEFAP).
3. Supporting the continuation of USDA's Local Food Purchase Assistance Cooperative Agreement Program (LFPA).
4. Supporting an exemption for farmers or farm workers from the need to be Haz-Mat certified to transport herbicides, insecticides, etc. between farms or return empty containers provided the farmer or farm worker has had training through a private pesticide applicator's license update or other educational program.

Federal and State Resolutions

1. Supporting the ability to take Section 179 deductions for ag equipment in the year in which the equipment is ordered and paid for.
2. Supporting a change in the due dates for quarterly state and federal tax payments to be April 15th, July 15th, October 15th and January 15th to represent true quarterly payments.

State Resolutions

1. Supporting the addition of resident senior hunters (65 and older), resident senior lifetime hunter (65 and older), and POW license holders to the current state Game Commission policy which allows junior license holders, mentored youth, disabled hunters with a permit to use a vehicle, and resident active-duty Armed Services personnel, to harvest antlered deer with two or more points on one antler, or spike three or more inches in length.
2. Supporting the development of an Earn-a-Buck Program where harvesting a second antlered deer within a license year would be permitted if the hunter has harvested and submitted harvest tags for at least two antlerless deer.
3. Supporting the expansion of the Red Tag Program to allow taking deer on Sundays with the landowners approval.
4. Supporting the Game Commission following their staff biologists' recommendations when setting seasons and limits.
5. Supporting a review of the DEP/Growing Greener grant reimbursement process to provide reimbursement within 30 days to participating farm operations and county conservation districts.
6. Supporting requirements for government agencies and authorities levying Stormwater Management Fees to calculate, publish and enact unlimited offsetting credits to those fees for the following:
   a. Each acre of compliance for each of the following:
      i. An NRCS or County Conservation District approved Plan.
      ii. an Erosion and Sediment Plan.
      iii. An Act 38 Nutrient Management Plan, and/or an implemented NRCS Comprehensive Nutrient Management Plan.
   b. Each approved Manure Management Plan.
   c. Erosion controlling structures including diversion ditches, grass waterways, stone waterways and terraces.
   d. NRCS or County Conservation District approved manure holding structures.
   e. Each acre of forested, wooded or grass acres.
   f. Positive ratios of pervious to impervious areas.
7. Supporting requirements that stormwater credits be established before fees are levied and that such credits include currently implemented practices as well as new practices.
8. Supporting requirements that no stormwater fee be levied on properties with less than 20 percent impervious land area.
9. Supporting an agricultural exemption for storm water management for building projects that are 10,000 sq. ft. or less.
10. Supporting provisions that hayride attractions not be recognized as an amusement ride and therefore exempt from the Amusement Ride Inspection Act regulations.
11. Supporting the development of an online portal by the Pennsylvania Department of Agriculture develop to provide safety resources, requirements and online training for conducting agritourism operations.
12. Supporting the establishment of size and weight requirements by the Pennsylvania Department of Agriculture for tow vehicles involved in hayride agritourism operations.
13. Recognizing Penn State Extension's continued relevance to production agriculture and field-based extension education efforts and urging the University to build upon these programs that are vital to our industry composed of small family farms, including nearly a quarter of which belong to the plain communities who do not have access to online resources.



NEWS

Directors Meet in State College

continued from page 2

a member because the Association just started offering a "buy-one-get-one-free" membership offer to growers who had never been members before.

The Scholarship Committee announced they are considering scholarship applications from seven applicants. They will be awarding up to $4,400 in scholarships.

The Administrative Committee presented a draft budget for 2023 which again included $10,000 for "start-up" funds for the extension entomologist position. While it is hoped that income from the Farm Show Booth and the Mid-Atlantic Convention will increase in 2023, using conservative figures and allowing for paying both a new Executive Director and at a reduced rate the retiring Executive Director during the period of transition, the draft budget projects a deficit of $49,900 for 2023.

Membership for 2022 was reported at 862 compared to 793 in 2021 and 983 in 2020. To engage more members and growers particularly among the plain community, the Administrative Committee recommended hosting several breakfast meetings in the late winter/early spring at different locations around the state. They also recommended having a booth at the Pasa Conference and at Ag Progress Days. The Committee is also recommending moving some funds to different accounts as interest rates and the economy change. Finally the Committee recommended the following donations/sponsorships and promotions for 2023:

Farm Show Reception Sponsorship	$500
Ag In The Classroom Program	$500
Ag Science Education Mobile Lab	$500
Capitol Hunger Garden	$200
Delaware Valley College A-Day Program Ad	$125
Ag Progress Days Booth	$550
Farm-City Day Vegetables	+$50
Farm Show Vegetable Day Cooking Demonstrations	$1,650
Pasa Conference Compact Booth	$500
Pasa Conference Program Advertisement	$250
Farm Show Public Officials Day	$500
Keystone Cornucopia Reception	$200
Ag Council Research Tour for Legislators	$100
Farm Show Livestock Sale	+$100
Farm Show Bus Transportation	+$300
Farm Show Food Court Table Cleaning	+$600
Farm Show Visitor's Guide Advertisement	$875
Banquet Sponsorship	$500
Ice Cream Social	$800 to $1,100

The Farm Show Food Booth Committee is preparing for the 2023 Farm Show. Veggie burgers will be added to the menu. Some prices will be increased to account for increased expenses.

The Educational Committee recommended increasing the budget for educational meeting grants for Penn State Extension sponsored meetings but also organizing a series of PVGA on-farm grower meetings around the state. This year the Association helped sponsor Extension meetings at the Snyder Co. Produce Auction in January, a summer twilight meeting at the Carl Wenger farm in Port Trevorton, an At-Market Twilight at Crooked Row Farm Market in Orefield and a Cut Flower Twilight Meeting at the Southeast Agricultural Research and Extension Center in Manheim, The Association will continue to offer transportation assistance to groups of growers from the plain community and also remind high school agriculture teachers that students are admitted to the Convention at no cost.

The Government Affairs Committee recommended that the Association maintain its membership in the Pennsylvania Agricultural Alliance and the International Fresh Produce Association. They also recommended 19 additions to the Association's Policy Resolutions. They are outlined in the separate article on the Annual Meeting where the resolutions will be considered by the members.

The Board adopted the following legislative priorities for 2023:

State

- Elimination of unemployment compensation fees for H-2A workers.
- Adequate agricultural research and extension funding.
- Relaxed stormwater management requirement for high tunnels.
- Reduction of stormwater fees for farmland.
- Increased broadband internet access in rural areas.
- Farmers' Market Nutrition Program funding.
- Coordination of the state Business Depreciation Deduction Limit with the federal limit.

Federal

- Immigration and farm labor reform.
- Reform of the Municipal Separate Storm Sewer System regulations.
- Reasonable water use and produce traceability Food Safety Modernization Act rules for small growers.
- Continued Specialty Crop funding.
- Adequate agricultural research and extension funding.
- Continued nutrition program funding.
- Reasonable cost healthcare options for the self-employed and small employers.
- Inheritance tax elimination.
- An increase in the Business Depreciation Deduction Limit to at least $1,000,000.

The Board also received reports from the Vegetable Promotion, Vegetable Research, Potato, Berry, Simply Sweet Onion and Penn State Liaison Committees. The Berry Committee is planning to continue their virtual monthly Berry Grower Exchange meetings and also to hold an on-farm twilight meeting.

The Board's next meeting will be January 30, 2023, in Hershey prior to the Mid-Atlantic Convention.

NEWS

State News Briefs

Pennsylvania's CHEMSWEEP to Provide Safe Pesticide Disposal in 18 Counties in 2023

Agricultural businesses and pesticide applicators in 18 counties can dispose of unwanted pesticides safely and easily in 2023 through the Pennsylvania Department of Agriculture's CHEMSWEEP program.

New for 2023- inventory forms will be submitted digitally through on the PDA website at www.agriculture.pa.gov/chemsweep. Paper forms will still be available for those without internet access by calling (717) 772-5210.

The program is offered in different counties each year. In 2023 it will be available in Bucks, Crawford, Dauphin, Erie, Fayette, Greene, Huntingdon, Juniata, Lycoming, Mercer, Mifflin, Montgomery, Perry, Philadelphia, Susquehanna, Tioga, Wayne, and Westmoreland counties.

"Pesticides can be a problem when they outlive their usefulness, sitting in barns and sheds and becoming hazardous to the environment and to your safety," said Agriculture Secretary Russell Redding. "Thanks to CHEMSWEEP, it's easier for our agriculture industry to safeguard our environment and properly dispose of pesticides."

Over 3.0 million pounds of unwanted or unusable pesticides have been properly destroyed through the program since it was established in 1993.

Every year, many pesticide products are discontinued, phased out or become unusable, leaving growers, commercial establishments and applicators with potentially dangerous and toxic materials that cannot be placed in landfills. The unwanted pesticides often become a safety hazard and an environmental concern through long-term storage in garages, barns, or other areas.

Farmers, licensed pesticide applicators, pesticide dealers and commercial pesticide application businesses from the designated counties are eligible to participate by completing the CHEMSWEEP registration/inventory form online through our website. The registration period ends March 31.

An independent contractor hired by the state agriculture department collects and packages all waste pesticides at each participating location, primarily for incineration at facilities approved by the U.S. Environmental Protection Agency. CHEMSWEEP covers the disposal cost for the first 2,000 pounds per participant. Above that level, participants are billed at the agriculture department's contracted price.

The program is funded through annual registration fees paid by pesticide manufacturers and applicators.

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

PA Game Commission Applauds Change in Law for Antlerless License Sales

The way hunters apply for Pennsylvania antlerless deer licenses is about to change for the first time in decades.

Senate Bill 431, which would allow hunters to buy antlerless licenses through the HuntFishPA automated licensing service, was signed into law this week. When it takes effect with the 2023-24 license year, antlerless licenses will be available for purchase online or in person at any license issuing agent.

PFB is in favor of the legislation aimed at making it easier to purchase an antlerless license when you purchase an antlered license.

The Game Commission, hunting organizations including the National Deer Association, Pennsylvania Chapter of Backcountry Hunters and Anglers, Pennsylvania Federation of Sportsmen and Conservationists, the United Bowhunters of Pennsylvania and others, and everyday hunters supported the bill, championing it as the final step to fully modernizing license sales.

Until now, hunters applied for antlerless licenses via mail, sending those familiar pink envelopes to county treasurers, the only entity permitted to sell them. They had to do so according to a set schedule, with various deadlines based on state residency and rounds of sales, using a self-addressed stamped envelope and paper checks, something increasingly foreign to some hunters.

There were, in short, a lot of variables in play, and that occasionally led to problems with hunters getting licenses or not.

Given all that, the pink envelope system was seen by many as a barrier to hunting participation, especially when it comes to recruiting new hunters. Allowing for antlerless license sales through HuntFishPA will address those issues.

Prior to the start of next license year, the Game Commission will notify hunters on the process for applying for an antlerless license under the new system.

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

Mental Health Resources Available

Research has found that many farmers are experiencing new stress and mental health concerns as a result of the COVID-19 pandemic, the farm economy and other pressures.

If you or someone you know is struggling or has concerns about their mental health, please know that you are not alone and there is help available.

There are unique factors that affect stress in the farming community as well as unique warning signs that someone is struggling. Those include:

- Change in routines or social activities
- Decline in the care of domestic animals
- Increase in illness or other chronic conditions
- Increase in farm accidents
- Decline in appearance of the farm
- Decreased interest in activities or events
- Signs of stress in children including struggles with school

Help and Resources Available:

National Suicide Prevention Lifeline: Call 1-800-273-TALK (8255) or use the online chat at suicidepreventionlifeline.org/chat 24/7 for free and confidential support and to be connected with a skilled, trained counselor in your area.

Crisis Text Line: Text HOME to 741741 for 24/7 support via text.

PA 211 is a United Way statewide partner which offers trained resource navigators who can tell farmers what services may be available in their area to help with a variety of health and human service needs, from utility or food assistance to mental health support. Visit www.pa211.org, dial 211 from any landline or cell phone, or text your zip code to 898-211.

Avera Health Farm and Rural Stress Hotline: Call 800-691-4336 to be connect with a skilled, compassionate mental health professional.

Substance Abuse and Mental Health Services Administration: Call 1-800-662-HELP (4357) for treatment locators, SAMHSA's National Helpline, a Disaster Distress Helpline and other important information.

Find additional resources, learn tips for starting important conversations about mental health, and register for free rural resilience training by visiting farmstateofmind.org.

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

NEWS

Farm Bureau Staff Chosen for State Advisory Panel Roles, Governor-Elect's Transition Team

Pennsylvania Farm Bureau members and staff regularly participate on state advisory boards and commissions, as well as other groups formed to provide advice and counsel to state officials.

Farm Bureau Environmental Specialist Grant Gulibon was recently elected to chair the DEP Agricultural Advisory Board (AAB) for 2023. The AAB provides advice and expertise to the DEP Secretary regarding the nature of agriculture in the Commonwealth. The board also reviews and provides comment on DEP policies, rules, and regulations which have an impact or a potential impact on agriculture or the agricultural community.

Farm Bureau Manager of Government Affairs and Communications Justin Clapper was recently appointed to Governor-elect Josh Shapiro's Economic Development transition team. He will be serving on the Rural/Agriculture subcommittee and providing perspective to the new administration on ways to grow agriculture in Pennsylvania and improve rural quality of life.

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

Hoffman Elected as PFB's Ninth President

Juniata County farmer Chris Hoffman has been elected as the ninth President of the Pennsylvania Farm Bureau (PFB) by voting delegates at the 72nd Annual Meeting of the state's largest farm organization. Hoffman served as the vice president for the past eight years.

"As an organization we are called to be the leader in agriculture and I am excited about what the future has in store for all of us," President elect Hoffman said. "I know that we need to be united, we need to work hard to identify the problems, and we need to communicate. We need to come together as a unified voice to make this Farm Bureau do the impossible."

Hoffman has been heavily involved with Farm Bureau over the past 28 years, serving on PFB's State Board of Directors for 11 years and as a member of the board's Executive Committee.

As Vice President, Hoffman was responsible for chairing PFB's policy development process, where farmers recommend solutions to benefit agriculture and rural communities.

He currently chairs the Pennsylvania Farm Bureau State Agriculture Promotion Committee, which focuses on raising money for the Pennsylvania Friends of Agriculture Foundation and encouraging county-level events that promote consumer awareness of agriculture. Hoffman also previously served for four years as chair of the American Farm Bureau Federation's Promotion and Education Committee. He was named America's Pig Farmer of the Year by the National Pork Board in 2019.

Cambria County beef and crop farmer Tommy Nagle was elected as the Vice President of the Pennsylvania Farm Bureau (PFB) by the state board of directors after the position was vacated by Chris Hoffman, who is now serving as PFB President.

Nagle has been heavily involved with Farm Bureau for more than a decade, serving as a member of PFB's state board of directors, representing District 12, which consists of Cambria, Clearfield and Indiana counties for the last three years.

In 2013, Nagle and his wife Tracy won PFB's Young Farmer and Rancher Achievement Award. Nagle raises beef cattle and grows crops on his family farm in Patton, Cambria County.

Respirator Fit Tests

Free Respirator Fit tests required under WPS and OHSA regulations will be available at the Mid-Atlantic Fruit and Vegetable Convention. You do need to schedule these tests ahead of time – please email us at pvga@pvga.org or call us at 717-694-3596 for further information on how to schedule these fit tests.

Convention Lodging

Plan to stay at the Hershey Lodge and take advantage of the special convention rate of $166 (per room per night plus taxes). Call the Lodge at 1-855-729-3108 and tell them you are attending the Mid-Atlantic Fruit and Vegetable Convention. Or you can make reservations online at www.mafvc.org/Lodging.

Convention Proceedings

If you cannot attend the Convention, you can purchase a copy of the Proceedings which contains summaries of many of the vegetable, small fruit, greenhouse and marketing presentations. Simply send a check for $20 to PVGA and indicate 2023 Proceedings in the memo.

CONVENTION

2022 Mid-Atlantic Fruit and Vegetable Convention *continued from page 1*

at $33 billion. This amount doesn't even include the social, cultural, well-being, and community development contributions.

We want to highlight this year's Urban Ag keynote speaker, Kafi Dixon. She will lead a discussion on Focusing Energies – Finding Your Balance and Strengths. Kafi is an urban farmer and founder of The Common Good Co-op, located in Boston, Massachusetts. Common Good Co-op provides opportunities for women of color to learn about agriculture and entrepreneurship. Kafi's experiences founding Common Good Co-op were documented in A Reckoning in Boston. A short documentary screening of the film will be shown in the session, followed by a question-and-answer period.

Given the significance of urban agriculture, starting in 2023, the Mid-Atlantic Fruit and Vegetable Convention will have a full day of sessions for urban farmers. The lineup of speakers, shown below, includes urban farmers, university specialists, and industry representatives.

9:00 a.m. Icebreaker, in-state and regional networking opportunities, and industry demonstrations, led by Dan Dalton from PASA and Megan Chawner and Elsa Sánchez from Penn State University who organized the Urban Ag sessons.

9:45 a.m. The Promises and Realities of Urban Agriculture, presented by Molly Riordan from Practice Greenhealth and Anu Rangarajan from Cornell University

Break for Convention Keynote and urban agriculture networking lunch

1:30 p.m. Insect Pests and Natural Enemies on Urban Farms: What We Can Learn from a Survey in Indiana, presented by Laura Ingwell from Purdue University

2:00 p.m. Urban Soils Testing and Remediation, presented by Patrick Drohan from Penn State University and John Bixler from Hilltop Urban Farm

3:00 p.m. Urban Ag Keynote: Focusing Energies—Finding Your Balance and Strengths, presented by Kafi Dixon from Common Good Farm

4:00 p.m. Visualizing the Future Using Benchmarking Insights, presented by Dan Dalton from PASA

We hope you'll join us for this first-ever Urban Agriculture session at the Mid-Atlantic Fruit and Vegetable Convention.

Pre-Convention Workshops and Farm Market Tour

Greenhouse Vegetables

Sponsored by ProFarm Group and Griffin Greenhouse Supplies
$50 includes lunch
8:30 a.m. to 4:00 p.m.
This all-day in-depth workshop will give an overview of greenhouse vegetable production featuring nationally-known expert Dr. Richard Snyder, formerly at Mississippi State University, who will cover the basics. Varieties, water quality, lighting, disease management, pesticide application techniques, and nutrition will all be covered by industry and extension experts. Presentations on indoor strawberry production and transitioning from greenhouse ornamentals to greenhouse vegetable will finish out the day. Designed especially for new growers just getting started in greenhouse vegetables, the speakers

Food Safety Modernization Act Grower Training

$45 includes lunch
9:00 a.m. to 5:15 p.m.
This training is for fruit and vegetable growers and others interested in learning about: produce safety, the Food Safety Modernization Act (FSMA) Produce Safety Rule, Good Agricultural Practices (GAPs), and co-management of natural resources and food safety. This PSA course is one way to satisfy the grower training requirement of the FSMA Produce Safety Rule as outlined in Section 112.22(c).\ Participants in the course will learn about:

- Microorganisms relevant to produce safety and where they may be found on the farm;
- How to identify microbial risks, practices that reduce risks, and how to implement produce safety practices on the farm;
- Requirements in the FSMA Produce Safety Rule and how to meet them.

After attending the entire course, participants will be eligible to receive a certificate from the Association of Food and Drug Officials (AFDO) that verifies they have completed the training course. The Pennsylvania Food Safety Resource Center is providing funds to cover AFDO certification fees and course material costs for this workshop.

Spotted Lanternfly Permit Training

$25 (no lunch)
1:00 to 3:00 pm
If your Pennsylvania business requires the movement of products or vehicles, you are required to obtain the SLF permit. A permit shows other businesses and states your due diligence to avoid transporting SLF to new areas. This 2-hour session will include the required education and exam to get the SLF permit.

Starting & Improving Your Farm Transition Plan

$20 no lunch
2:00 – 5:00 p.m.
$25 (no lunch)
9:00 a.m. to 12:00 p.m.
Join Penn State Extension Educators from the Farm Transition Team for this half-day workshop. We will be focusing on topic areas to start, improve, and/or refresh your overall farm transition planning goals. Topics include "How to Find a Successor" and "How to Transfer Your Assets and Tax Implications."

Pennsylvania Pesticide Applicators License Training

$75 includes lunch and manual
9:00 a.m. to 4:00 p.m.
If you intend to purchase and/or apply restricted use pesticides for the purpose of producing an agricultural commodity on land which is owned or rented by you, then you need a Pennsylvania Department of Agriculture Pesticide License. To become a certified private applicator, testing is required. This full day session on January 30 will cover the basics and prepare you for the pesticide applicator's exam which will take place the next morning, January 31, from 8:30 a.m. – 11:30 a.m.

Managing A Profitable Farm Market Bakery

$25 (no lunch)
1:00 to 4:30 p.m.
Having a bakery within your farm market is a big commitment. Once you decide to do it, there is no going back. It's adding another business within your business. Whether you have a bake-off bakery or a scratch bakery, it needs to be managed well and it needs to be profitable. In this workshop we'll hear from three markets with bakeries that are a destination experience! Topics include: best practices, baked goods as a community fundraiser, workforce management and other innovative ideas. Speakers are: Tad Kuntz with the Masonic Village Farm Market; Josh Smith & Holly Haas with Frecon Farm and Calib Torrice with Tabora Farm.

Young Grower Alliance Workshop - Tree Fruit Pruning

Fruit Research and Extension Center, 290 University Dr, Biglerville, PA 17307
$30 (no lunch)
2:00 to 4:00 p.m.
Please join the Young Grower Alliance (YGA) for a pruning

demonstration/pre-conference workshop at the Fruit Research and Extension Center in Biglerville (not at the Hershey Lodge!). Dr. James Schupp will be providing hands-on pruning information. Dr. Schupp has done many research projects on pruning fruit trees and his expertise is recognized nationally. This workshop will take place outside, so please wear appropriate attire. Meals will NOT be provided during the workshop.

Adams County Bus Tour

$70 (includes lunch)
7:45 a.m. to 5:30 p.m.
Departure and return is from the Hershey Lodge Chocolate Lobby

This year's annual bus tour will visit the following agricultural businesses in Adams County:

Hollabaugh Bros. Fruit Farm and Market – Biglerville, PA. Hollabaugh Bros. has been growing and marketing fruit and vegetable crops from their 500-acre farm and other local producers for over 65 years. Their market features fresh produce, gourmet food items, baked goods, gifts, local meats, ice cream, and prepared foods, and an educational "Bee Room". hollabaughbros.com

Rice Fruit Company – Gardners, PA. Rice Fruit Company is a fruit grower/packer/shipper located in Adams County, PA. We'll tour the packing operations which utilize some of the most up-to-date technologies available, and learn about protocols the company has in place to ensure delivery of high-quality products and food safety compliance. ricefruit.com

Hickory Bridge Farm and Restaurant – Orrtanna, PA. We'll have lunch served family style in Hickory Bridge's historic barn that is about 150 years old built of chestnut and oak. The business includes a restaurant, bed-and-breakfast operation, special events venue, and farming. www.hickorybridgefarm.com

Musselman Greenhouses – Cashtown, PA. This operation consists of an acre and a half of greenhouses dedicated to growing seasonal blooming plants and foliage plants. musselmangreenhouses.com

Adams County Nursery – Aspers, PA. ACN is a family business founded in 1905, and is currently operated by the 5th generation. They supply fruit trees and orchard sup-plies to commercial growers in the multiple growing regions and also operate 200+ acres of apple and peach orchard. acnursery.com

Reduced Registration for Spouses, Children or Employees

Remember the Convention offers a reduced pre-registration fee for additional persons attending from a member farm. The first person from the farm must pay the $80 pre-registration fee but spouses, adult children, or employees are eligible for a $65 pre-registration fee. The purpose is to make it more feasible for growers to bring additional persons from their farms to experience the educational opportunities available at the Convention. Remember, one $70 PVGA membership qualifies all persons from the farm for the membership registration rates. And children under 16 and all students are admitted free.

Annual Growers Banquet

Many of you plan to gather with friends for the evening meals at Hershey. Why not plan to join a larger group of friends and fellow growers at the Annual Fruit and Vegetable Growers Banquet on January 31. There will be door prize drawings for the ladies and brief presentations by the participating grower organizations. PVGA will present its twenty-fourth Annual Award at the Dinner. Tickets for the banquet and reception are $35.

Spanish Session

In an effort to provide additional education to Hispanic orchard employees, Penn State Cooperative Extension is again organizing a special session in Spanish to be held on Wednesday, February 1 at the Convention. Various relevant fruit and vegetable production topics will be presented. All are welcome, so please encourage your Hispanic friends and workers to attend the day's seminars and trade show.

Spanish session attendees must pay the regular registration fee. Employees of PVGA members are eligible for the $65 pre-registration rate.

Continued on page 10

CONVENTION

2022 Mid-Atlantic Fruit and Vegetable Convention *continued from page 9*

Ice Cream Social

After you have enjoyed dinner on your own on Wednesday, February 1, come to the Great Lobby outside the trade show hall for the twenty-third annual PVGA Ice Cream Social from 7:00 to 8:00 p.m. The social will be open to all Convention attendees, so come early to enjoy a visit with old friends and to meet new friends. We will again be designating different tables for round-table discussions on the following topics: High Tunnels, Labor, Marketing Brags & Blunders, Wildlife Controls, Farm Transition, and other topics. While you can still come just to enjoy the ice cream, we hope the designated tables will foster some valuable networking between growers. The ice cream will only be served until 8:00 p.m. but you can continue to visit for as long as you like.

The Hershey Lodge

The Hershey Lodge offers an indoor pool and water park, exercise and game room, and restaurants while the Hershey area has an outlet center, Chocolate World and other attractions that will appeal to whole family. So why not plan a mid-winter vacation at the Lodge. In case of a winter storm, you can still attend all the Convention events without setting foot outside - the Convention will go on regardless of the weather. A special Convention room rate makes the Lodge more affordable. Rooms are $166 per night for up to four persons. To make a reservation, call 1-800-HERSHEY or 717-533-3311 and tell them you are with the Mid-Atlantic Fruit and Vegetable Convention. Staying at the Hershey Lodge rather than some other motel ultimately enables us to keep the registration prices down. Plan now to spend the week in Hershey.

Pre-Register

There is no better opportunity for you to meet with vegetable, potato and small fruit experts from across the nation, dozens of vendors and fellow growers in one place. Plan now to be there! Remember that pre-registration helps us make better plans and can save you from waiting in a long registration line. You also save $15 to $30 by pre-registering by January 27. There is a pre-registration form in the November issue of the newsletter and on the Convention website at www.mafvc.org where you can also register online. Each member's membership renewal form, mailed by first-class mail to each member, is also a Convention registration form. You can also call PVGA at 717-694-3596 and we will be happy to mail or fax you a registration form. (Please note, if you are mailing in your registration, it should arrive at the PVGA office by January 27 so plan to mail it by January 24 at least. Online registration will close on January 27.) Walk-in registration at the Convention is also available. Checks must be used for all pre-registrations by mail. Cash, checks or credit cards are accepted at the Convention.

Convention Program

The following sessions been scheduled for the educational program at the 2023 Mid-Atlantic Fruit and Vegetable Convention. The complete program was published in the November newsletter and is available at www.mafvc.org or by calling PVGA at 717-694-3596.

Educational Program Outline

Tuesday Morning, January 31	Tuesday Afternoon, January 31
11 High Tunnels	***21 High Tunnels***
12 Phytophthora	***22 General Vegetables***
13 Cole Crops	***23 Soil Health/Cover Crop***
14 Garlic	***24 Biocontrols***
15 Urban Ag	***25 Urban Ag***
16 Snap Beans	***26 Wholesale Marketing***
17 Farm Market Staff Training	***27 Achieving Success at Farmers Markets***
18 Tree Fruit	***28 Tree Fruit***
19 Keynote	

Wednesday Morning, February 1	Wednesday Afternoon, February 1
31 Tomatoes	***41 Basic Vegetable Production***
32 Basic Vegetable Production	***42 Organic Veg Production***
33 Organic Veg Production	***43 Stone Fruit***
34 Greenhouse Ornamentals	***44 Greenhouse Ornamentals***
35 Marketing 101	***45 Diversification in Agritourism***
36 Small Fruit	***46 Small Fruit***
37 Labor/Farm Management (joint)	***47 Labor/Farm Management***
38 Tree Fruit	***48 Tree Fruit***
39 Spanish	***49 Spanish***

CONVENTION

Wednesday Evening, February 1	
71 Commercializing Your Ideas Roundtable	
Thursday Morning, February 2	**Thursday Afternoon, February 2**
51 Pumpkins	*61 Sweet Corn*
52 General Vegetables	*62 Pollinators*
53 Potatoes	*63 Potatoes*
54 Cut Flowers	*64 Equipment Technology,*
55 Growing and Marketing High Value Niche Crops to Enhance Your Direct Market	*65 Digital and Social Media Marketing*
56 Small Fruit	*66 Small Fruit*
57 Stone Fruit	*67 Labor/Farm Management*
58 Tree Fruit	*68 Tree Fruit*

VEGETABLE PRODUCTION

Are You Using Biopesticides?

Leah Fronk

Keeping up with pesticides is a big task! Resistance issues, government bans, and supply chain issues can make finding the right spray daunting. And there are many different styles of pesticides available.

Photo: Leah Fronk, Penn State

Some of the products farmers use to control insects and diseases on crops are made from naturally-occurring plant extracts, bacteria, and fungi. These types of products are referred to as biopesticides. Depending on what pest they control, the product may be referred to as a bioinsecticide, biomiticide, or biofungicide. Products that control mites may be listed as a bioinsecticide even though mites are not insects. Remember that all three categories are included in the umbrella term of biopesticides. Another way companies list them is biological insecticide or biological fungicide. To put it simply, some people call these products "biologicals." Some common examples of biological insecticides include Dipel (Bacillus thuringiensis subsp.), Neemix 4.5 (azadirachtin), and Pyganic EC 5.0 (pyrethrin). Examples of biological fungicides include Serenade (Bacillus subtilis), Howler (Pseudomonas spp.), and Rootshield WP (Trichoderma spp.). Many are OMRI-listed with approval for use in organic production, but not all.

Benefits and Drawbacks

Biopesticides are a great addition to your pesticide cabinet. If you are an organic grower, you've likely been using biological products from the beginning. Still, many conventional growers are aware of their usefulness and take advantage of the success of biologicals. In general, biopesticides are considered safer and have low pre-harvest intervals (PHI) and re-entry intervals (REI). The risk of disease or insect resistance is lower, and in some cases, they can improve the efficacy of other products. Biologicals are often classified as having multiple modes of action, giving them an advantage over a conventional pesticide that only works in one way.

Some examples of different modes of action include competition with pathogenic organisms, inducing plant defenses, causing mycoparasitism, and others. There are drawbacks to biological products. As a rule, biopesticides do not work well in environmental extremes or under high disease pressure. They are best used when pest pressure is low or as a preventative. Biolog-

icals are not considered a cure for plant disease or a silver bullet to banish all insects. In most cases, the shelf life of biological products is shorter than conventional pesticides.

Too Good to Be True?

Sometimes when a new product comes out, the advertising and marketing sound wonderful. You may be tempted to make the investment and use the new product as a replacement for other products. Be careful! Set up a comparison on your farm. Use the new product in 1 row or a specific portion of a crop. Take notes about what you see. If the product shows promise, slowly integrate it with your existing products. Also, it is worthwhile to figure out how much the product costs per application and how many pathogens/insects may be managed.

Summary of a Recently Approved Biopesticide

Recently, I've read good things about Theia; a new biological fungicide recently approved for use in PA and a few other Mid-Atlantic states as of August 2022. Theia is a non-pathogenic bacteria called Bacillus subtilis subsp. that works in multiple modes of action. It is OMRI-listed and should be available for commercial purchase in late 2022. The label allows Theia to be used in the field or greenhouse. It is labeled for many crops, including small fruit, tree fruit, and vegetables. It has fungicidal and bactericidal properties against foliar and soil-borne plant diseases. The label states it should be used as a protectant and with a surfactant. It can be applied in almost any method, including bare root dip, tray drench, foliar spray, and through the irrigation system.

Throughout the product label, there are reminders for constant agitation to keep the product uniform while applying. The solution should not be left in the sprayer for more than 24 hours. The label directs users to have a spray solution pH of 4.5-8.5. A product sheet for Theia states that it is shelf-stable for two years. Researchers in Ohio, New York, and California have written reports on the use of Theia. Crops used in the research varied from cole crops to grapes to peppers, though Theia is labeled for many crops. Researchers in OH found Theia to reduce the incidence of black rot on cabbage significantly. In CA, grape researchers found Theia to be comparable with Quintec for powdery mildew control and superior to other biological products, i.e., Serenade and Double Nickel. Both examples included the use of a surfactant with Theia. If you want to try Theia or another new product on your farm, keep good records about the rate, surfactant used, and application method. Choose a portion of your field or greenhouse to trial the new product.

You are missing out if you rely solely on conventional chemical pesticides to keep diseases and insects at bay. I encourage you to add biopesticides to your spray cabinet. There are many options for bio-insecticides, -miticides, and -fungicides. Using products that work on multiple modes of action and act against resistance issues is a benefit you want on your farm.

Leah Fronk is with Penn State Extension in Juniata Co. From Penn State Extension, https://extension.psu.edu/are-you-using-biopesticides?, December 6, 2022.

VEGETABLE PRODUCTION

Science, Tomatoes, and How to Read a Table

Elsa Sanchez and Thomas Butzler

Numerous knowledge systems exist, including intuition, invention, personal experience, statistical data collection, storytelling, religious teachings, philosophical schools, and science.

Photo: Tom Ford, Penn State

They all have value in certain situations. For example, we tell our kids to listen to their intuition when they go places and leave if they feel something is wrong in their gut. And whenever we go to Penn State football games, we leave our house super early to avoid the frustration of sitting in traffic, based on our personal experience.

As Extension educators at Penn State, we primarily focus on knowledge generated through scientific studies. The strength of science-based information is that it does not rely on opinion. Instead, information is built on unbiased observations and systematic experimentation. Scientists follow the scientific method, which is a rigorous process of answering questions. You can find out more about the scientific method, including the steps involved at Scientific Method - Definition, Steps & Example (https://byjus.com/physics/scientific-methods/).

Science is the best system we have for unlocking how the universe works. Because of science, we know how plants respond to different fertilizers, training systems, light levels, weed pressure, and so much more. However, one of the problems with science is that it involves terminology that can be difficult to explain and lead to misunderstandings.

Take the results from our recent tomato cultivar evaluation as an example. We have been evaluating cultivars of key vegetables since 2008 because one of the most frequent questions farmers ask is, "What cultivars should I grow?". In 2022-23, we are focusing on early-maturing red slicer tomatoes. Below is a table of some of our results from the 2022 growing season.

Plants were grown using a plasticulture system with 18-inch in-row spacing and 10 feet between rows. Water was supplied at a rate of 1 acre-inch per week, and pests were managed following recommendations in the Mid-Atlantic Vegetable Production Recommendations guide.

1. The first column, highlighted in green, lists the cultivars we evaluated. Cultivar evaluations conducted to develop recommendations generally have a "standard" cultivar. This is a widely grown cultivar that is included so that you can compare the other cultivars to it. In this case, the standard is 'Red Deuce,' which is bolded.
2. The next column is the mean marketable fruit yield in pounds, followed by the mean marketable fruit yield by number. These columns are highlighted in blue. The values in these columns are yields of tomatoes that are saleable.
3. The next two columns, highlighted in orange, are the mean unmarketable fruit yields by pounds and number. The values are of yields of tomatoes that are culls.
4. The last two columns, highlighted in yellow, are the total fruit yields by pounds and number. The values in these columns combine the marketable and unmarketable yield. If you add the values for a cultivar's marketable and unmarketable pounds of fruit, they will roughly add up to the total fruit yield in pounds. Sometimes they don't add up exactly because of rounding, but the values are very close.
5. The first value in the table is 7.8, in purple font, which is the mean marketable fruit yield in pounds for 'Red Deuce.' The value of 7.8 means that, on average, 'Red Deuce' produced 7.8 pounds of fruit per plant.
6. The letter "a" follows 7.8. In fact, every value in this column is followed by an "a." This is how we signal whether the data analysis showed differences between the cultivars. When the letters are the same or overlap, the values are not different, according to the analysis. Since an "a follows all the values in the column," they are not statistically different from each other. A shorthand, when all of the values in a column are not different from each other, leaves off the letters. We've used this method in the mean total fruit yield columns (highlighted in yellow) as an example.
7. The first value in the next column is 13.1, highlighted in red font. This is the mean number of marketable fruit that 'Red Deuce' produced per plant. The value 13.1 is followed by "ab." The next value is 16.8 for 'Patsy.' It's highlighted in brown font and followed by an "a." Since 'Red Deuce' and 'Patsy' values for the mean number of marketable fruit share an "a," they are not statistically different from each other.
8. The rest of the column reveals that none of the other cultivars are different from 'Red Deuce.' Now compare 'Patsy' with 'Thunderbird,' highlighted in blue font. The value for 'Patsy' is

Table 1. Yield per plant of tomato cultivars grown at the Penn State University Russell E. Larson Agricultural Research Center in Pennsylvania Furnace, Pennsylvania, in 2022.

**Values are means of six plants per replication and four replications; 'Red Deuce' (bolded) is the standard to which all other cultivars were compared; Values followed by different letters or within a column are statistically different at P ≤ 0.05. A randomized complete block design was used for the experiment, with each cultivar replicated four times. Data were analyzed using the mixed procedure, and means were separated using pdiff.*

Cultivar	Mean marketable fruit yield (lb)	Mean marketable fruit yield (number)	Mean unmarketable fruit yield (lb)	Mean unmarketable fruit yield (number)	Mean total fruit yield (lb)	Mean total fruit yield (number)
Red Deuce	**7.8 a***	**13.1 ab**	**7.9 abc**	**16.0 abc**	**15.8**	**29.1**
Patsy	7.3 a	16.8 a	5.4 c	15.4 abc	12.7	32.3
Carrie	7.2 a	14.0 ab	6.8 abc	14.7 c	14.0	28.7
STM 2255	6.7 a	11.7 ab	7.4 abc	15.4 bc	14.2	27.1
9744	6.3 a	12.4 ab	8.7 ab	18.2 abc	15.1	30.5
Red Snapper	6.2 a	9.5 b	9.2 a	16.8 abc	15.3	26.3
Mountain Fresh Plus	5.4 a	11.4 ab	6.8 abc	16.5 abc	12.1	28.0
Thunderbird	5.3 a	10.0 b	8.0 abc	18.3 abc	13.3	28.3
9745	4.9 a	10.1 b	6.1 bc	12.8 c	11.0	22.9
Rambler	4.5 a	8.8 b	8.6 ab	22.4 ab	13.1	31.3
Roadster	4.2 a	8.7 b	8.5 ab	22.5 a	12.7	31.2

followed by an "a" and 'Thunderbird' by a "b." This indicates that these yields are statistically different. To take it further, 'Patsy' produced more tomatoes than 'Thunderbird.'

Let's go back to the first value in the table—7.8. The asterisk behind 7.8 signals a note at the bottom of the table in orange font. The note provides more information about how to read the table, the experiment was designed, and the data were analyzed. The underlined text states, "Values followed by different letters within a column are statistically different at $P \leq 0.05$". "P" stands for probability. You can think of probability as the likelihood that an event will happen. The value of ≤ 0.05 can be thought of as a percent or how often in 100 times the event will happen. Using our study as an example, if we conducted our tomato evaluation 100 times, in 5 or fewer of those times, the cultivars would have different mean marketable fruit yield in pounds. Put another way; if we conducted our tomato evaluation 100 times, in 95 of those times, the yields would not be different.

This can be confusing because, numerically, the values are different. For example, the 7.8 for 'Red Deuce' is numerically different from the 7.3 for 'Patsy,' highlighted in green font. These values are means which are the average values of the experimental data. In our experiment, we harvested fruit from 6 plants of each cultivar planted per row or block and had four rows. The mean, then, is based on the yield of 24 plants. You can get the same average from different sets of numbers. For example, the average of 4 and 6 is 5, and the average of 0 and 10 is also 5. However, 4 and 6 represent a much smaller range than 0 and 10. We call this variability. It's the same for the means in the table, sometimes, the range that resulted in the mean is small, and sometimes it is large.

Standard deviation is used in experiments to measure the variability around the mean. In the table, we have used the letters after the numbers to signal when the means and standard deviation show differences between the values. Even though the 7.8 for 'Red Deuce' is numerically different from the 7.3 for 'Patsy,' when you consider the variability or the range between the numbers that resulted in 7.8 and 7.3, they are not different according to the data analysis.

Another way to think of this is by analogy:

- Pretend you go to a restaurant, and the server tells you that the wait for a table will be 30 minutes plus or minus 10 minutes; they are giving you the variability. You may have to wait 20 minutes on the low end and 40 minutes on the high end. Your friend goes to another restaurant, and the server tells them that the wait is 20 minutes plus or minus 15 minutes. They would have to wait between 5 minutes on the low end and 35 minutes on the high end.
- Now, let's add the concept of the P-value using $P \leq 0.05$. Since the two wait times overlap, 10 to 40 minutes and 5 to 35 minutes, we would say they were not different even though the average wait times of 30 or 20 minutes are different numerically. In other words, 95 times in 100, the wait time for you and your friend will fall into that overlapping range and, therefore, not be different. Experiments and data analysis are more involved than this, but this analogy offers a simplified explanation.

With this knowledge, anyone reading the table can interpret it. For example, none of the cultivars evaluated were different from 'Red Deuce' for mean marketable fruit by weight or number, mean unmarketable fruit by weight or number, and mean total fruit by weight and number. This means that growing any of these cultivars using the same growing methods and similar environments will produce yields of tomatoes not different than 'Red Deuce' most of the time and may be a good option for growing.

Dr. Sanchez is with the Penn State Department of Plant Science and Mr. Butzler is with Penn State Extension in Clinton Co. From Penn State Extension, https://extension.psu.edu/science-tomatoes-and-how-to-read-a-table?, December 6, 2022.

VEGETABLE PRODUCTION

To Graft or Not to Graft?

Francesco Di Gioia, Leah Fronk, Claudia Schmidt, Andrew Blunk, Raymond Balaguer and Erin Rosskopf

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

When is it worth using grafting for your high tunnel tomatoes? How do you select the right rootstock.

As high tunnel tomato growers are starting to plan and purchase seeds for the next growing season, many may be considering whether it is worth it or not to use grafted plants; and if grafting is considered advantageous, the consequent questions may be: What would be the best rootstock? Should I graft myself, or is it better to purchase grafted plants from a specialized nursery?

A grafted tomato plant correctly planted. Photo by Francesco Di Gioia, Penn State

The answer to these questions is not simple, and what works in one situation may be different in other cases. To assist growers in making such decisions, we briefly describe the principles of this biotechnology and restate why grafting is used and the criteria that should be used to select suitable rootstocks.

The Principles of Vegetable Grafting

Vegetable grafting is a method applied primarily to fruiting vegetable crops (solanaceous and cucurbits) to create a new plant by physically combining two plants, one providing the shoot (scion) with the desired fruit quality traits, and the other providing the root system (rootstock). If rootstock and scion are compatible, after a relatively short healing phase, the vascular bundles within the stems of the scion and rootstock reconnect in correspondence with the grafting union, and the flow of water, nutrients, and phytoregulators is gradually re-established between the two genotypes (Figure 1).

Why Are Grafted Plants Used?

Grafting allows the combination in a single plant of the traits of the desired cultivar of tomato, which may be selected for the high yield, fruit quality, or resistance/tolerance to

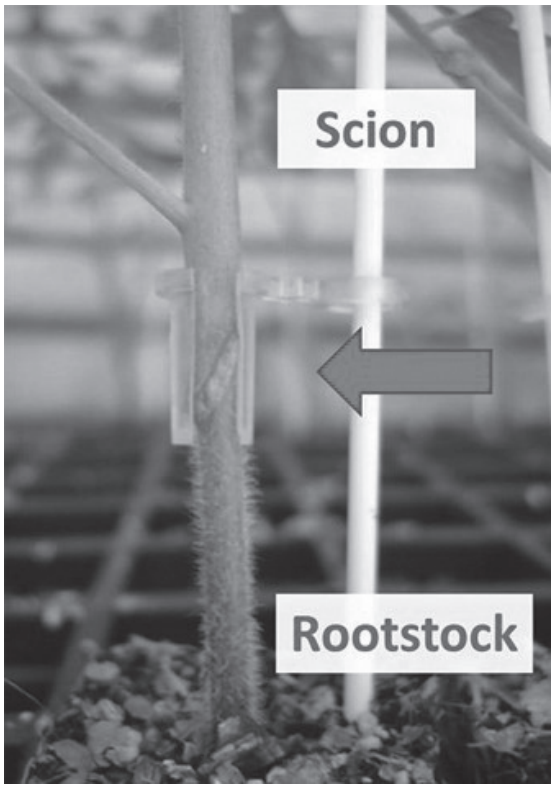


Figure 1. Detail of a tomato grafted seedling showing the grafting point through which rootstock and scion are united to create a new plant. Photo by Francesco Di Gioia, Penn State.

foliar pathogens, with those of the rootstock, generally selected to provide resistance or tolerance to soilborne pests and pathogens and/or to provide vigor and in some cases to enhance tolerance to abiotic stress conditions.

Vegetable grafting could be considered a shortcut to obtaining a plant with the desired fruit quality traits and a vigorous and resistant root system simultaneously. For instance, through grafting, it is possible to cultivate high-quality heirloom tomatoes that otherwise would be highly susceptible to soilborne pathogens (Di Gioia et al., 2010). Obtaining a similar plant with good fruit quality traits and resistance/tolerance to biotic and abiotic stress conditions through standard tomato breeding may not always be feasible and certainly would require a long time and a substantial research investment.

Grafting for the Management of Soilborne Pests and Pathogens

Vegetable grafting is primarily considered an Integrated Pest Management (IPM) tool for managing soilborne pests and pathogens and constitutes an environmentally sustainable alternative to the use of chemical fumigation. Grafting can be integrated with other agronomic solutions such as the use of resistant cultivars, crop rotation, cover crop, and other biocontrol approaches such as anaerobic soil disinfestation.

Tomato grafting with resistant or tolerant rootstocks has been successfully used to overcome soilborne pest and pathogen issues that are present in our soils such as Fusarium wilt (*Fusarium oxysporum* f. sp. *lycopersici*), Fusarium crown and root rot (*Fusarium oxysporum* f. sp. ra*dicis-lycopersici*) (Rivard and Louws, 2008), Verticillium wilt (*Verticillium albo-atrum* and *V. dahliae*), and root-knot nematode (*Meloidogyne* spp.) (Kokalis-Burelle and Rosskopf, 2011; Barrett et al., 2012). Moreover, grafting may

Continued on page 18

To Graft or Not to Graft?

continued from page 17

provide resistance to viruses (Spanò et al., 2020) as well as to southern bacterial wilt (*Ralstonia solanacearum*) (Rivard and Louws, 2012) and southern blight (*Athelia rolfsii* anamorph *Sclerotium rolfsii*) (Rivard et al., 2010) a pathogen that is moving north (Figure 2).

In Pennsylvania, the intensification of vegetable production associated with the increased adoption of high tunnels with limited crop rotation opportunities is leading to soil health issues and the emergence of several soilborne pests and pathogens, including Fusarium wilt (Figure 3), Fusarium crown and root rot, Verticillium wilt, and root-knot nematodes. The use of grafted plants with resistant rootstocks is highly recommended in the presence of these specific pest and pathogen issues.

Figure 2. Detail of a tomato plant affected by southern blight (Athelia rolfsii) with the typical white mycelium and light-brown reddish sclerotia observed in Pennsylvania. Photo by Francesco Di Gioia, Penn State.

Figure 3. An example of a non-grafted tomato plant affected by Fusarium wilt (caused by Fusarium oxysporum f. sp. lycopersici) manifested with typical yellowing on one side of the leaf (left), browning of the vascular system and consequent wilting of the plant (right). Photo by Francesco Di Gioia, Penn State.

Figure 4. An example of a tomato root system affected by root-knot nematodes (caused by Meloidogyne incognita) manifested with typical root galling. Photo by Francesco Di Gioia, Penn State.

Selecting the Right Rootstock

The rootstock selection should be based primarily on the level of resistance/tolerance provided to specific soilborne pests and pathogens that we have or are likely to have in our soil. A second aspect to consider is the rootstock's vigor and potential capacity to tolerate abiotic stress conditions.

If you are observing diseased plants, plant wilting, yellowing, or a consistent general decline of your tomato crop and yield, it may be time to check your soil and the health of the plant root system to identify the main cause of the problem. You can submit your diseased plants to the Penn State Plant Disease Clinic. Inspecting the root system during or at the end of the growing season may allow you to identify visible root damage or discoloration, limited root growth, and root galling in the case plants are affected by root-knot nematodes (Figure 4). If the issue is caused by root-knot nematodes, a good option would be to submit soil samples and conduct a nematode assay through the North Carolina Department of Agriculture & Consumer Services Agronomic Division. The nematode assay may allow for determining the level of infestation and the nematode species causing the problem. Once you have identified the main cause of the issue, and there could be several concurring causes, it will be good to check what rootstocks can provide resistance or tolerance to such issues.

As reported in Table 1, several tomato rootstocks available on the market can provide resistance to Corky root rot, Fusarium crown, and root rot, Fusarium wilt, Verticillium wilt, root-knot nematodes, as well as to tomato mosaic virus.

The present table is not exhaustive of all the rootstocks commercially available, and a more complete list is available through the Vegetable Grafting website.

In selecting the rootstock, it should be considered that sometimes the rootstock provides resistance only to specific races of pathogens, such as Fusarium wilt and Verticillium wilt. Diseases like Fusarium root and crown rot (For) caused by *Fusarium oxysporum* f.sp. *radicis-lycopersici* (Figure 5) can also be transmitted through the seeds, and the use of resistant rootstocks may avoid the manifestation of the disease.

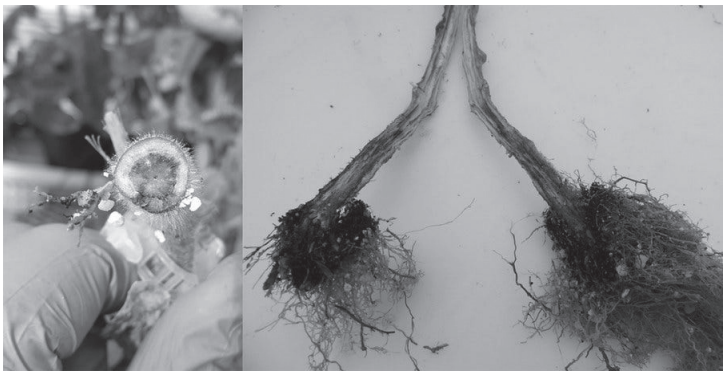


Figure 5. The stem section of the non-grafted Brandy Boy tomato plant is visibly affected by Fusarium root and crown rot (caused by Fusarium oxysporum f.sp. radicis-lycopersici) transmitted by seeds in a soilless growing system. The issue was observed only on non-grafted or self-grafted Brandy Boy tomato plants and not in plants grafted onto DRO141TX and Estamino, which provide high resistance to this pathogen. Photo by Francesco Di Gioia, Penn State.

In selecting the rootstock, particular attention should be given to the compatibility between rootstock and scion. If there are well-known incompatibility issues, the rootstock seed company should report those. A possible incompatibility issue between rootstock and scion may be associated with the tomato mosaic virus (ToMV) susceptibility/resistance. Most rootstocks provide high resistance to ToMV. However, grafting a susceptible heirloom tomato variety

Continued on page 20

To Graft or Not to Graft?

continued from page 19

Table 1. Example of commercial tomato rootstocks and their resistance/tolerance or susceptibility to the main pest and pathogen issues affecting tomatoes in Pennsylvania.[1]

Commercial rootstock	Corky root rot (Pi)	Fusarium Crown Rot (For)	Fusarium wilt (Fol)	Verticillium wilt	Tomato Mosaic Virus	Root-knot Nematodes
Armstrong	IR	HR	HR (Fol: 1, 2)	HR	HR (ToMV: 0, 1, 2)	IR (Ma, Mi, Mj)
Arnold		IR	IR (Fol: 1, 2)	IR (V, Va, Vd)	IR (ToMV: 0, 1, 2)	IR (Ma, Mi, Mj)
Balance	IR	HR	HR (Fol: 1, 2, 3)	HR (Va: 1, Vd: 1)	HR (ToMV: 0, 1, 2)	IR (Ma, Mi, Mj)
Beaufort		HR	HR (Fol: 0, 1)	HR (Va: 0, Vd: 0)	HR (ToMV: 0, 1, 2)	IR (Ma, Mi, Mj)
Bowman	IR	HR	HR (Fol: 1, 2, 3)	HR (Va: 1, Vd: 1, 2)	HR (ToMV: 0, 1, 2)	IR (Ma, Mi, Mj)
DRO138TX	HR	HR	HR (Fol: 1, 2)	HR (Va: 1, Vd: 1)	HR (ToMV: 0, 1, 2)	IR (Ma, Mi, Mj)
DRO141TX	HR	HR	HR (Fol: 1, 2)	HR (Va: 1, Vd: 1)	HR (ToMV: 0, 1, 2)	IR (Ma, Mi, Mj)
Estamino	HR	HR	HR (Fol: 0, 1, 2)	HR (Va: 0, Vd: 0)	HR (ToMV: 0, 1, 2)	IR (Ma, Mi, Mj)
Fortamino	HR	HR	HR (Fol: 0, 1, 2)	HR (Va: 0, Vd: 0)	HR (ToMV: 0, 1, 2)	IR (Ma, Mi, Mj)
Guardian		R	R (Fol: 3)	R	R Tm	R (N)
Kardia	IR	HR	HR (Fol: 0, 1)	HR (Va, Vd)	HR (ToMV: 0, 1, 2)	IR (Ma, Mi, Mj)
Maxifort	HR	HR	HR (Fol: 1, 2)	HR (Va: 1, Vd: 1)	HR (ToMV: 0, 1, 2)	IR (Ma, Mi, Mj)
Multifort	HR	HR	HR (Fol: 1, 2, 3)	HR (Va: 1, Vd: 1)	HR (ToMV: 0, 1, 2)	IR (Ma, Mi, Mj)
Protector	IR	HR	HR (Fol: 0, 1, 2)	HR (Va: 0, Vd: 0)	HR/R (Tm) HR (ToMV: 0, 1, 2)	HR/R (Ma, Mi, Mj)
Rootpower	HR	HR	HR (Fol: 0, 1)	HR (Va, Vd)	HR (ToMV)	IR (Ma, Mi, Mj)
RST-04-105-T	HR		HR (Fol: 1, 2, 3)	HR	S	HR
RST-04-106-T	CR		Fol: 1, 2, 3	S	MCR (ToMV) Suitable R (Tm)	CR
RST-04-107-T	CR		CR	CR	MCR (TMV)	CR
Synergy	IR	HR	HR (Fol: 1, 2, 3)	HR (Va: 1, Vd: 1)	HR (ToMV: 0, 1, 2)	IR (Ma, Mi, Mj)

[1]*Fol:* Fusarium oxysporum *f. sp.* lycopersici*; For:* Fusarium oxysporum *f. sp.* radicis-lycopersici*; Pi:* Pseudopyrenochaeta lycopersici*; Va:* Verticillium albo-atrum*; Vd:* Verticillium dahliae*; Ma:* Meloidogyne arenaria*; Me:* M. enterolobii*; Mi:* M. incognita*; Mj:* M. javanica*; TMV: Tobacco mosaic virus; ToMV: Tomato mosaic virus; CR: complete resistance; HR: high resistance; IR: intermediate resistance; R: resistant; S: susceptible.*

affected by ToMV onto a highly resistant rootstock may cause incompatibility issues (Figure 6). Therefore, selecting rootstock compatible with heirloom varieties susceptible to ToMV should be done carefully, considering that these plants may be compatible only with rootstocks that are susceptible to ToMV.

Grafting for Plant Vigor and Tolerance to Abiotic Stress Conditions

Grafted plants are also used for their enhanced plant vigor, which can benefit high tunnel production systems given the longer crop cycle and harvesting season. The vigor of grafted plants is defined by the vigor of the rootstock selected and is modulated by the rootstock-scion interaction; therefore, selecting both rootstock and scion is critical to have a good synergy. Vigorous rootstocks may also be beneficial to face some abiotic stress conditions that may occur during the crop cycle. In Pennsylvania, tomato plants may be exposed to several abiotic stress conditions associated with relatively low and high temperatures, drought, salinity, and/or excess of nutrients (Figure 7). Using grafted plants with a vigorous rootstock may provide more tolerance in facing lower temperatures in an early planting (Venema et al., 2008) and relatively high temperatures over the summer (Schwarz et al., 2010). Yet, the capacity of a larger root system to uptake more water and nutrients (Djidonou et al., 2013) and explore a larger volume of soil may help face drought stress and/or salinity stress (Di Gioia et al., 2013), nutrient excess (Di Gioia et al., 2017), and even lower levels of nutrients.

Figure 6. Example of an heirloom tomato plant affected by Tomato Mosaic Virus (ToMV) manifesting leaf yellowing (A), distortion (B), and sudden wilting of the plant (C) when grafted on rootstock resistant to ToMV. The bottom right photo (D) shows the outcome of the Agdia ELISA test for ToMV, confirming the presence of the virus. Photos by Francesco Di Gioia, Penn State.

Figure 7. Example of high tunnel tomato crop affected by the excess of boron and other nutrients. Photo by Francesco Di Gioia, Penn State.

Most seed companies indicate whether their rootstock is vigorous or not, but there is no standard metric to define the vigor of a rootstock, and the claim of the rootstock seed companies should be verified.

Some growers may be concerned about an excess vigor of grafted plants and a potential delay in fruit ripening or a negative impact on the fruit quality. For this reason, some seed companies are breeding rootstocks that they claim to be more regenerative, but this should also be verified.

Our research conducted at the Penn State High Tunnel Research Facilities shows that in a high tunnel, the use of grafted tomato plants with a vigorous rootstock may improve the nitrogen use efficiency and provide higher marketable yield and extra-large fruit compared to non-grafted plants even in the absence of soilborne pests and pathogens or abiotic stress conditions (Blunk, 2022). We observed a slight delay in fruit ripening only for a week or two at the beginning of the season and no consistent negative or positive effects on the fruit quality. Due to the higher plant vigor and biomass produced, grafted plants need additional trellising compared to non-grafted plants, and a hanging trellising system rather than stakes may be beneficial if grafted plants are used (Figure 8).

Continued on page 22

VEGETABLE PRODUCTION

To Graft or Not to Graft?

continued from page 21

Figure 8. Example of hanging trellising systems used for grafted tomato plants in a high tunnel. Photo by Francesco Di Gioia, Penn State.

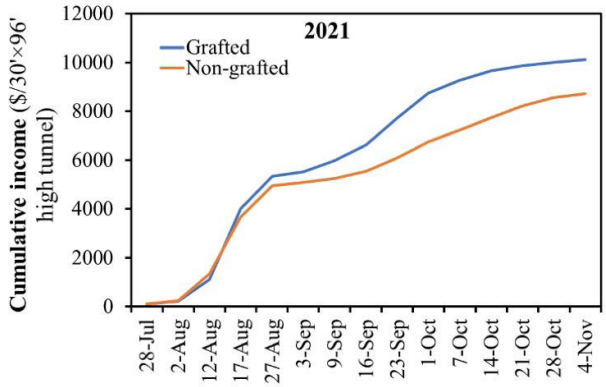
Besides the trellising, a simple but very important recommendation, often forgotten or given for granted, is that grafted plants should be transplanted, maintaining the grafting point well above the soil surface (Figure 9). This is critical because if the scion is covered or comes in close contact with the soil, it may easily develop adventitious roots and bypass the rootstock. When this happens, the resistance or tolerance to soilborne pests and pathogens and all the potential advantages provided by the rootstock may be lost.

Economic Considerations

From an economic point of view, it is important to consider that the cost of production of grafted plants is usually higher than non-grafted plants. However, under the conditions of our study, the economic analysis revealed that despite the higher cost, grafted tomato plants were more profitable due to the higher yield, even in the absence of biotic and abiotic soil-level stressors (Blunk, 2022). Figure 10 shows the estimated cumulative income derived from Red Deuce tomato plants non-grafted or grafted onto DRO141TX for a 30' × 96' high tunnel calculated by multiplying the marketable yield provided by the grafted and non-grafted plants throughout the growing season by the weekly red fresh-market tomato prices recorded at the Leola Produce Auction during the 2021 growing season. Similar results were obtained during the 2020 growing season. Based on the results of our two-year study and previous studies, our experience suggests that in a high tunnel or greenhouse production system, the longer the crop cycle, the higher the potential benefits and return of investment on using grafted tomato plants.

Figure 9. Example of grafted tomato plant correctly planted with the grafting point above the ground surface. The silicon grafting clips should be left on the grafting point, and they will come off by themselves as the stem is growing. Photo by Francesco Di Gioia, Penn State.

Figure 10. Cumulative income estimated over the 2021 trial season for a 30' × 96' high tunnel. Income was calculated using weekly marketable yield multiplied by the corresponding weekly red fresh-market tomato prices recorded at the Leola Produce Auction (Blunk, 2022).



The choice of grafting tomato plants on your own farm versus purchasing grafted plants from a specialized nursery is primarily a personal choice. Even though in some cases grafting on your own may be more cost-effective than purchasing grafted plants, the actual prospect of grafting plants on your own farm is dependent on the availability of time, specialized labor, proper greenhouse facilities, and adequate understanding and experience of the grafting process. Not always doing your own graft is the cheaper option. The costs of these two strategies must be carefully weighed against each other.

Grafting tomato plants require some planning, experience, and a particular set-up for the healing process, as described in the following Vegetable Grafting Manual (Rosskopf et al., 2018). Therefore, more and more growers prefer to rely on nurseries specializing in the production of grafted plants. In Pennsylvania, it is possible to purchase grafted plants from local nurseries, or plants can be shipped from a long distance as long as the order is placed on time. Specialized nurseries can produce plants with the rootstock-scion combination of your choice right on time for your defined planting date. Having experience with different grafting combinations may provide suggestions on alternative rootstocks and rootstock-scion combinations. Of course, the quality of grafted plants may determine the success of your crop, so the choice of grafting on your own or the selection of the nursery that will produce your plants are important choices.

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VEGETABLE PRODUCTION

Sanitation Is the Key to Prevent Diseases in High Tunnels

Thomas Ford

Figure 1: Crop debris and weeds should be removed at the end of the growing season to reduce inoculum. Photo: Thomas Ford, Penn State

Disease prevention in high tunnels starts with proper sanitation.

At the end of the growing season, it is imperative that growers remove all plants (with roots when possible) and any dropped fruit to limit the likelihood of infection from overwintering sources of inoculum. If a grower is planning to compost their high tunnel debris, they should locate their compost and/or cull piles far away from their production areas to prevent windblown spores from infecting the high tunnel crops in the coming year.

Weeds are a scourge in any production system, and when encountered in high tunnels, their impact may be greatly amplified. Weeds will impede airflow in high tunnels, promoting plant diseases like gray mold and powdery mildew. Weeds also compete with crops for light, water, and nutrients and are known to harbor a variety of pests and diseases that may reduce overall crop yield or even cause crop loss. Weeds like crop residue should be physically removed from the high tunnel at the end of the growing season to limit sources of inoculum for the next year.

Tools and equipment used in the high tunnel should be cleaned and sanitized to prevent the introduction of pests, diseases, and weed seeds into the high tunnel environment next season. Products containing hydrogen peroxide and peracetic acid are often labeled for use on hard non-porous surfaces to kill pathogens that may infect horticultural crops. Before using any product to clean or sanitize equipment, ensure that the product is properly labeled for use in your state.

Used wooden stakes often serve as a source of inoculum in fields and in high tunnels. Bacterial diseases like bacterial speck, bacterial spot, and bacterial canker can often be introduced into production areas on used wooden stakes. Wooden stakes crack and check during exposure to the elements, and the small fissures in the wood serve to collect bacteria and fungal spores. When these "used" wooden stakes are deployed to support crops, the plant foliage will inadvertently come in contact with the stake resulting in infection. At the conclusion of each growing season, consider burning or burying all wooden stakes that were used during the previous growing season. Only use new wooden stakes when supporting vegetable crops in the field and/or high tunnel systems.

Mr. Ford is with Penn State Extension in Cambria Co. From Penn State Extension, https://extension.psu.edu/sanitation-is-the-key-to-prevent-diseases-in-high-tunnels?, December 6, 2022.

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