

PENNSYLVANIA  
VEGETABLE GROWERS

# NEWS

August 2021 / Volume 44 Number 7

for the commercial vegetable, potato and berry grower



## Promoting PA Vegetables and PVGA at Ag Progress Days

Penn State's Ag Progress Days was again held in-person this year on August 10 to 12 after going virtual last year due to the coronavirus pandemic. Although the weather was hot and included several passing showers, good crowds came out for this year's event. Like it has the past several years, PVGA set up a display in the ECM Building. PVGA partnered with the PA Vegetable Marketing and Research Program to celebrate August as PA Produce Month and promote Pennsylvania-grown vegetables to show attendees. About 750 copies of a special brochure with vegetable

recipes were distributed to adults and over 850 "Fun and Healthy Facts" vegetable activity cards were given to children. Besides promoting vegetables to the consumers attending the show, the Association also had sample newsletters and PVGA membership brochures on hand to give to any vegetable, potato or small fruit growers attending the event who were not members. The booth also gives Association staff the opportunity to connect with any PVGA members who are attending the show.

## NEWS



*Pennsylvania  
Vegetable Growers  
Association*

*An association of  
commercial vegetable,  
potato and berry growers.*

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## In Memory

### Mildred Schantz

Mildred Schantz of Quakertown passed away on April 16 at her home. She was the wife of Daniel Schantz, who served as president of PVGA three different times for two-year periods and served on the Board of Directors for over 40 years.

Born on May 29, 1932, she and her husband began their farming career raising fruits and vegetables to sell at various retail farmers markets. Over the years they operated several large farm markets in the Lehigh County handling a full line of fruits and vegetables. They also began a greenhouse operation to raise seasonal plants and flowers. In later years, they focused their vegetable production on fall ornamental crops – pumpkins, gourds, and Indian corn and greatly expanded their greenhouse business enabling them to serve national chain store customers. Mildred was an active partner in the businesses.

Besides Dan, her husband of 67 years, she is survived by her son Tom and his wife, her daughter Connie, five grandchildren and four great grandchildren. She was a life-long active member of Swamp Mennonite Church where she served on the church council and other committees. She enjoyed cooking and entertaining in her home as well as gardening. She and her husband also enjoyed traveling to various places throughout the United States, Canada and Europe and participated in several PVGA tours in years past.

Memorial contributions may be made to Spruce Lake Wilderness Camp, 5389 Rt 447, Canadensis, PA 18325.

### Jerry Shimmel

Jerome "Jerry" Shimmel of Shickshinny passed away on July 25 at his home. Jerry's wife, Brenda Michaels and her sister Karen own Michael's Concessions which contracts with PVGA to produce the batter-dipped vegetables and blooming onions at the Association's Farm Show food booth. Jerry was kept busy peeling onions, frying onions or running various errands.

Shimmel was born September 27, 1967 and graduated from Phillipsburg-Osceola Mills Area High School. He served in the U.S. Air Force for four years and worked at a brickyard for several years after returning from the Air Force. After his marriage to Brenda, he worked in their concession business which traveled to various events around the state throughout the year. He was a member of the Masonic Lodge.

He survived by his wife Brenda, his mother Gail Shimmel, his sister and her husband, three brothers and their wives, his step son Kelley Michael and his life partner Jen and two grandchildren Hunter and Avery. He is also survived by this cousin, Kenneth Brian Sawtelle, and his life partner Elaine Miley and their daughter Adeline. His cousin was his "right hand and arm" and a big part of his life.

In lieu of flowers, contributions may be made in his memory to the Wilkes-Barre V. A. Medical Center, 1111 East End Blvd., Wilkes-Barre, PA 18711; or to the CMA Church, 112 Trczyulny Street, Osceola Mills, PA 16666.

## Don't Forget – Plan Now to Attend the In-Person



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

815 Middle Road, Richfield, PA 17086-9205

Phone and fax: 717-694-3596 • Email: [pvga@pvga.org](mailto:pvga@pvga.org) • Website: [www.pvga.org](http://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.

## National News Briefs

### EPA Takes Action to Ban Chlorpyrifos on Food Crops

The U.S. Environmental Protection Agency (EPA) announced it will stop the use of the pesticide chlorpyrifos on all food to better protect human health, particularly that of children and farmworkers.

In a final rule released August 18, EPA is revoking all “tolerances” for chlorpyrifos, which establish an amount of a pesticide that is allowed on food. In addition, the agency will issue a Notice of Intent to Cancel under the Federal Insecticide, Fungicide, and Rodenticide Act to cancel registered food uses of chlorpyrifos associated with the revoked tolerances.

“Today EPA is taking an overdue step to protect public health. Ending the use of chlorpyrifos on food will help to ensure children, farmworkers, and all people are protected from the potentially dangerous consequences of this pesticide,” said Administrator Michael S. Regan. “After the delays and denials of the prior administration, EPA will follow the science and put health and safety first.”

Chlorpyrifos is an organophosphate insecticide used for a large variety of agricultural uses, including soybeans, fruit and nut trees, broccoli, cauliflower, and other row crops, as well as non-food uses. It has been found to inhibit an enzyme, which leads to neurotoxicity, and has also been associated with potential neurological effects in children.

The steps the agency is announcing today respond to the Ninth Circuit’s order directing EPA to issue a final rule in response to the 2007 petition filed by Pesticide Action Network North America and Natural Resources Defense Council. The petition requested that EPA revoke all chlorpyrifos tolerances, or the maximum allowed residue levels in food, because those tolerances were not safe, in part due to the potential for neurodevelopmental effects in children.

Under the previous Administration, EPA denied the petition in 2017 and denied the subsequent objections in 2019. These denials were challenged in the Ninth Circuit Court of Appeals in 2019 by a coalition of farmworker, health, environmental, and other groups. In April 2021, the Court found that “...EPA had abdicated its statutory duty under the Federal Food, Drug and Cosmetic Act...” to “conclude, to the statutorily required standard of reasonable certainty, that the present tolerances caused no harm.” In its decision, the Court ordered EPA to grant the petition, issue a final rule in which the agency either modifies the chlorpyrifos tolerances with a supporting safety determination or revokes the tolerances, and modify or cancel food-use registrations of chlorpyrifos.

EPA has determined that the current aggregate exposures from use of chlorpyrifos do not meet the legally required safety standard that there is a reasonable certainty that no harm will result from such exposures. A number of other countries, including the European Union and Canada, and some states including California, Hawaii, New York, Maryland, and Oregon have taken similar action to restrict the use of this pesticide on food.

While farmers have historically relied on chlorpyrifos, its use has been in decline due to restrictions at the state level and reduced production. Additionally, some alternatives have been registered in recent years for most crops. There are also other chemistries and insect growth regulators available for certain target pests. EPA is committed to reviewing replacements and alternatives to chlorpyrifos.

Farm Bureau criticized the decision to revoke all tolerances, saying the EPA should rely on sound science in its decision making. “Farmers and ranchers care deeply about the quality of our crops—nothing is more important than producing safe, nutritious food,” American Farm Bureau President Zippy Duvall said. “So, we must be guided by the most reliable determinant of safety, which is science. This administration has repeatedly made com-

mitments to abide by science, yet the EPA decision on chlorpyrifos strays from that commitment and takes away an important tool to manage pests and insects. We urge EPA officials not to make determinations on pesticides outside of the regular registration review process already underway. The integrity of the registration review process and commitment to using sound science must be prioritized in a decision of such far-reaching consequences.”

*From the United States Environmental Protection Agency and Penna. Farm Bureau.*

### USDA Updates Pandemic Assistance for Specialty Crop Growers

The U.S. Department of Agriculture (USDA) is updating the Coronavirus Food Assistance Program 2 (CFAP 2) for contract producers of eligible livestock and poultry and producers of specialty crops and other sales-based commodities. CFAP 2, which assists producers who faced market disruptions in 2020 due to COVID-19, is part of USDA’s broader Pandemic Assistance for Producers initiative. Additionally, USDA’s Farm Service Agency (FSA) has set an Oct. 12 deadline for all eligible producers to apply for or modify applications for CFAP 2.

“We listened to feedback and concerns from producers and stakeholders about the gaps in pandemic assistance, and these adjustments to CFAP 2 help address unique circumstances, provide flexibility and make the program more equitable for all producers,” said FSA Administrator Zach Ducheneaux. “The pandemic has had a tremendous impact on agricultural producers, and we have made significant progress since announcing our plans in March. While additional pandemic assistance remains to be announced in the coming weeks, USDA is also ramping up its efforts to make investments in the food supply chain to Build Back Better.”

USDA is amending the CFAP 2 payment calculation for sales-based commodities, which are primarily comprised of specialty crops, to allow producers to substitute 2018 sales for 2019 sales. Previously, payments for producers of sales-based commodities were based only on 2019 sales, with 2019 used as an approximation of the amount the producer would have expected to market in 2020. Giving producers the option to substitute 2018 sales for this approximation, including 2018 crop insurance indemnities and 2018 crop year Noninsured Disaster Assistance Program (NAP) and Wildfire and Hurricane Indemnity Program Plus (WHIP+) payments, provides additional flexibility to producers of sales-based commodities who had reduced sales in 2019.

Grass seed has also been added as an eligible sales commodity for CFAP 2. A complete list of all eligible sales-based commodities can be found at [farmers.gov/cfap2/commodities](https://farmers.gov/cfap2/commodities). Producers of sales-based commodities can modify existing applications.

Sign-up for CFAP 2 was re-opened in March and remains open to address inadequate initial outreach efforts to reach underserved producers and particularly those who produce sales commodities. Newly eligible producers who need to submit a CFAP 2 application or producers who need to modify an existing one can do so by contacting their local FSA office. Producers can find their local FSA office by visiting [farmers.gov/service-locator](https://farmers.gov/service-locator). Producers can also obtain one-on-one support with applications by calling 877-508-8364. All new and modified CFAP 2 applications are due by the Oct. 12 deadline.

As USDA looks to long-term solutions to build back a better food system as announced in June, the Department is committed to delivery of financial assistance to farmers, ranchers and agricultural producers and businesses who have been impact-

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## National News Briefs continued from page 3

ed by COVID-19 market disruptions. Since USDA rolled out the Pandemic Assistance for Producers initiative in March, the Department has announced approximately \$7 billion in assistance to producers and agriculture entities.

*From USDA.*

### Senate OKs Bipartisan Infrastructure Deal

The U.S. Senate has approved a bipartisan legislation supported by Farm Bureau that authorizes transportation and infrastructure spending over the next five years.

The roughly \$1 trillion spending plan includes \$550 billion in new spending, including on surface transportation infrastructure and broadband expansion. In addition to authorizing infrastructure spending, the bill exempts livestock and insect haulers from Hours of Service regulations within a 150 air-mile radius of their final destination, which Farm Bureau supports.

Farm Bureau applauded the Senate's passage of the bill.

"Farmers and ranchers depend on millions of miles of roadways and waterways to get their products to America's dinner tables, and they rely on ports to ship food, fiber and fuel to countries around the world," said American Farm Bureau Federation President Zippy Duvall. "Improvements in transportation infrastructure, as well as repair and upgrades to the aging western water infrastructure, will ensure farmers can continue to keep this nation fed."

The measure allocates \$110 billion for road and bridge projects, \$66 billion for passenger and freight rail, and also authorizes funding for safety, public transportation, airports, ports and waterways, power and grid infrastructure, resiliency, electric and low-carbon school busses and ferries, and more. The bill also includes \$65 billion for broadband expansion, one of Farm Bureau's top priorities.

"Extending digital access to rural America is just as important as paved roads and solid bridges," Duvall said. "Increased funding to bring broadband to hundreds of thousands of farms that currently have no access to the internet will help farmers meet the demands of a growing world while using emerging technologies to build on climate-smart practices."

The measure, developed as bipartisan compromise by a team of both Democratic and Republican senators, has the backing of President Joe Biden. But it faces an uncertain future in the Democratic-controlled House, where leaders have signaled they want infrastructure to be addressed along with a separate \$3.5 trillion budget package that addresses social programs and climate change priorities.

*From Penna. Farm Bureau, <https://pfb.com/senate-oks-bipartisan-infrastructure-deal/>, August 20, 2021.*

### Guidance for Flood-Affected Food Crops

If your farm is susceptible to flooding, please read the FDA's Guidance

for Industry: Evaluating the Safety of Flood-affected Food Crops for Human Consumption, found at this link: <https://www.fda.gov/regulatory-information/search-fda-guidance-documents/guidance-industry-evaluating-safety-flood-affected-food-crops-human-consumption>

Per the guidance: "If the edible portion of a crop is exposed to flood waters, it is considered adulterated under section 402(a)(4) (21 U.S.C. 342(a)(4)) of the Federal Food, Drug, and Cosmetic Act and should not enter human food channels. There is no practical method of reconditioning the edible portion of a crop

that will provide a reasonable assurance of human food safety. Therefore, the FDA recommends that these crops be disposed of in a manner that ensures they are kept separate from crops that have not been flood damaged to avoid adulterating "clean" crops (Ref. 1, 2, 3)."

The guidance also addresses potential microbial, chemical and fungal contamination, the safety of food crops when flood waters did NOT contact the edible portion of the crop, as well as flooding vs. pooled water.

*From the **Vegetable Notes for Vegetable Farmers in Massachusetts**, Univ. of Mass. Extension, Vol. 33, No. 18, August 19, 2021.*

### USDA Revises U.S. Standards for Watermelon

The U.S. Department of Agriculture (USDA) Agricultural Marketing Service (AMS) is revising the U.S. Standards for Watermelon to provide a common language for trade.

AMS is establishing a total tolerance for Anthracnose and decay in the U.S. No. 1 and U.S. No. 2 grades; adjusting the range of average weight from 20-42 to 10-34 pounds to align with current marketing trends; adding sunburn as a permanent defect; revising scoring guides for hail, rind worm injury, scars, hollow heart, sunburn, and transit rubs; removing metric measurements from the standard; and making minor editorial changes.

The revisions were published in the Federal Register on August 19, 2021 at <https://www.federalregister.gov/documents/2021/08/19/2021-17814/revision-of-us-standards-for-grades-of-watermelons>, and become effective on September 20, 2021.

Copies of the current U.S. Standards for Grades of Watermelon are available at <https://www.ams.usda.gov/grades-standards/watermelon-grades-and-standards>.

For more information, contact David Horner at 540-361-1128 or [Dave.Horner@usda.gov](mailto:Dave.Horner@usda.gov).

## New Vegetable/Small Fruit Extension Educator in Butler County



Glen Bupp, will serve as the new Commercial Horticulture Educator on the Penn State Extension Vegetable and Small Fruit team out of Butler County. Bupp has a M.S. degree in Ecology from the Florida Institute of Technology. His extension career began with the University of Florida IFAS as Commercial Horticulture Agent in Brevard County, Florida. During his time in Florida he worked primarily with landscapers, nurseries, and mango farms. Recently, he was the Consumer Horticulture Educator and Master Gardener Coordinator for Penn State Extension in Allegheny County, Pennsylvania. Bupp also has experience in plant propagation, crop inspection, and pesticide education. In his spare time he enjoys mountain biking, home brewing, and gardening with his two children. He is looking forward to getting to know and working with the vegetable farmers in Southwest Pennsylvania.

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GENERAL

# Can Direct-Market Vegetable Farmers Make a Middle-Class Income?

Franklin Egan

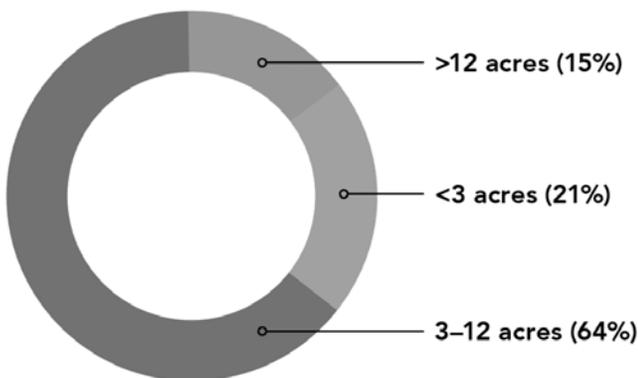
Our new report offers the most comprehensive review of direct-market vegetable farm finances to date.

Vegetable farms that sell their produce through farmers markets, CSA programs, on-farm stores, and other direct-market channels are the foundation of local food movements everywhere. Yet there is surprisingly little information available to help answer a basic question: Can farmers make a middle-class income selling vegetables through direct-market outlets?

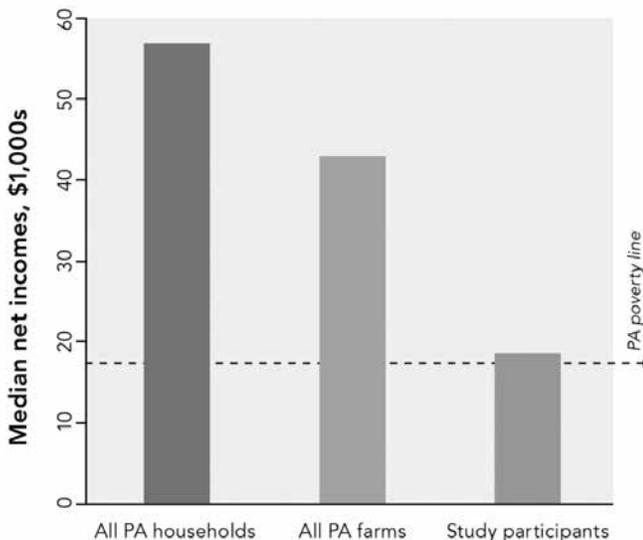
We launched an ongoing study in 2017 to help fill this critical gap in information and provide insights that could help vegetable farmers start and grow their businesses. Our new report offers the most comprehensive review of direct-market vegetable farm businesses to date, sharing detailed financial benchmarks from 39 farms collected over three years.

Participating farms were located in four Mid-Atlantic states: Pennsylvania, Maryland, Virginia, and West Virginia. Most had less than 15 acres in vegetables production; the largest had approximately 100. Farms studied had been in business for anywhere between one and 50 years.

STUDY PARTICIPANTS: ACRES IN VEGETABLES PRODUCTION



MEDIAN NET INCOMES FOR PA HOUSEHOLDS, FARMS & STUDY PARTICIPANTS



## Findings

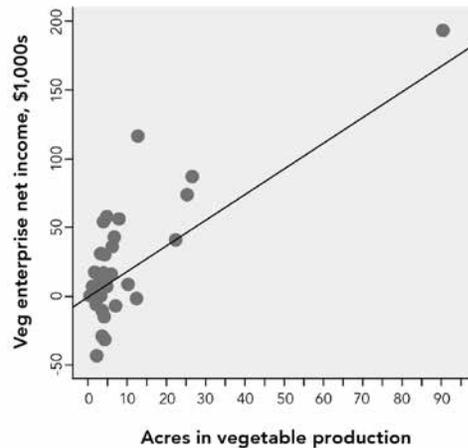
Our findings were consistent with structural challenges that negatively impact small- and medium-scale farms in a highly consolidated agriculture industry. In other words: They were sobering.

We found that the majority of direct-market vegetable farms were not earning a middle-class income. Participating farms had a median net income of \$18,500, which approximates the 2020 poverty rate in Pennsylvania for a two-person household. Further, the net incomes of more than 70% of the farms in our study were less than half the median net income for all Pennsylvania farms, which include among others dairy, row crop, and wholesale vegetable operations.

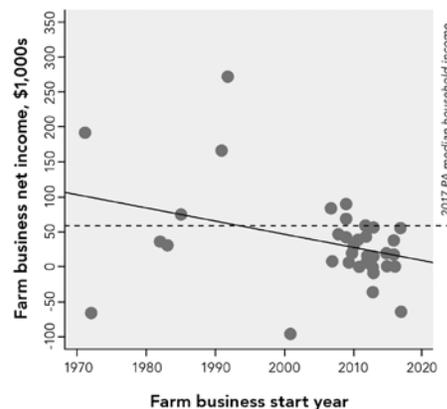
We did find some farms bucking the trend. A quarter of study participants had earned net incomes greater than the Pennsylvania median household annual income of \$57,000. These farms tended to be larger in scale than many market-garden-style farms—typically, ten acres or more in vegetable production—and often capitalized on diversifying their revenue streams, with reselling products produced by other local farms proving to be one of the more profitable added enterprises.

Notably, however, many of the owners of these high-performing farms partially attributed their success to good fortune, such as access to especially lucrative markets or reliable farmland arrangements.

VEGETABLE ENTERPRISE NET INCOME RELATED TO ACRES IN VEGETABLE PRODUCTION



FARM BUSINESS NET INCOME RELATED TO NUMBER OF YEARS IN BUSINESS

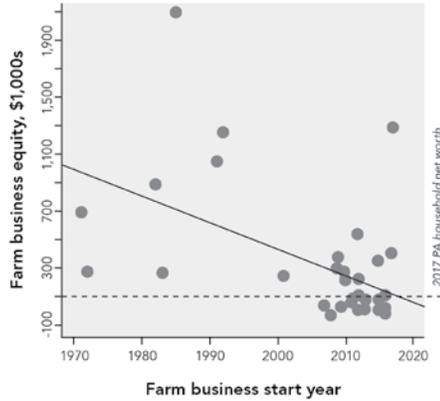


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# Can Direct-Market Vegetable Farmers Make a Middle-Class Income?

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## FARM BUSINESS NET INCOME (EQUITY RELATED TO NUMBER OF YEARS IN BUSINESS)

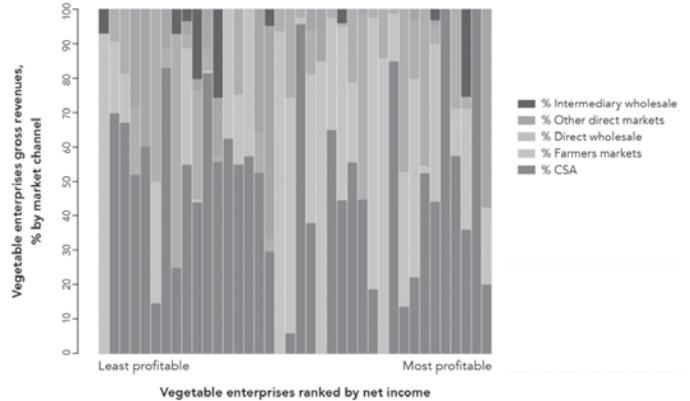


We also found that farms steadily increased income and equity over time, generally becoming more profitable the longer they were in business. Most farms' net incomes exceeded the Pennsylvania median household income within 12 years of business, while accumulating equity in land, buildings, and equipment in the meantime.

Interestingly, no single direct-market channel consistently outperformed all others. We found that all of the major sales channels utilized by farms in the study—farmers markets, CSAs, and direct wholesale—had a mix of higher and lower income cases.

For farmers wondering whether or not to focus on selling their produce through particular direct-market channels, this finding indicates there isn't a one-size-fits-all business model for financial success.

## NET VEGETABLE ENTERPRISE INCOME & MARKET CHANNEL COMPOSITION



### Pathways to higher incomes

We identified three primary pathways for improving direct-market incomes: (1) increasing the number of acres in vegetable production; (2) growing more and higher-value crops per

Continued on page 8

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## GENERAL

## Plans Underway for the 2022 Mid-Atlantic Fruit and Vegetable Convention

The program chairs for the vegetable and small fruit sessions at the 2022 Mid-Atlantic Fruit and Vegetable Convention recently met to go over the plans for next year's Convention. The Convention Committee is moving ahead with plans for an in-person event at the Hershey Lodge on February 1 to 3. One of topics discussed was the fact each year growers tell us that really enjoy hearing grower speakers and grower panels. However, our experience has usually been that many growers are reluctant to speak at the Convention.

**Therefore, we are asking that YOU consider**

- 1) volunteering to either be part of a panel or making a presentation on your own on one of the unique crops or practices on your farm; or**
- 2) volunteering your neighbor or another grower you know who is doing something unique (how easy is that!); or**
- 3) say "yes" if you are asked to speak or participate in a panel.**

One of the key principles of PVGA is being a group of growers working together to help the industry as a whole and each other individually. One of the best ways you can do that is being willing to share your knowledge and your experiences with other growers at the Mid-Atlantic Convention. Participating in a panel is often just a matter of answering a set of questions that is presented to each of the panelists - telling how you do it on your farm and what has worked best for you - or what has not worked for you. Making a solo presentation does take some time to plan out what you want to say, but sometimes preparing an explanation of why you do things the way you do may actually help you identify those reasons and focus on them better. If you are unsure of whether you can prepare the Powerpoint slides, we can usually provide some assistance with that.

**Please consider whether you could present a topic or whether you would like to hear a particular grower speak. Remember - being speaker or panelist at the Convention entitles you to FREE registration for the Convention and an honorarium.** Contact us at 717-694-3596 or [pvga@pvga.org](mailto:pvga@pvga.org).

## Can Direct-Market Vegetable Farmers Make a Middle-Class Income?

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acre; and (3) developing more efficient production systems. Still, the land, labor, and capital needed to pursue these strategies may be out of reach for farmers who are operating at a loss or aren't earning a living wage.

**SCENARIOS FOR ACHIEVING A NET INCOME GOAL (\$56, 951)  
BY INCREASING SCALE, INTENSITY, OR EFFICIENCY**

Scenario	SCALE (acres in vegetable production)	INTENSITY (gross revenue per acre in vegetable production)	EFFICIENCY (vegetable net income to revenue ratio)	Vegetable enterprise net income
Baseline	10	\$27,589	12.5%	\$34,486
1. Increase scale	16.5	\$27,589	12.5%	\$56,951
2. Increase intensity	10	\$45,561	12.5%	\$56,951
3. Increase efficiency	10	\$27,859	20.4%	\$56,951

While all farmers want to operate profitable, self-sustaining businesses, the financial benchmarks identified by our study are consistent with industry structural challenges that negatively impact small- and medium-scale farms. Creating and expanding public and private programs and partnerships will be necessary to help direct-market vegetable farmers continue their essential work providing fresh, nutritious food for their communities.

These programs and partnerships should focus on equitably increasing farmland access, improving market opportunities, encouraging workforce development, reducing financial risk, and rewarding conservation best practices such as building soil health, protecting wildlife, and improving water quality.

### What's Next?

Our financial benchmarking research is ongoing. Since compiling the findings detailed in our new report, we've partnered with peer organizations in New England (Community Involved in Sustainable Agriculture) and the Carolinas (Carolina Farm Stewardship Association) to expand the scope of our study to include data from vegetable farms located outside of the Mid-Atlantic region. We will also be analyzing the impact the coronavirus pandemic has had on study participants.

Read the full report: [Financial Benchmarks for Direct-Market Vegetable Farms: 2021 Report](#)

Our Financial Benchmarks Study was initially made possible with investments from Lady Moon Farms, the Jerry Brunetti family, the Shon Seeley family, and more than 120 private donors committed to strengthening local and regional food systems. Additional support was provided by a Pennsylvania Department of Agriculture Specialty Crop Block Grant and a Pennsylvania Department of Agriculture Research Grant.

### Want to join this study?

If you are a direct-market vegetable farmer and are interested in joining this study, email us at [research@pasafarming.org](mailto:research@pasafarming.org). Participating farms get custom financial benchmark reports and access to a learning community of their peers.

GENERAL

# New Hemp Maze Opens at Cedar Meadow Farm

A “one-of-a-kind” visitor experience is launching at Steve Groff’s Cedar Meadow Farm in Holtwood, PA. Steve is preparing a maze created in a 4 acre field of fiber hemp for families to explore.

This maze is brand new in 2021 and is the first of its kind in the area. The creative design is shaped like “Grizbot,” the friendly logo character of Cedar Meadow Farm. Grizbot is the online persona of Grizzly, the Groff’s real-life farm dog and a significant part of the branding for CedarMeadow.Farm CBD Hemp Extract.

The maze is divided into two parts. Grizbot’s head is cut into fiber hemp that is 7-10 feet tall with a complex shape for older kids and adults to enjoy. Griz’s body is designed for smaller kids, with shorter hemp and wider, easier paths. Over a dozen learning stations and fun activities are scattered throughout, enhancing the guest experience for both entertaining and educational aspects.

Along with the unique maze, visitors will be able to pick their own pumpkins, squash and gourds as well as sunflowers that will be growing all around the maze.

Cedar Meadow Farm has decades of history and innovation in the area of regenerative agriculture. Steve Groff, known widely as the Cover Crop Coach, is a farmer, international speaker, and consultant. He recently published a book, “The Future Proof Farm- Changing Mindsets in a Changing World”, which advocates for the use of cover crops, no-till farming, and soil health.

The soil on his 200-acre, family-owned southern Lancaster County farm, hasn’t been tilled in over 30 years. The resulting healthy soil and ecosystem limits run-off from heavy rains, produces cleaner water and captures massive amounts of CO2 from the atmosphere, offsetting the emissions of over 200 cars annually! In addition, the soil teems with biological life and increased mineral availability, yielding healthy nutrient-dense food.

Cedar Meadow Farm has produced and distributed nutrient-dense food to places like Blue Apron, Giant, Trader Joes, and Whole Foods for years. They began growing hemp in 2019 and have debuted a line of hemp oil extract (CBD oil) promoting the tagline “Better Soil, Better Oil.” More recently, fiber and grain hemp are being researched in order to develop the vast opportunities that this crop has to offer both for the benefit of humanity and the regeneration of the planet.

The new hemp maze experience, launched under the brand “Cedar Meadow Adventures,” will open Labor Day weekend and



continue through October. Visitors will be able to purchase tickets on their website, “CedarMeadowAdventures.com.” The Facebook page “Cedar Meadow Adventures” will also have updates and information.

## Hillside Cultivator Co. LLC



**Hydraulic adjusted cultivator** for the edges of plastic mulch



**Cultivators** especially for **Strawberries**



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Contact: John Shenk 717-669-3158 Lititz, PA [hillsidecultivator@gmail.com](mailto:hillsidecultivator@gmail.com)

## VEGETABLE PRODUCTION

## PA Vegetable and Berry Current Issues

Beth Gugino and Shelby Fleischer

**General conditions** as of August 17: Across Pennsylvania, August is produce month and needless to say production is in full swing and fall crops are in the ground. The drier and slightly warmer than average first half of August is now being followed with the potential for significant rainfall from tropical storm Fred over the next couple of days. Be on the lookout for physiological damage that comes from fluctuating water conditions such as rain checking on field tomatoes. There will also likely be an increase in fruit rots caused by *Phytophthora* blight in fields with poor drainage and retain standing water. Asymptomatic (visibly healthy) fruit at harvest could still develop symptoms post-harvest. It usually takes several days for visible symptoms to develop. If a bin is rejected, avoid disposing of rotting fruit in production fields.

- There continue to be no reports of **late blight** as of August 25 on tomato or potato in the mid-Atlantic region but this week there was a confirmed report on tomato in eastern Tennessee determined to be caused by the US-23 genotype. This makes a total of six confirmed reports so far in 2021. Late blight is favored by temperatures between 65 and 70°F and high relative humidity or leaf wetness. If you suspect late blight on your farm, please let me know either by email at [bkgugino@psu.edu](mailto:bkgugino@psu.edu) or by phone at 814-865-7328 or contact your local Extension Office. Additional information about late blight can be found on the US-ABlight website (<https://usablight.org>).

Epidemic Status Map: cucurbit downy mildew (*Pseudoperonospora cubensis*) for (8-25-2021)  
on  
Cantaloupe (*Cucumis melo*)  
Cucumber (*Cucumis sativus*)



*Cucurbit downy mildew monitoring map as of 8:30 am 25 August 2021. Top map represents confirmed reports on cucumber and cantaloupe. Bottom map is all other cucurbit hosts including pumpkin, watermelon, and squash (<https://cdm.ipmpipe.org>).*

Epidemic Status Map: cucurbit downy mildew (*Pseudoperonospora cubensis*) for (8-25-2021)

on  
Acorn / Yellow / Summer squash / Pumpkin - jack-o-lantern L...  
Butternut squash, Pumpkin - processing (*Cucurbita moscha...*)  
Giant pumpkin (*Cucurbita maxima*)  
Watermelon (*Citrullus lanatus*)



- As of the fourth week of August there have been no new reports of **cucurbit downy mildew** across the region. So, to date in PA, it has been confirmed on cucumber and/or cantaloupe in Centre, Huntingdon, Mifflin, Juniata, Luzerne, Lehigh, Bucks, Lancaster, Chester, and Lackawanna, Erie, and Butler Counties. There have also been no new reports of downy mildew on jack-o-lantern pumpkin in central Ohio or Kentucky. The closest report on butternut squash is remains in eastern North Carolina. As crops mature, the threat of downy mildew impacting yield decreases since it is a foliar disease that does not directly impact the fruit. Scouting is still highly recommended. Inclusion of a downy mildew specific fungicide in a fungicide program should be considered for crops that are not close to harvest. It is important to maintain a regular fungicide program on cucumbers and cantaloupes. As you finish with a planting, burning down the crop will reduce spread other succession plantings. Once the plant tissue is dead, the pathogen is dead. If you suspect downy mildew on your farm, please let me know either by email at [bkgugino@psu.edu](mailto:bkgugino@psu.edu) or by phone at 814-865-7328 or contact your local Extension Office. Knowing where the disease is an important component for area-wide management. See <https://cdm.ipmpipe.org> for the latest reports and disease risk forecasts.

- There have been several reports of **post-harvest fruit rots** of cucurbit crops. The fruit visibly appear healthy at harvest however several days post-harvest in the bins fruit rot symptoms develop. Fruit rots can be caused by several soilborne fungal/oomycete pathogens including *Phytophthora*, *Fusarium*, *Pythium*, *Didymella* (gummy stem blight), *Colletotrichum* (anthracnose), and *Plectosporium* as well as several bacterial pathogens. Even though the symptoms develop post-harvest, the fruit were infected in the field typically on the side in contact with the soil. Management of any one of these diseases requires an integrated approach. No single method is going to adequately manage the disease. In the future consider using cover crops, mulches, or strip tillage to reduce direct contact between the fruit and the soil. Integrate practices that improve soil health and drainage. Also



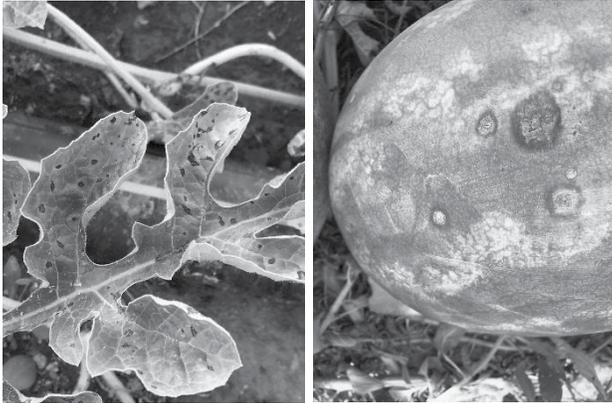
minimize drought stress to reduce potential cracking and minimize wounding at harvest. Reliance on fungicides for managing fruit rot is nearly impossible due to issues with coverage. Also keep in mind that post-harvest washing of the fruit will not “cure” a fruit that is already infected and the act of washing may actually spread the fruit rot pathogens in the wash water.

*Fusarium fruit rot on Delicata squash that developed post-harvest in the bin (Photo: Tom Ford, Penn State Extension)*



*Post-harvest watermelon fruit rot caused by *Phytophthora* blight. Fruit were infected in the field but symptoms did not develop until several days later (Photo: Jeff Stoltzfus, Penn State Extension).*

## VEGETABLE PRODUCTION

PA Vegetable and Berry Current Issues *continued from page 10*

Anthrachnose caused by the fungal pathogen *Colletotrichum orbiculare* on leaves and fruit of watermelon (Photo: Tim Elkner, Penn State Extension).



Mottling and leaf deformation associated with virus infection in pumpkin leaves (Photo: Beth K. Gugino).

**Cucurbit virus issues** continue to be reported in several different cucurbit crops. Symptoms can easily be confused with herbicide injury and diagnostic tests can be used to help confirm the presence of a virus(es). Symptomatic plants cannot be cured and can serve as a reservoir of the virus(es) which are most often transmitted by aphids passing through the field. If only a few plants, rogueing them from the field can help reduce inoculum. Some growers have salvaged symptomatic pumpkins that are warty and misshapen by marketing them as “spooky” pumpkins for the fall holiday market. To manage aphid-transmitted viruses, it helps to understand how aphids feed. These are with ‘stylet-borne’ viruses. Stylet refers to the needle-like feeding tubes of aphids. When a winged aphid –the life stage that immigrates into a field – alights onto a plant, it first ‘tastes’ the plant. The tasting probe is short (30 seconds or less, maybe a minute), and shallow. If the ‘taste’ is good, the aphid may ‘decide’ to stay and feed –send the stylets down to the phloem, with mouthparts that are longer than the aphid body, and deposit live offspring, which leads to the wingless forms. But if the taste results in rejection, the winged aphid moves to another plant.

That early, tasting, probes can move stylet-borne viruses quickly. Think of the taste as a two-step process. First, the aphid pushes fluid out – imagine a drop of saliva getting pushed out of a straw. The ejected saliva mixes with the plant sap and gets pulled in. Stylet-borne viruses adhere to proteins in the stylet. If an aphid feeds on an infected plant, the virus gets pulled in, adheres to the stylet. If the aphid then moves to another plant, during that tasting probe the ejected saliva carries the virus with it. There is a limit, because after a few tasting probes on clean plants, the viruses are cleared from the stylets. There is also an interaction going on: aphids may be attracted more to plants with virus symptoms, which helps the virus get acquired.

**Bacterial canker** is being reported on tomato as well as **early blight** and **Septoria leaf spot**. Due to the persistent high relative humidity, **leaf mold** is being observed both in field and high tunnel tomato production. So far there is no reported late blight in the region. The closest reports are on potato and tomato in northern Georgia. As the night temperatures start to drop and we experience longer dew periods, the risk for late blight will increase if there is inoculum nearby.

*Continued on page 12*

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## VEGETABLE PRODUCTION

## PA Vegetable and Berry Current Issues

*continued from page 11*



Corn earworm comes in many color morphs (left, photo Purdue Extension) while the fall armyworm is much darker in color (right, photo R. Bessin, Univ. Kentucky).

Night flying moths that infest sweet corn, tomatoes, and many other vegetables were captured in pheromone traps at high levels the week of August 17. **Corn earworm** trap captures spiked in multiple counties and neighboring states. In some locations, there was a 10, 20, and even 100 fold increase from the previous week. This may be due to immigration on weather fronts, emergence of a locally-produced generation, or a combination of both. CEW overwinters wherever the soil does not freeze to a depth of about 3-5 inches: we now have overwintering in the DelMarVA, parts of NJ, and possibly pockets in PA. Concurrently, we continue to see very high **fall armyworm** (FAW) counts. FAW does not undergo diapause, so overwintering is limited to very far south (southern FL, southern TX, perhaps the Gulf Coast). Genetic signatures distinguish populations arriving from TX or FL., after the three or five generations that occur as they move poleward. Historically, our FAW populations originated from TX, moving up the continental interior and easterly along nighttime wind currents. FL populations can also arrive, but they are also blown easterly, so few reach PA. That why our FAW populations are mostly in the western side of the state, and almost always the highest in Erie.



Corn earworm (left) has a light-colored head capsule. Fall armyworm (right) has a prominent upside-down 'Y' on the head capsule, due to the light band on the edges of chitinous plates. (Photos: G. Dively, Univ. of MD).

CEW eggs are laid individually on silks, and young larvae move into the ear tip within 2 to 5 days, depending on temperature. CEW are cannibalistic, so you usually only get one per ear, often with a lot of frass. FAW lay eggs in a mass on vegetative tissue (including the flag leaf). Although FAW larvae feed on vegetative corn, when tassel or silking the larvae chew their way rapidly into the ear, from the base, side or tip. CEW come in many color morphs but are usually lighter in color than FAW. You can distinguish CEW from FAW by looking closely at the chitinous plates that make up the head capsule. CEW will be light greenish or yellow/tan in color, with no strong band along the edge of the plates. FAW have a strong color band on the edge of the plates, resulting in a upside-down 'Y' pattern on their head.

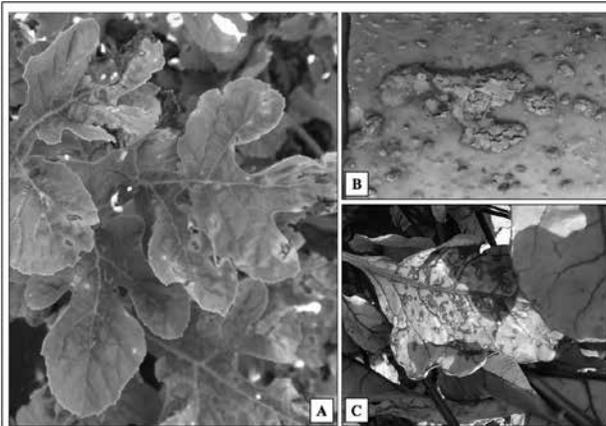
Both CEW and FAW exhibit resistance to pyrethroids. Other options include spinosyns (IRAC group 5: Blackhawk, Radiant) and diamides (IRAC group 28: Coragen, Vantacor). Diamides have low bee toxicity. These also control ECB, but not sap beetles, silk-clipping beetles (adult Western corn rootworm), or stink bugs – pyrethroids are often used for these. Premixes that include pyrethroids and diamides (Beseige, Elevest) are options.

We are also seeing increases in **cucumber beetles**, **flea beetles** in eggplant, **two-spotted spider mites**, **stink bug** damage in tomatoes, and **worms** in cabbage.

*Dr. Gugino is with the Department of Plant Pathology and Environmental Microbiology and Dr. Fleischer is with the Department of Entomology at Penn State Univ. From Penn State Extension.*

## Bacterial Leaf Spot of Cucurbits, Beets and Swiss Chard

Beth Gugino



Typical symptoms of bacterial leaf spots on beet, chard, and cucurbits. (A) Wart-like symptom on butternut squash fruit; Photo: C.T. Bull; (B) Leaf spots on watermelon, Photo: S. Da Silva, M.L. Paret; and (C) leaf spots on table beet, Photo: L. Coulter.

Bacterial leaf spot (BLS) on cucurbits and chenopods (beet and chard) is caused by strains of the seedborne bacterial pathogen *Pseudomonas syringae*. In beet and chard, the most common initial symptom of BLS is pale brown, irregular to circular shaped, water-soaked necrotic lesions surrounded by a red halo. Yellow lesions, that subsequently turn necrotic as the disease progresses, may be observed on the leaf margins. Although BLS symptoms can be confused with *Cercospora* leaf spot (CLS), these can be differentiated by the shaped and size of the spots, as CLS tends to produce circular spots that are smaller in diameter. Another way to distinguish CLS from BLS is by looking for signs of the pathogen; for example, stromata (fungus fruiting bodies that appear as black dots) can be easily seen in the center of the spots with a hand lens in the case of CLS. In cucurbits, circular necrotic lesions are observed during early stages of disease development, but in later stages lesions become irregularly shaped and are delineated by leaf veins (Newberry et. al., 2016). Lastly, wart-like eruptions may be present on the fruit.

As part of a federally funded research project, that will lead to more effective integrated management strategies by enhancing understanding on this pathogen's genetic diversity and epidemiology, our research team will be searching for the disease on beet, chard, and cucurbits from vegetable producing regions in the state of Pennsylvania. You can contribute to our search and management of this important plant pathogen by reaching out to members of our team (see contact information below) and extension educators if you suspect you have BLS on beet, chard, and cucurbits in your plantings or by sending your samples to the PSU Disease Clinic. For more information about this project, please visit the "Seedborne cucurbits and chenopods diseases caused by *Pseudomonas syringae*" website (<https://dev.pseudosonseed.org/>) or read the article published in Penn State News (<https://news.psu.edu/story/591380/2019/10/03/research/plant-pathologist-awarded-grant-aid-global-study-seedborne>).

For detailed information on how to prepare and send your samples, please visit the PSU Plant Disease Clinic website (<https://plantpath.psu.edu/about/facilities/plant-disease-clinic/instructions>) for more information.

For more information about the project contact: Raymond O. García-Rodríguez; rog5265@psu.edu; 814-865-7448; Carolee T. Bull; ctb14@psu.edu; 814-865-7448; or Beth K. Gugino; bkgugino@psu.edu; 814-865-7328.

*Dr. Gugino is with the Department of Plant Pathology and Environmental Microbiology at Penn State Univ. From Penn State Extension.*

**VEGETABLE PRODUCTION**



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TENTATIVE MEETING DATES  
 Year 1: November 23, 2021; January 11, 2022; March 15, 2022  
 Year 2: November 23, 2021; January 20, 2022; March 24, 2022

## VEGETABLE PRODUCTION

## Two-Spotted Spider Mite on Vegetables

Andrew Muza

The two-spotted spider mite is a common problem in high tunnels and greenhouses but can also be problematic in vegetables grown in the field during seasons with extended periods of hot, dry weather.

### Host Plants

The two-spotted spider mite (TSSM) feed on a wide variety of vegetables, some of which include: tomato, sweet corn, eggplant, bean, pepper, and cucurbits. In addition, these spider mites will also attack tree fruit, small fruit, agronomic crops, ornamentals, and weeds.

### Life Stages and Description

TSSM has 4 life stages - egg, larva, nymph, and adult.

Eggs are laid singly on the undersides of leaves and look like tiny round balls which appear translucent-yellow in coloration.

Larvae have 6 legs, are colorless to light yellow with red eyes, rounded bodies and are about the size of eggs.

Nymphs vary in coloration from light yellow-greenish-reddish orange, have 2 dark, dorsal spots but are smaller than adults.

Adults are similar in coloration to nymphs and also have 2 dark, dorsal spots. Adult females are oval-shaped and about 0.03- inch- long while the slightly smaller males have pointed abdomens. Females can lay 100 eggs or more, and development from egg-adult takes 5-19 days depending on the temperature. Under optimum environmental conditions (i.e., high temperature and low humidity), the life cycle from egg to adult may be completed in 7 days or less. There are multiple, overlapping generations of TSSM in a season.

### Plant Injury

TSSM feed mainly on the undersides of leaves. Spider mites puncture leaf tissue and extract chlorophyll and plant sap from cells causing white-yellowish, pinpoint dots (stippling/speckling) on the upper leaf surface (Figures 1 & 2). Extensive feeding by high populations of mites can cause yellowing and browning of leaves, premature leaf drop, and a reduction in plant vigor.



Figure 1. White speckling (stippling) caused by two-spotted spider mites on the upper surface of tomato leaf. Photo: Andy Muza, Penn State

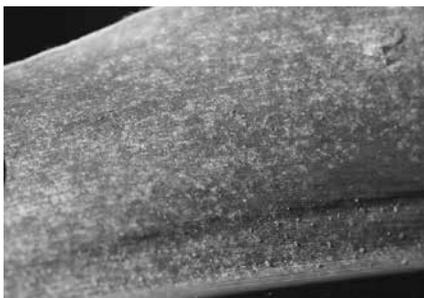


Figure 2. Feeding injury (leaf stippling) caused by two-spotted spider mites on the upper surface of a sweet corn leaf. Photo: Andy Muza, Penn State

### Scouting

Early detection of mite populations is important since initial spider mite infestations can be spotty/localized. Frequent scouting, especially during hot, dry conditions, is recommended. Initially, scouting should be focused on the borders of vegetable fields. Check on the undersides of leaves, especially those with any stippling injury, using a 10-20X hand lens to observe the presence of TSSM. If heavy infestations are occurring, then webbing on the leaves may also be noticeable. If the presence of mites is observed on the border rows of the field, ten random locations in the interior portions of the field should also be checked for TSSM infestations. Another option for mite detection while scouting is to hold a white sheet of paper under leaves while tapping the leaves to dislodge any mites onto the paper.

### Management

**Plant health** - Healthy plants can tolerate higher levels of mite feeding compared to stressed plants. Therefore, proper nutrient management and timely irrigation to reduce plant stress are beneficial. However, avoid excessive nitrogen, which can increase mite populations.

**Weeds** - Early and routine management of weeds/grassy areas around and within fields is important to prevent a buildup of mite populations on surrounding vegetation. However, if weeds around fields are not properly managed and already have TSSM, then avoid mowing these areas after midsummer. Mowing weedy areas containing mites may cause the migration of these pests into adjacent vegetable fields.

**Beneficial mites and insects** - Natural enemies of mites (e.g., predatory mites, lady beetles, minute pirate bugs, predatory thrips, etc.) play a major role in managing mite populations. However, broad-spectrum insecticides, such as pyrethroids, can severely reduce these natural enemies causing mite outbreaks. Avoid over-reliance on broad-spectrum insecticides and, when possible, use insecticides that have the least impact on beneficial insects.

**Miticide options and application** - There are a variety of miticides labeled for vegetable production. However, the labeled miticides will vary depending on the vegetable crop being produced. Therefore, consult the latest edition of the Mid-Atlantic Commercial Vegetable Production Recommendations for miticides approved for specific crops.

If scouting efforts detect spotty/localized mite populations then spot spraying areas may be effective before mites spread throughout the field. If spot spraying is conducted, then treat a buffer zone of at least 100 feet beyond the mite infested area. Whether spot spraying or treating the entire field, good coverage of both lower and upper leaves is essential. Since miticides differ in their effectiveness against varying life stages of the TSSM, a second application may be needed about 7 days later, depending on the miticide used.

Be aware that some miticides may be toxic to bees and/or predatory mites and beneficial insects. Consult the miticide labels for targeted life stages, product rates, application information, and restrictions. Also, as a resistance management strategy, rotate miticides among mode of action group numbers.

Mr. Muza is a Penn State Extension educator in Erie County. From Penn State Extension, <https://extension.psu.edu/two-spotted-spider-mite-on-vegetables>, August 25, 2021.

## VEGETABLE PRODUCTION

### Late Season Cover Crops

Fields that may be done producing earlier than planned this year offer an opportunity to get a cover crop into the ground earlier than normal. A well-established late-season cover crop increase organic matter, improve soil structure, scavenge remaining nutrients, choke out weeds, and prevent soil erosion. Each cover crop species has strengths and weaknesses. We have noticed that the fall planting window has extended, in some cases into November! Below is a list of several good choices for getting ground cover when crops are finished for the season, depending on your specific goals and field conditions.

**GRASSES** can reduce erosion and return a significant portion of organic matter and other nutrients to the soil if planted after removing a seasonal crop and if given enough time to mature. Kill grasses before maturity in the spring to ensure efficient decomposition. Mix grass species with a legume to reduce the C:N ratio and supply more nitrogen for the following year's crop, or with any broadleaf species to increase weed suppression.

**Annual or Italian ryegrass (*Lolium multiflorum*) and perennial ryegrass (*Lolium perenne*)** are gaining popularity with some growers because of increasing availability of commercial varieties such as 'Fria Annual Rye'. These grasses have dense root systems that outcompete weeds, protect against erosion, and are easy to incorporate in the spring. Annual ryegrass can tolerate some flooding. Perennial ryegrass is more cold-hardy but also harder to kill if it goes to seed. Both are shade tolerant but may not germinate very well under dry conditions. Plant 6-8 weeks before the fall frost date. The seed is small and light, so specialized equipment such as a Brillion seeder is needed to seed a large area. **Seeding rate:** 20-30 lbs/A broadcast; 10-20 lbs/A drilled; 8-15 lbs/A mixed with a legume.

**Winter or cereal rye (*Secale cereale*)** is the most common cover crop used by growers in Massachusetts. It is inexpensive, easy to get and to establish, and can be seeded up until 2 weeks before a killing frost. However, it is best planted before September 15th in order to recover the available N from the soil and produce enough canopy to outcompete weeds and protect the soil from erosion. It consistently overwinters here and will continue to grow in the spring, producing up to 7,000 lbs/A of biomass contributing to soil organic matter. It should be seeded with a legume to keep the C:N ratio low, making more N available in the spring. It can take several weeks and multiple tillage passes to break down in the spring; some growers are hesitant to use this cover crop because of the longer decomposition rate and allelopathic effects on direct-seeded spring crops. **Seeding rate:** 90-120 lbs/A broadcast; 60-120 lbs/A drilled; 50-60 lbs/A mixed with a legume.

**Winter wheat (*Triticum aestivum*)** is increasingly being used as a cereal grain and as a cover crop. It is winter hardy, but does not grow as tall or mature as quickly as rye so there is no rush to kill it in early spring and risk compacting wet soils. Wheat is excellent for erosion control, scavenging N, P, and K, building soil organic matter, and improving tilth. For best results, plant it in late-summer to early-fall, before September 15th. Best growth will be in well-drained soils with moderate fertility. Rye is a better choice on wet soils. Wheat works well as a nurse crop for legumes such as hairy vetch, clover, or peas. **Seeding rate:** 90-160 lbs/A broadcast; 60-120 lbs/A drilled; 60-90 lbs/A mixed with a legume.

Continued on page 16

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## VEGETABLE PRODUCTION

Late Season Cover Crops *continued from page 15*

**Triticale (*x Triticosecale*)** is a hybrid between wheat and rye. It can be seeded as early as August and can produce more fall growth than winter wheat, providing more weed suppression and erosion control. **Seeding rate:** 90-100 lbs/A broadcast; 75-80 lbs/A drilled; 60-90 lbs/A mixed with a legume.



Oats and peas.

However, oats provide less weed control and lower organic matter contribution. To maximize nitrogen carry-over to the following crop, mix with a legume that will overwinter such as hairy vetch. **Seeding rate:** 110-140 lbs/A broadcast; 80-110 lbs/A drilled; 60-90 lbs/A mixed with a legume.

**LEGUMES** are a good choice if you are interested in adding nitrogen to the soil and reducing nitrogen fertility bill. Before planting, it is important to inoculate seed with the appropriate root-nodulating bacteria that will fix nitrogen from the air. Some growers use Coca-Cola or sugar water to help the inoculum stick to the seed; plant while the seed is still wet to keep the bacteria alive. There are several bacterial inoculants that are each specific to certain legumes and therefore must be used with the correct plant groups in order to establish. If well-managed, legume cover crops can provide as much as 100-150 lbs N per acre to the following crop. Imagine the fertilizer cost savings!



Rye and vetch. Photo: K. Campbell-Nelson

in late-May. If the vetch is planted in late-July or early-August, it is less likely to survive the winter, which can be a good thing if you've ever struggled with vetch that has re-seeded itself. With a good flail mower, vetch can be used in a reduced tillage system without matting and tangling in the equipment. **Seeding rate:** 25-40 lbs/A broadcast; 15-40 lbs/A drilled, 15-20 lbs/A mixed with a grass.

**Red clover (*Trifolium pratense*)** is a short-lived perennial that is somewhat tolerant of soil acidity and poor drainage. Mam-

**Oats (*Avena sativa*)** come up quickly and can be seeded in the late-summer. It is best planted before September 15th, similar to winter rye. Unlike winter rye, oats will winterkill in Massachusetts, making for simpler field preparation in the spring.

moth red clover produces more biomass for plow-down than medium red clover, but does not regrow as well after mowing. Mammoth will often establish better than medium red clover in dry or acid soils. Sow in early-spring or late-summer. Red clover can be undersown in mid-summer into corn or winter squash before it vines, and into other crops such as fall brassicas if soil moisture is plentiful. Clovers germinate and grow slowly and so can be planted along with a faster-growing grass and/or peas as a nurse crop. Clovers are a good option to include in a field that won't be planted into a cash crop for a full year or more. **Seeding rate:** 10-15 lbs/A broadcast; 6-15 lbs/A drilled; 6-10 lbs/A mixed with a grass.



Crimson clover. Photo: K. Campbell-Nelson

moth red clover produces more biomass for plow-down than medium red clover, but does not regrow as well after mowing. Mammoth will often establish better than medium red clover in dry or acid soils. Sow in early-spring or late-summer. Red clover can be undersown in mid-summer into corn or winter squash before it vines, and into other crops such as fall brassicas if soil moisture is plentiful. Clovers germinate and grow slowly and so can be planted along with a faster-growing grass and/or peas as a nurse crop. Clovers are a good option to include in a field that won't be planted into a cash crop for a full year or more. **Seeding rate:** 10-15 lbs/A broadcast; 6-15 lbs/A drilled; 6-10 lbs/A mixed with a grass.

**Crimson clover (*Trifolium incarnatum*)** grown as a winter annual should be seeded early-August to early-September in New England; seed it too early and it will make seeds in the fall and won't re-grow until spring

soils warm up. While it grows well in dry conditions, it may have trouble germinating. This clover is a better fall weed suppressor than hairy vetch. This crop is easily killed by incorporation or can even be rolled or mowed in the spring at late-bloom stage for no-till operations. See notes above in the red clover section about germination speed. **Seeding rate:** 22-30 lbs/A (15-20 lbs/A in a mixture) broadcast; 15-18 lb/A (10-12 lbs/A in a mixture) drilled.

**Field pea (*Pisum sativum subsp. arvense*)** also known as Austrian winter peas (black peas) or Canadian field peas (spring peas) should be planted mid-August to mid-September in much of New England. These peas fix nitrogen more quickly in dry conditions than white clover, crimson clover, or hairy vetch. Field peas are susceptible to Sclerotinia so don't plant them in a field with a history of white mold. Drill or incorporate seed 1-3 inches deep to ensure good soil moisture contact. **Seeding rate:** 80-120 lbs/A broadcast; 75-100 lbs/A drilled; 60-80 lbs/A in a mix.

**BRASSICAS** are used as cover crops for pest management or, in the case of the tillage radish, for improving water drainage and soil structure. Brassica cover crop species are susceptible to the same pests as brassica cash crops, so be sure to factor in any brassica cover crops that you plant when planning crop rotations for pest management.

**Tillage radish (*Raphanus sativus*)** is also known as daikon, forage, or oilseed radish. They act as biological subsoilers as their taproots can grow to 8-14 inches long. With its deep roots, this cover crop can recover N, P, S, Ca, and B for the following season, but a cash crop must be planted early in the spring or else these nutrients are lost through fast decomposition and the deep root holes. Best planted in late-August, this cover crop typically winterkills in November or December. A unique no-till strategy with forage radish includes seeding it in the late summer along with cover crop mixtures on 6-ft. centered beds, then in the spring, place transplant plugs directly in the holes where the radishes grew. This cover crop releases most of its harvested N by May, unless seeded with a grass such as oats. Higher seeding rates are effective for weed management, while lower seeding rates are better for breaking compaction. **Seeding rate:** 10-13 lbs/A broadcast; 7-10lbs/A drilled; 5-8 lbs/A in a mixture.

**Brown mustard (*Brassica juncea*)** found in many of the 'Caliente' seed mixes is a biofumigant planted to combat root-knot nematode and a variety of soil-borne fungal pathogens,

## VEGETABLE PRODUCTION

### Late Season Cover Crops *continued from page 16*



Flowering mustard crop

including Fusarium, Verticillium, Rhizoctonia, Pythium, and Phytophthora capsici. It is also allelopathic against weeds. If allowed to flower, this crop is highly attractive to honey bees. Successful biofumigation with this cover crop is achieved by following these steps:

1) Apply adequate fertility (50 lbs N/A and 20 lbs S/A); 2) allow it to flower before incorporation; 3) mow, disc, or rototill under, and roll or pack the soil immediately; 6) irrigate after incorporation or incorporate before rain to enhance fumigation. Plant brown mustard in late-August through September. Other brassica cover crops include rapeseed or canola and turnips, which are often used as livestock forage. **Seeding rate:** 10-15lbs/A broadcast; 8-12 lbs/A drilled. It is always better to plant a cover crop, regardless of the type, than leave a field bare; leaving a field bare over the winter is very damaging to soil structure, increasing erosion and reducing long-term fertility. Though it may take several growing seasons or a lifetime to perfect the art of cover cropping, your soil will thank you.

#### Resources:

Northeast Cover Crops Council Cover Crop Explorer and Species Selector Tool – (<https://covercrop.tools>)

A Comprehensive Guide to Cover Crop Species Used in the Northeast United States. ([https://www.nrcs.usda.gov/Internet/FSE\\_PLANTMATERIALS/publications/nypmcpu10645.pdf](https://www.nrcs.usda.gov/Internet/FSE_PLANTMATERIALS/publications/nypmcpu10645.pdf)) Prepared by USDA-NRCS.

Managing Cover Crops Profitably. (<https://www.sare.org/resources/managing-cover-crops-profitably-3rd-edition/>) 3rd ed. Published by the Sustainable Agriculture Network, Beltsville, MD.

Cover Crop Plant Guides (<https://www.nrcs.usda.gov/wps/portal/nrcs/detail/national/climatechange/?cid=stelprd-b1077238#Cover%20Crop%20Plant%20Guides>) prepared for USDA by NRCS, RMA and FSA.

Cover Crop Chart (<https://www.ars.usda.gov/plains-area/mandan-nd/ngprl/docs/cover-crop-chart/>) prepared by USDA-ARS.

*Compiled by Katie Campbell-Nelson. Adapted from work by R. Hazzard & F. Mangan, UMass, Vern Grubinger, UVM and Thomas Bjorkman, Cornell. Reviewed by Julie Fine, 2016.*

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## VEGETABLE PRODUCTION

## Harvest and Curing Tips for Onions



Proper lodging in onions. Photo: C. Hoepfing

Deciding when and how to harvest onions, then where and how to cure them can be challenging. When are they really ready to be pulled? Is the weather too wet or too hot to field cure? How did my onion field get so weedy? What should I do if there is a lot of foliar disease in my crop? Here are a few tips, originally from University of Minnesota Extension:

**Harvest:** Optimum harvest from the standpoint of maximum storage life (before bulb sprouting), occurs while the onion foliage is still partially (30-40%) erect, and long before maximum yield is attained (when tops are completely down and dry). Since yields may increase 30-40% between the stage when tops begin to go down, and the leaves are fully down and dry, it is tempting to leave onions to cure in the field as long as possible. The optimum time for harvest therefore, must be a balance between highest yields and reduced bulb storage quality. Furthermore, excessively field drying onions increases the risk of bald onions in storage. From the University of Georgia Extension: "Maturity is best determined by pinching the neck of the growing onion. Necks of immature onions are stiff, while necks of optimally mature onions are soft and limber. When the necks are so weak that they cannot support the tops, the onions are over-mature. Simply observing the percentage of tops having fallen over is not a true indication of maturity, since the tops can be knocked over by strong winds, rain or become limp from lack of moisture."

**Digging and windrowing:** To facilitate curing onions for harvest and storage, onion rows are undercut, lifted and windrowed for field curing. Rod-weeder diggers and knife undercutters are most often used. After an appropriate interval, the undercut onions are lifted and windrowed. This may be done with tops on or off, but most commonly with tops on to protect the onions from sunscald damage. Windrows are often mechanically "fluffed" to facilitate curing and later combined to facilitate loading. This will also shorten the drying period and should be done after each rainfall. After field drying has occurred, the onions may be topped and placed in storage buildings.

**Topping:** If onions are to be bulk-stored it is best to store them without their tops. This facilitates handling, loading and unloading the storage. If onions are to be topped and stored, tops must be totally dry, or only the dry portion cut and removed. Cutting through any portion of the top while it is still green or moist may result in excessive Botrytis neck rot in storage. In very wet years, do not top onions until after they have been cured. When all or a portion of the onion top is left on, the remaining tops are removed during grading and packing using roller toppers at the storage or packing facility.

**Curing:** Onions should be adequately cured in the field, in open sheds, or by artificial means before or in storage. Adequate curing in the field or in open sheds may require 2 to 4 weeks, depending on the weather. The best skin color develops at 75 to 90°F. This should be continued until the outer skins and neck are dry. Onions are considered cured when the neck is tight and the outer scales are dry and make a rustling sound when handled. This condition is reached when onions have lost 3-5% of their weight. If not adequately cured, onions are likely to decay in storage. The common form of decay is gray mold rot (Botrytis), which

occurs at the top of the bulb - hence its name "neck rot". High temperatures and high humidity (80%) during curing with good air circulation favor development of desirable skin color.

**Here are our low-tech recommendations for curing and storage in New England:** A greenhouse or hoophouse provides



Topped and cured onions are brought into a well ventilated barn to bring them down to temperature slowly for storage.

Photo: R. Hazzard

A greenhouse or hoophouse provides a good environment for curing, where temperature, airflow, and moisture can be controlled. Be sure to keep the temperature in the house below 85°F, which will probably require turning on fans and/or leaving sides and doors wide open—consider using shade cloth over the house to help moderate temperature. Curing can be done in the field, but it is harder to achieve good conditions for curing in an uncontrolled field setting. Avoid field-curing onions if rain is forecasted and, if it does rain, let the onions dry fully before handling—don't handle the bulbs when they are wet. If the field is weedy, it may be excessively moist and air circulation may be limited; these conditions are not suitable for curing. Temperature and sun are also factors to consider—sunshine and temperatures in the 80s will enhance the bronze color in the skins, but extremely hot sun and temperatures in the 90s can cause sunscald. Onions curing on a sandy soil will heat up more quickly than those curing on a heavier soil.

**Storage:** To ensure maximum storage life, onions must be promptly stored after curing. Get them out of the sun as exposure to light after curing will induce greening of the outer scales. The optimum temperature for long-term storage of onions is 32°F with 65-70% relative humidity, but it is important to bring them down to this temperature slowly. In fact, holding onions in a barn or garage so that they cool along with the average outdoor temperature in late-summer and fall works quite well. Avoid cooling bulbs to well-below the average daily temperature because they will draw moisture from the warmer air, which can lead to disease. If you are selling the onions within a couple of months, keeping them in an uninsulated barn is fine. An insulated storage room is needed for longer-term storage.

### Harvest Tips for Best Quality

**Be sure onions are well-dried and necks are tight** (i.e. the tissue does not slide when you roll the neck between your fingers) before topping. Bacterial diseases and Botrytis neck rot can move through green tissue into the bulbs. These diseases do not move in dry tissue.

**Leave 2-3 inches of neck on the bulb.** This increases the distance from the cut surface to the bulb for these pathogens to travel.

**Minimize mechanical injury during harvest & topping.** Reduce drops to 6" and pad sharp surfaces. Bruises provide direct entry points for diseases to get started.

**Grade out damaged onions before putting them into storage.** Damaged bulbs give off moisture, which is favorable for development of diseases in storage.

Written by the Univ. of Massachusetts Extension Vegetable Program. From Vegetable Notes for Vegetable Farmers in Massachusetts, Univ. of Mass. Extension, Vol. 33, No. 16, August 5, 2021.

## VEGETABLE PRODUCTION

## Scout for Onion Thrips in Brassicas

While growers have been scouting for and battling onion thrips (*Thrips tabaci*) in their alliums since May, the struggle doesn't end with the onion harvest. Onion thrips can be a significant problem on cabbage, where thrips feed on inner leaves of the head, which are difficult to target with sprays. Damage may also occur on leafy brassicas such as broccoli, kale, and collards, especially fall plantings near a maturing onion crop. Thrips damage manifests as rough, golden or brown scars on the undersides of open leaves, scars and discolored layers within cabbage heads, and generally reduced vigor in plants. Inspection with a 10X lens shows wounds to the epidermis from the rasping mouthparts, and scars from wounds that healed over. Thrips damage can be confused with oedema, a physiological disorder that causes small, bump-like protrusions to form on leaf surfaces.

Tolerant varieties are the most cost-effective means of controlling thrips in cabbage, but are generally not available in other brassicas. Cabbage varieties that have shown tolerance in trials (see here for a summary of Cornell trial data) include Capture, Celebrate, Benelli, Cairo, Superkraut 86, Bravo, Brutus, Cheers, Huron, and the various Vantage varieties. Varieties that are rated as susceptible include Atlantis, Bajonet, Charmant, Checkmate, Market Prize, and Rinda. There are a great number of varieties, and not all have been tested. Also, available varieties change. Some seed catalogues rate thrips tolerance. Consult your seed suppliers and search recent research trials regarding thrips tolerance on new varieties.

The Cornell Organic Production and IPM Guide for Cole Crops (<https://ecommons.cornell.edu/bitstream/handle/1813/42893/2016-org-cole-crops-NYSIPM.pdf?sequence=2>) has an extensive list of cabbage varieties and their thrips tolerance. Avoid thrips by not planting cabbage or fall brassica crops

near alliums or field crops such as alfalfa, clover, wheat, or oat, as thrips may migrate to brassicas when these crops are cut or harvested. Scout young plants for presence and feeding injury. Begin insecticide applications when damage is first noticed; in cabbage, apply foliar treatments before heads form. In fall brassicas, the need for thrips control may coincide with sprays for flea beetle or caterpillars and some insecticides control both.

Broad-spectrum products include neonicotinoids (Admire Pro, Assail), numerous synthetic pyrethroids (including Warrior, Pounce, Baythroid, Brigade, and Mustang), and the Group 23 insecticide spirotetramat (Movento). In Cornell trials, imidacloprid applied to the base of transplants and again 4 weeks after transplanting provided the most effective control. Biorational or organic products include spinosad (Entrust, OMRI listed; has both contact and ingestion toxicity), spinetoram (Radiant SC), novaluron (Rimon 0.83EC, insect growth regulator for immature stages only; not for mustard greens), and pyrethrin (PyGanic EC5.0, OMRI listed; contact activity only). Repeat applications at 7- to 10-day intervals based on scouting and label allowances. Use a shorter interval in hot, dry weather. Use a spreader-sticker for better coverage. Apply in early evening, using high pressure and 100 gal water/A for best results. Systemic insecticides applied as a side dress up to 4-6 weeks after transplanting may provide adequate control in long-season cabbage. Rotate between insecticide groups to help prevent or delay resistance development.

Written by the UMass Vegetable Program, based on research by Christy Hoeping, Cornell Cooperative Extension.

From *Vegetable Notes for Vegetable Farmers in Massachusetts*, Univ. of Mass. Extension, Vol. 33, No. 16, August 5, 2021.

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## VEGETABLE PRODUCTION

## Winter-Killed Cover Crops for Vegetable Growers Revisited

Gordon Johnson

Cover crop decisions for vegetables should be made soon for this fall and next year's crops. The following is a reprint of information on winter killed cover crops for vegetable systems

Cover crops that put on significant growth in the fall and then die during the winter can be very useful tools for vegetable cropping systems. These winter-killed cover crops add organic matter, recycle nutrients, improve soil health, and allow for earlier spring vegetable planting.

Winter-killed cover crops that are late summer and fall planted include spring oats, several mustard species, and forage and oilseed radish. Earlier planted summer annuals (millets; sorghums, sudangrasses, and hybrids; annual legumes such as sun hemp or forage soybeans; buckwheat and many others) can also be used as winter killed species. Timing of planting will vary according to the species being used and winter killed species selection will depend on when fields will be available for seeding. Summer annuals should be planted in late July or during August for use in a winter killed system to obtain sufficient growth.

Spring oats and mustard species can be planted from late August through September. For best effect, forage and oilseed radishes should be planted before the middle of September. Spring oats, radishes and mustards are not suited for October or later planting because they will not produce adequate fall growth.

All of the winter killed non-legumes mentioned above will benefit from the addition of 30-60 lbs of nitrogen.

The following are several options for using winter killed-species with vegetables:

### Compaction mitigation for spring planted vegetables

Forage radishes have worked very well as a winter-killed cover crop in fields with soil compaction. The extremely large taproot penetrates deep into the soil, and after winterkilling, will leave a large hole where future crop roots can grow. Oilseed radish also provides considerable "biodrilling". Winter killed radish cover works well with spring planted crops such as spinach, peas, early sweet corn, and early snap beans. One issue with radishes is that in mild winters they may not fully winter kill.

### Soil health benefits for early planted vegetables

A wide range of early planted vegetables may benefit from winter killed cover crops. For example, peas no-till planted or planted using limited vertical tillage after a winter killed cover crop of forage radish, oilseed radish, or winter killed mustard have performed better than those planted after conventional tillage. Early sweet corn also has potential in these systems as do a wide range of spring vegetables including spinach, potatoes, and cabbage. Winter killed radishes and mustards also have the advantage of outcompeting winter annual weeds leaving relatively weed free fields and also in recycling nutrients from the soil so that they are available in the spring for early crops (decomposition has already occurred).



Fall growth on mustards and radishes that will then winter kill. A potential winter kill mix would include a radish, a mustard, and spring oats.

### Mixed systems with windbreaks for plasticulture

By planting planned plasticulture bed areas with winter killed cover crops and areas in-between with cereal rye you can gain the benefits of these soil improving cover crops and eliminate the need to make tillage strips early in the spring. The winter killed areas can be tilled just prior to laying plastic.

### Bio-strip till

By drilling one row of forage or oilseed radish and other adjacent rows with rye or other small grains, you can create a biodrilled strip that winter kills and that can be no-till planted in the spring without the need for strip-till implements. This opens up dozens of options for strip tilling (seed or transplanted) spring vegetables.

*Dr. Johnson is the Extension Vegetable and Fruit Specialist at the Univ. of Delaware. From the **Weekly Crop Update**, Univ. of Delaware Extension, Vol. 29, Issue 21, August 13, 2021.*

## VEGETABLE PRODUCTION

# Pumpkin and Winter Squash Harvest, Curing and Storage

Genevieve Higgins and Ruth Hazzard

Pumpkin and winter squash are sizing up in the field, and harvest is on the horizon. Correct harvest timing, curing and storage conditions can significantly affect eating quality, storage length and post-harvest disease.



*Delicata squash*

The balance of starch (texture) and sugar (sweetness) in a squash determines the eating quality. Squash is mature when seeds are completely filled. If squash is harvested before it is mature, the fruit will use starch reserves from the flesh to fill the seeds, resulting in poor flesh quality. Immature squash will also not have enough starch to convert into sugar later on.

Most squash varieties are mature and ready to harvest 50-55 days after fruit set, or days after pollination (DAP). In many varieties, this is many weeks after the fruit turns a marketable color, which can be misleading. Dr. Brent Loy, former researcher emeritus at the NH Ag Experiment Station, says that days to maturity listed in seed catalogs are often incorrect, especially for acorn squash; catalogs often state 70-76 days to maturity (from time of seeding) when in reality it's more like 90-100 days to maturity. It's not necessarily easy to keep track of fruit set, so there are some other indicators that squash is ready for harvest—see the end of this article for more information about specific varieties.

**Harvest Timing for Pumpkins:** Since the pumpkin market lasts from Labor Day to Halloween, pumpkins may need to be held for several weeks before they can be sold. One factor in deciding when to harvest is the condition of the vines. Intact foliage protects fruit from the sun, and when vines and foliage die down from powdery or downy mildew, fruit can get sunscald. There are several races of cucurbit downy mildew, and only some affect pumpkin. So far this year, downy mildew on pumpkin has not been reported north of Kentucky. However, powdery mildew is widespread. Foliar diseases, especially powdery mildew, can also reduce the quality of pumpkin handles, leading to reduced marketability for jack-o-lantern pumpkins. As September approaches, the other major factor in deciding when to harvest is avoiding chilling injury. Chilling hours accumulate when squash or pumpkins are exposed to temperatures below 50°F in the field or in storage. Injury increases as temperature decreases and/or length of chilling time increases. This is particularly important for squash headed into long-term storage.

There can be extra work involved in bringing fruit in early and finding good storage locations, especially for growers who normally have pick-your-own harvest. However, we recommend that growers harvest as soon as crops are mature and store under proper conditions, if it is feasible. Proper curing and storage conditions are key for pumpkins in particular, because improper conditions can result in handles shrinking and shriveling, making the pumpkins unmarketable. If you need to hold fruit in the field for pick-your-own or any other reason, using a protectant fungicide (e.g. sulfur, oil, or chlorothalonil) along with one of the targeted powdery mildew products can help protect from black rot, powdery mildew, and other fungal fruit rots. For information

## Harvest Timing for Winter Squash and Pie Pumpkins:

For winter squash and pie pumpkins, harvest timing determines the flavor and texture of the fruit. As squash fruits grow, they accumulate starch, which is then converted into sugar in the field and during storage.

The balance of starch (texture) and sugar (sweetness) in a squash determines the eating quality. Squash is mature when seeds are completely filled. If squash is harvested before it is mature, the fruit will use starch reserves from the flesh to fill the seeds, resulting in poor flesh quality. Immature squash will also not have enough starch to convert into sugar later on.

on identifying and controlling fungal fruit rots of winter squash, see the September 3, 2020 issue of Veg Notes ([https://ag.umass.edu/sites/ag.umass.edu/files/newsletters/september\\_3\\_2020\\_vegetable\\_notes.pdf](https://ag.umass.edu/sites/ag.umass.edu/files/newsletters/september_3_2020_vegetable_notes.pdf)). Scout for insects feeding on the fruit and handles, which may include squash bug nymphs and adults and striped cucumber beetles, and control them if damage is evident. See the Pumpkin, Squash, & Gourds insect control section of the New England Vegetable Management Guide (<https://nevegetable.org/crops/insect-control-19>) for treatment recommendations.

**Harvest:** Despite their tough appearance, squash and pumpkin fruit are easily damaged. It is important to avoid bruising or cutting the skin during harvest. Once the rind is bruised or punctured, decay organisms will invade the fruit and quickly break it down. Place fruit gently in containers and move bins on pallets. Use gloves to protect both the fruit and the workers. For some squash, especially butternut, stems can be removed to prevent them from puncturing adjacent fruit during harvest and storage. If stems are removed, allow the stem scars to heal before putting into storage (see Curing below).



*Butternut squash curing in a high tunnel*

**Curing:** For some squash types (e.g. acorn and delicata), the mature fruit can be eaten immediately after harvest. Other squash types (e.g. butternut, hubbard, kabocha), need more time to convert starches to sugars and must be cured or stored for specific amounts of

time before they are eaten. Curing speeds up the conversion of starches to sugars so that squashes reach optimum eating quality sooner. It also causes fruit skin to harden and accelerates wound healing to prevent disease development. *P. maxima* and *moschata* squash varieties can be cured to hasten market readiness. However, curing is not always necessary: if you are planning to store squash for a few months before selling, and the fruit is free of wounds, it should have sufficient time to convert starches to sugars and can go directly into storage conditions without the extra boost. *P. pepo* squash types are ready to eat at harvest (if harvested when mature!) and curing can actually reduce their storage lifespan.

To cure squash, store it for a short period of time (5-10 days) at a high temperature (80-85°F) and 80-85% relative humidity immediately after harvest. This can take place in the field if weather allows (night temperatures should not drop below 60°F), or in a well-ventilated barn, greenhouse, or high tunnel.

**Storage:** Pumpkins and winter squash should be stored in a cool, dry, well-ventilated area. Store fruit at 50-60°F with 50-70% relative humidity. Chilling injury is possible at temperatures below 50°F, and long-term storage at temperatures above 60°F will result in weight loss due to increased respiration rates. Large fluctuations in temperature favor condensation on fruit within the bin, which encourages disease. Therefore, fruit temperature should be kept as close to the temperature of the air as possible to avoid condensation and fruit rot. Relative humidity above 70% provides a favorable environment for fungal and bacterial decay organisms, and relative humidity below 50% can cause dehydration and weight loss. In a greenhouse, temperature can be managed with ventilation on sunny days; heaters will be needed for storage into November and beyond. An inner curtain can reduce heat loss and cost.

*Continued on page 22*

## VEGETABLE PRODUCTION

## Sulfur, Calcium and Boron for Cole Crops

Gordon Johnson

Apart from recommended NPK fertility programs, growers of cabbage, broccoli, cauliflower, Brussels sprouts, kale, and collards need to pay attention to sulfur, calcium, and boron in their cole crop fertility programs.

In vegetable crops, sulfur removal is generally in the 10-20 lb/A range. Mustard family crops (cole crops, mustards, turnips and radishes) remove between 30 and 40 lbs/A of sulfur.

Most of the sulfur in the upper part of the soil is held in organic matter. Upon mineralization, sulfur is found in the soil as the sulfate ion (SO<sub>4</sub><sup>2-</sup>) which has two negative charges. The sulfate ion is subject to leaching, especially in sandy textured soils (loamy sands, sandy loams). It does accumulate in the subsoil but may not be available for shallow rooted vegetables.

Sulfur can be added by using sulfate containing fertilizers such as ammonium sulfate, potassium sulfate, and K-mag (sulfate of potassium and magnesium). It is also a component of gypsum (calcium sulfate). In liquid solutions, ammonium thiosulfate is often used as the sulfur source. Sulfur is also found in manures and composts. For example, broiler litter has about 12-15 lbs of sulfur per ton.

Calcium deficiency is most commonly seen as tipburn of cauliflower, cabbage, and Brussels sprouts. This problem can cause severe economic losses. Tipburn is a breakdown of plant tissue inside the head of cabbage, individual sprouts in Brussels sprouts, and on the inner wrapper leaves of cauliflower. It is a physiological disorder which is associated with an inadequate supply of calcium in the affected leaves, causing a collapse of the tissue and death of the cells. Calcium deficiency may occur where the soil calcium is low or where there is an imbalance of nutrients in the soil along with certain weather and soil nutrient conditions, such as high humidity, low soil moisture, high potash or high nitrogen, all of which can reduce calcium availability. Secondary rot caused by bacteria can follow tipburn and heads of cauliflower can be severely affected.

Some cabbage and cauliflower cultivars are relatively free of tipburn problems. Check with your seed supplier for tipburn resistant varieties and choose tipburn resistant varieties where possible. Manage liming so that soil pH is above 6.0 and calcium levels are optimal. Avoid using only ammonium forms of nitrogen, and ensure an adequate and even supply of water. Adjust planting date so that head maturation occurs during cooler temperatures. In general, calcium foliar sprays have not been shown to be effective for controlling tipburn incidence.

Cole crops have a high boron requirement. Symptoms of boron deficiency vary with the cole crop. Cabbage heads may simply be small and yellow. Most cole crops develop cracked and corky stems, petioles and midribs. The stems of broccoli, cabbage and cauliflower can be hollow and are sometimes discolored. Cauliflower curds become brown and leaves may roll and curl. It is important to note that cole crops are also sensitive to boron toxicity if boron is over-applied. Toxicity symptoms appear as scorching on the margins of older leaves.

It is recommended in broccoli and kale to apply 1.5-3 pounds of boron (B) per acre in mixed fertilizer prior to planting. In Brussels sprouts, cabbage, collards and cauliflower, boron and molybdenum are recommended. Apply 1.5-3 pounds of boron (B) per acre and 0.2 pound molybdenum (Mo) applied as 0.5 pound sodium molybdate per acre with broadcast fertilizer. Boron may also be applied as a foliar treatment to cole crops if soil applications were not made. The recommended rate is 0.2-0.3 lb/acre of actual boron (1.0 to 1.5 lbs of Solubor 20.5%) in sufficient water (30 or more gallons) for coverage. Apply foliar boron prior to heading of cole crops.

Dr. Johnson is the Extension Vegetable and Fruit Specialist at the Univ. of Delaware. From the **Weekly Crop Update**, Univ. of Delaware Ext., Vol. 29, Issue 22, August 20, 2021.

## Pumpkin and Winter Squash Harvest, Curing and Storage

continued from page 21

Storage life depends on the condition of the crop when it comes in and your ability to provide careful handling and a proper storage environment. All fruit placed in storage should be free of disease, decay, insects, and unhealed wounds. See the end of this article for maximum storage times for different types of squash. Fruit that has been exposed to chilling temperatures (below 50°F) will not store well and should be marketed first.

Few farms have the infrastructure to provide ideal post-harvest conditions for all of their fall crops. Fortunately, finding a method that is 'good enough' often does the job. Even if it is difficult to provide the ideal conditions, storage in a shady, dry location, with fruit off the ground or the floor, is preferable to leaving fruit out in the field.

### Harvest timing and storage needs for different squash types:

**Cucurbita pepo (acorn, delicata, sweet dumpling, some pie pumpkins):** Acorn squash turns dark green 2-3 weeks after fruit set, which is 40-50 days before it should be harvested. Because acorn squash can be marketed as soon as it turns dark green, regardless of eating quality, many acorn varieties will never accumulate enough starch and will therefore never be sweet. UNH has developed two varieties, 'Honey Bear' and 'Sugar Dumpling', that both have high sugar content at harvest. Harvest C. pepo squashes when the 'ground spot' (the part of the squash that lays on the ground) is dark orange. Pie pumpkins should be harvested when the skin is fully orange. These varieties can be eaten at harvest and will store for 2-3 months. They should not be cured, because it can reduce their lifespan in storage.

**Cucurbita maxima (kabocha, hubbard, buttercup):** Stems becomes dry and corky when the fruit is ready to be harvested. These are more susceptible than other squash to sunburn and so if vines go down from disease, they should be harvested early (40 DAP), cured, then stored at 70-75°F for 10-20 days to achieve acceptable eating quality. These have high starch content at harvest and so need to be stored for 1-2 months before being eaten, with the exception of all mini-kabochas and all red-skinned kabochas, which can be eaten at harvest. They will store for 4-6 months.

**Cucurbita moschata (butternut, some edible pumpkins):** Butternut will turn tan 45 DAP but should not be harvested for another 2 weeks. Mini-butternut can be eaten at harvest and will store for 3 months. All others should be stored 1-2 months before eating to allow for starches to be converted into sugars and will store for 4-6 months. Carotenoid, the pigment that gives squash its yellow/orange color, also increases in storage for these squash, giving them more color and making them more nutritious.

Ms. Higgins and Ms. Hazzard are or were with the Univ. of Massachusetts Extension Vegetable Team., Compiled 2018 from *Eating Quality in Winter Squash and Edible Pumpkins* and *The Nuts and Bolts of Fruit Quality in Cucurbits* by Brent Loy, former researcher emeritus, New Hampshire Agricultural Experiment Station and professor emeritus of genetics, Univ. of New Hampshire.

From the **Vegetable Notes for Vegetable Farmers in Massachusetts**, Univ. of Mass. Extension, Vol. 33, No. 18, August 19, 2021.

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## BERRY PRODUCTION

## Berry Crop Current Issues

Kathy Demchak



Grasshopper feeding causes irregular shaped holes in strawberry leaves. (Photos: K. Demchak).

Overall, growers are reporting satisfactory growth on renovated matted-row strawberry plantings. However, this is the time of year when feeding damage from strawberry rootworm adults is most severe. The adults are small brown beetles that feed on the leaves at night and hide in soil crevices during the day. Their feeding causes many small circular or oval-shaped holes in the leaves, and plant vigor can be negatively affected if leaves are riddled with holes. Many of the broad-spectrum insecticides applied for spotted wing drosophila will control this pest, but sprays should be made at night when the beetles will soon be exposed to the spray material. Holes caused by other larger insects present this time of year such as grasshoppers and Japanese beetles vary more in shape and are often larger.



Aggressive strains of *Neopestalotiopsis* can rapidly colonize large portions of a strawberry leaf (Photos: K. Demchak).

Collect and dispose of this material. Do not plant plug plants are wilted even when the cells are wet, or plug plants that appear very weak, as this may be a sign of a crown-rotting disease, such as *Phytophthora* crown rot, to which Flavorfest appears to be especially susceptible, or anthracnose crown rot.

Watch for *Neopestalotiopsis*, a newer disease that may be present on plug plants. It causes large brown leaf lesions and rapidly colonizes large areas of the leaves. It can also invade the crown area causing plant loss. Thiram and Switch help with this disease, but do not control it completely.

Ms. Demchak is with the Department of Plant Pathology at Penn State Univ. From Penn State Extension.

## Fall Planting Considerations in Plasticulture Strawberries

Gordon Johnson

September is when plasticulture strawberries are planted on Delmarva. Plug plants grown from strawberry tips by nurseries and greenhouses in the region are most commonly sourced by growers. Northern grown tips from Canadian nurseries often are used by plug growers to reduce diseases such as Anthracnose. While nurseries and plug growers are diligent in producing quality planting material, at times, problems can arise. In addition, planting practices can greatly influence the success of the planting. The following are some considerations to be successful with plasticulture strawberry establishment.

## Plug Conditions

When receiving plug plants, growers should inspect for plug conditions. It typically takes 4 weeks for tips to root but this depends on the growing conditions and tip condition. If tips are not fully rooted then the plugs will not pull properly and roots can be damaged in transplanting. In contrast, root bound transplants may dry out and be difficult to water. If dry plugs are transplanted they have a high probability of dying after transplanting. Blank plants that do not have a crown should be discarded and not planted

## Diseases and Mites

Nurseries and plug growers seek to produce disease-free plants. However fungal diseases such as Anthracnose can be brought in on plants. More difficult to detect are viruses. Inspect plants for virus symptoms such as abnormal leaf color, mottling, curling, or leaf distortions. Suspect plants should be sent to disease diagnostic laboratories for testing and should not be planted. If any plants appear to be weak, cut through a few of them, and look for signs of discoloration in the crown. Reddish or reddish-brown tissue is an indication of anthracnose crown rot, *phytophthora* crown rot, or the more recently identified foliar and crown disease *Pestalotiopsis*. Growers should also inspect plants for mites and treat with a miticide prior to planting if detected.

## Planting Depth

Strawberry plugs are very sensitive to planting depth – too deep and plants will die, too shallow and plants will dry out. Plugs should be placed so the plug is fully in the ground up to the crown, firmed with the surrounding soil, with no part of the plug exposed and with no soil covering over the crown.

## Water

Growers in plasticulture with drip irrigation often will try to irrigate bed before planting so they are fully saturated. This is not possible in our sandy soils with a single drip line in the middle (double lines will have more fully wetted soil). In addition, there is a risk of leaching nitrogen out of the strawberry root zone. It is preferred to add water during transplanting and then overhead irrigate a few hours for several days to establish plants until roots can reach wetted areas from the drip tape.

## Fall Fungicides

With wetter, warmer fall weather conditions and the use of overhead irrigation in establishment, there is a risk of foliar and crown diseases. To control *phytophthora* in susceptible varieties, apply mefenoxam through the drip system 15 days after planting followed up with foliar applications of a phosphite product (Phostrol, Prophyte, etc.) 2 to 3 weeks later.

If anthracnose crown rot or *Pestalotiopsis* is suspected, captan and Switch both have good efficacy and should be applied 2 or 3 times during the fall being sure to get good coverage into the crown area.

Dr. Johnson is the Extension Vegetable and Fruit Specialist at the Univ. of Delaware. From the **Weekly Crop Update**, Univ. of Delaware Ext., Vol. 29, Issue 22, August 20, 2021.

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