

Dr. Bill Lamont: Thanks for the Memories!

Bill Lamont, Penn State Professor of Plant Science and Vegetable Extension Specialist shares some thoughts as he prepares to retire.

I have borrowed the title for my last contribution (maybe) to the Vegetable and Small Fruit Gazette from the late Bob Hope's very familiar signature song. In this last article I wanted to reflect on my career that really began as a graduate student in the old Vegetable Crops Department at Cornell University in 1975 and then officially began on September 1, 1980 in the Department of Horticultural Science at North Carolina State University. It then migrated to the Department of Horticulture, Forestry and Recreational Resources at Kansas State University and will conclude here in the Department of Plant Science at Penn State University on June 30, 2017. To say that it has been both a wonderful and unique experience is certainly a gross understatement.

The reason that it was indeed a wonderful experience is the wealth of memories that have been generated by the myriad of people with whom I interacted throughout those 37 years. They were my extension specialist colleagues and university peers around the country, the great secretaries, administrative and technical staffs in the departments at the various universities, the second to none extension agents I had the privilege to work with over the years, the many excellent growers, the supportive and encouraging industry personnel, the editors and journalists with whom I worked on numerous articles with, and the Executive Director/Secretary and professional staff of the organizations I was involved with and who taught me how to lead and have fun at the same time.

To the graduate and undergraduate students that I had the privilege to teach and mentor at Kansas State University and then at Penn State University, a big thank you. You kept me young and intellectually stimulated through your energy and enthusiasm for horticulture. Sadly some of those that I have interacted have gone on to greener pastures but the memories we shared are still as bright as the day they were made. To each and every one of you that has enriched my life and career and



Spud Flag developed by Bill Lamont Dayton Reese and Mike Orzolek, shown here with two summer student employees.

given me so many wonderful memories, I say from the bottom of my heart- "Thanks for the Memories".

Throughout my career, I have had the privilege to do applied research and extension work in the field of plasticulture or the use of plastics in agricultural systems. I believe that the generation prior to mine, from whom my colleagues and I learned our craft and trade and my generation certainly changed and shaped the face of horticultural crop production and hopefully have made a positive impact on the usage of this technology. It was certainly exciting to work on plastic mulches, drip irrigation, fertigation, crop establishment techniques, low tunnels, floating row covers, high tunnels and most importantly the disposal of not only agricultural plastics but consumer plastics as well.

I thought about naming some of the individuals from the different categories above but then I would have inadvertently overlooked someone and I didn't want to chance that happening and plus the list would be pages long. I know that you know who you are and the memories that we have shared and the work that we did together. I just want to acknowledge each of you and what you did to make it a wonderful journey and once again say, "Thanks for the Memories".

(continued on page 8)

NEWS



**Pennsylvania
Vegetable Growers
Association**

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commercial vegetable,
potato and berry growers.*

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In Memory

Betty Miller

Betty Miller, who with her late husband, Rev. John D. Miller, co-owned Miller Plant Farm in York, passed away at her home on July 9 at the age of 92. Until recent years, she prepared a noon meal for the workers at the farm each day. She was a member of the New Fairview Church of the Brethren in York.

She is survived by her three sons – David Miller (PVGA President and present owner of Miller Plant Farm), John Miller, Jr., Esq. and Andrew Miller, Esq. and their wives; one daughter – Gloria Rohlfing and her husband; one son-in-law – Dr. Robert Stremmel; 17 grandchildren and 23 great-grandchildren.

Webinar on New Form I-9 Offered in September

Pennsylvania Farm Bureau is sponsoring an educational webinar September 6 to learn about changes to the new Form I-9 that must be used beginning September 18. Participants will receive an overview of recent changes and new resources available to assist with employment eligibility verification process. The presentation will review basics about the form - including step-by-step instructions and rules for retention and storage - but even the most seasoned business professionals will walk away with something new. The presenter will be Harry Nash of U.S. Citizenship & Immigration Services' Verification Division. The session begins at noon and will last approximately one and one-half hours. To participate, go to <https://uscisconnect.connectsolutions.com/pafarm/> to access the online materials and join the conference call by dialing 866.928.2008 and entering the code 716533.

From Farm Bureau Express, Penna. Farm Bureau, July 28, 2017.

Act Now: Time to Advocate to Ditch the Rule

As the federal government considers whether to rescind its controversial Waters of the U.S. (WOTUS) rule, it's time for farmers to urge national leaders to ditch the rule once and for all. The U.S. Environmental Protection Agency has opened a 30-day public comment period on its proposal to repeal the 2015 regulation. This is your chance to submit comments directly to EPA and it's critical that the agency hears from farmers about how WOTUS would affect your farms. Farm Bureau opposes the 2015 WOTUS rule and believes it attempts to expand federal authority far beyond what's allowed by law and would cause nearly every acre of farmland to be regulated. The rule, which is being challenged in court by Farm Bureau and others, hasn't gone into effect because of injunctions issued by federal courts that questioned its legality. Please urge EPA to ditch the rule by visiting: <https://www.regulations.gov/document?D=EPA-HQ-OW-2017-0203-0001> or <http://bit.ly/pfbWOTUS>.

From Farm Bureau Express, Penna. Farm Bureau, July 28, 2017.



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 website - www.pvga.org

Our Mission:

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

Our Vision:

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

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

21st “Are You Crazy” Retail Farm Market Bus Tour Hits the Road in September

Join Penn State Extension for the 21st Annual “Are You Crazy?” Retail Farm Market Bus Tour of the Hudson Valley region of New York on September 19, 2017. This tour is for retail farm market professionals and is held at the height of the season to enable participants to learn from their regional farm market peers during their best and most robust season.

The 2017 event will include behind the scenes tours and information directly from farm market owners including unique display and merchandising ideas and information on market expansion and farm transition. The September tour will visit five unique farms on this one day trip. Our rolling classroom environ-

ment enables market owners and managers to share lessons learned, season highlights and discuss pertinent topics as we travel between tour locations.

The tour bus will leave promptly at 8:00 am from the Lehigh County Agriculture Center, 4184 Dorney Park Rd, Allentown and return at 8:00 pm. The cost is \$50 per person which includes lunch and dinner. This tour is sponsored by the Risk Management Agency of the USDA and PVGA.

To register for the Are You Crazy Retail Farm Market bus tour call 610-391-9840 or go to <http://extension.psu.edu/business/farm/events>. Registration deadline is September 15, 2017.

State New Briefs

Funding for Penn Vet, Penn State Extension Remain in Flux as Senate OKs Tax Plan

State aid to two programs important to agriculture - University of Pennsylvania School of Veterinary Medicine and Penn State Cooperative Extension - remains held up as lawmakers and Gov. Tom Wolf continue discussions related to the state budget. State senators this week narrowly approved a mix of tax increases and other measures to fund the \$32 billion state budget adopted in June. That revenue plan now heads to the House where its future is uncertain. In addition to borrowing money and transferring cash from other funds, the Senate-approved proposal would impose a tax on natural gas production; increase taxes on natural gas, electric and telephone bills; apply the state sales tax to more online sales; and expand casino gambling. The budget bill passed in June allows the state to release money for most programs, including the Department of Agriculture's operations. But the state cannot release funds for Penn Vet or Penn State Extension without the approval of separate bills, which were approved by the Senate but have not yet received a vote in the House

From Farm Bureau Express, Penna. Farm Bureau, July 28, 2017.

Pa. Pension Overhaul Becomes Law, Further Action Sought

A long-sought effort to overhaul Pennsylvania's public pension system and shift the responsibility of making up future funding shortfalls away from taxpayers is finally law.

The General Assembly passed and Gov. Tom Wolf signed legislation that ends defined-benefit pensions for new state and public school employees and, instead, offers workers a choice between three retirement plans that combine elements of traditional pensions and 401(k)-style plans.

But while the change limits taxpayers' risk of being on the hook for major shortfalls in the future, it does not address the more than \$70 billion unfunded liability in the current pension system that is straining state budgets and prompting school districts to cut programs and raise property taxes.

Pennsylvania Farm Bureau is among the advocates calling for continued action that addresses pension costs in both the short and long term.

“While changes under the new pension law will likely be helpful in the future, the absence of a meaningful plan to reduce the current pension debt load will continue to drain Pennsylvania's financial resources and likely result in higher

real estate property taxes for landowners and cuts to services in many school districts across the Commonwealth,” said PFB President Rick Ebert. “Because farmers need to own large amounts of land to remain economically viable, they are often hit the hardest by increasing property taxes.”

From Pennsylvania Agricultural Alliance Issues Update, Penna. Farm Bureau, July 2017.

Noxious Weeds Update Passes Senate Committee

An update to the state laws governing control of noxious weeds has cleared its first hurdle in the state Senate. House Bill 790, by Rep. Eddie Day Pashinski of Luzerne County, was approved by the Senate Agriculture and Rural Affairs Committee and now heads to the full chamber for consideration.

The measure would add to the list of noxious weeds to be controlled several new species that are adversely affecting agriculture. It would also, by default, include weeds that are on the federal list and allow the state Controlled Plant and Noxious Weed Committee to conduct studies to add or delete plants from the list. The bill would also allow beneficial weeds with the potential to become invasive — such as *Miscanthus*, which is used for biofuel — to be cultivated in a controlled environment with a permit for research.

From Pennsylvania Agricultural Alliance Issues Update, Penna. Farm Bureau, July 2017.

Pennsylvania Agricultural Surplus Program Reaches Milestone

Four million pounds of food has gone to Pennsylvanians struggling with hunger through a state program that helps connect farmers' surplus with families in need.

The Pennsylvania Agricultural Surplus Program helps offset the cost of harvesting, producing and packing goods to be donated, making it easier for farmers and processors to see that their surpluses go to good use.

The program was created in 2010 and first funded in the 2015-2016 state budget. Since then, 78 producers from 39 counties have donated surplus dairy products, produce and meat to food banks, serving 558,000 households statewide, according to the state Department of Agriculture.

From Pennsylvania Agricultural Alliance Issues Update, Penna. Farm Bureau, July 2017.

(continued on page 4)

NEWS

National News Briefs

EPA Announces Plans to Consider Ditching WOTUS

The U.S. Environmental Protection Agency has officially announced proposed rulemaking to rescind its controversial Waters of the U.S. rule, in response to an executive order issued by President Donald Trump in February.

The rule — which gave EPA and the U.S. Army Corps of Engineers broad authority to regulate as “water” nearly all land areas, including 98 percent of Pennsylvania lands — was issued by former President Barack Obama’s administration but never went into effect because of injunctions issued by federal courts that questioned the rule’s legality.

Critics of the rule, including the American Farm Bureau Federation, say it attempts to regulate land areas far beyond what is allowed under the Federal Clean Water Act, and would cause nearly every acre of farm land to be regulated. A public comment period, during which farmers can advocate for the repeal of WOTUS, is expected to open in July.

From Pennsylvania Agricultural Alliance Issues Update, Penna. Farm Bureau, July 2017.

Deadline to Comply with New Water Rules for Produce Extended

The U.S. Food and Drug Administration is pushing back the deadline for produce farmers to comply with new agricultural water regulations as it considers whether to simplify the requirements.

The agency is considering revising the rule in response to criticism that it is overly complex, making it difficult to understand and implement. The regulation, established by the Food Safety Modernization Act, sets microbial quality standards for agricultural water that comes into contact with produce in an effort to prevent contamination.

The FDA has not yet determined how long the compliance deadlines will be extended but said the delay will give the agency a chance to work with stakeholders and offer farmers an opportunity to review their practices.

The original deadlines were staggered by farm size and the first round had been due to adhere to the new standards by

January 2018. The extension does not apply to farms that grow sprouts.

From Pennsylvania Agricultural Alliance Issues Update, Penna. Farm Bureau, July 2017.

New CRISPR Technology May Help Control Insect Damage to Crops

CRISPR is a new technology that applies gene editing techniques that are different from procedures used to create GMOs. The technology utilizes unique gene editing techniques that improve plants and livestock and may possibly be used to manage agricultural insect pests. Gene editing could potentially disrupt the reproduction cycle and feeding ability of insects or alter their immune system.

Scientists envision using CRISPR to reverse pesticide resistance in insect populations and provide effective control of mosquitoes to reduce exposure to deadly diseases. An extensive regulatory review by various government agencies would need to be conducted before the altered insects are released into the environment.

From Pennsylvania Agricultural Alliance Issues Update, Penna. Farm Bureau, July 2017.

Special Hoods on Sprayers May Substantially Reduce Drift

Methods are being developed to reduce the chances of pesticide drift onto neighboring, nontarget fields.

Special hoods have been introduced by the Redball Company that are installed over spray booms and have been found to improve coverage of crop protection products and reduce drift from spray droplets. The hood forms a curtain that envelopes the crop canopy providing protection from the wind by sealing off the spray zone.

Tests conducted at Mississippi State and the University of Nebraska determined that a spray boom equipped with a hood reduced particle drift more than what could be accomplished through drift reduction technology utilized in spray nozzles alone.

From Pennsylvania Agricultural Alliance Issues Update, Penna. Farm Bureau, July 2017.

State New Briefs *(continued from page 3)*

State Senate Committee Approves Wind Power Bill

A state Senate committee has approved a bill that would allow construction of wind turbines on preserved farmland.

House Bill 187, sponsored by Rep. Curtis Sonney of Erie County, was approved by the Senate Agriculture and Rural Affairs Committee and now heads to the full chamber for consideration. The plan would allow the owner of preserved farmland with 50 or more acres to grant a right-of-way for the installation of a wind power generating system. Now, such landowners may grant rights-of-way for other utilities, such as water, sewage, electric, telephone, underground mining and gas- or oil-product lines. The bill would add wind power to that list.

From Pennsylvania Agricultural Alliance Issues Update, Penna. Farm Bureau, July 2017.

Bill Extending Safe Harbor to Local Taxes Advances

A bill that would make it easier for farmers to estimate local tax payments is advancing in the state Senate.

Now, the state and federal governments allow farms and other businesses to estimate tax payments based on the previous year’s tax liability. But local taxing bodies don’t give those same “safe harbor” provisions. House Bill 866, sponsored by Rep. George Dunbar of Westmoreland County, would extend those provisions to local taxes.

The bill cleared the Senate Finance Committee and will now be considered by the full chamber. It already passed the House.

Estimating based on the previous tax year is important to farmers given the difficulty in predicting farm income, which varies widely from year to year and is influenced by market forces, commodity prices and input costs.

From Pennsylvania Agricultural Alliance Issues Update, Penna. Farm Bureau, July 2017.



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Get Prepared - Know Your Rights

Karen Eichman

If you've had a conversation with an immigrant in recent months, you know they are fearful of what might happen, either to themselves, their family members or friends. Naturalized citizens and sometimes even U.S. citizens can find themselves in the crosshairs of the current level of immigration law interpretation, the seemingly new level of scrutiny at border crossings and the deportation of so-called "bad hombres."

Make no mistake, though. No new laws have been passed concerning these issues. The up-tick is merely greater enforcement of existing laws, along with more publicity surrounding that enforcement. Our level of knowledge of such occurrences was decidedly lower and slower before the advent of smartphones, Twitter and other such technological marvels that have sped up the dissemination of facts - good, bad or otherwise.

Like many other labor-intensive industries, the mushroom industry [and fruit and vegetable industries] is heavily dependent on immigrant labor. What do you need to know and what can you do to help yourself and your immigrant employees stay on the right side of the law?

1. Make sure you accurately complete and retain I-9 forms, which includes properly correcting them when prepared incorrectly. Ensure you have one for each current employee and each employee who left your employment within the past three years.

Even if it is determined that one or more of your employees is not legally eligible to work in the U.S., your attention to detail on completing and retaining your I-9 forms is evidence of your good faith effort to only hire and retain employees who are legally eligible to work here. You are not supposed to become the I-9 police; however, sloppy I-9s can be an indication that you possibly knew the employee's ineligible status and chose to employ the individual anyway.

Poorly completed I-9s are subject to fines and, expensive as that can be, it is not nearly as devastating as the potential criminal charges for hiring or retaining persons ineligible to work in the U.S. So, step one: get your house in order.

2. Know your rights. Entry onto your property to search and question your employees about anything, including the legal status of employees, typically requires your free and voluntary consent' (which you are under no obligation to provide), or a valid search warrant.

3. Take reasonable steps to restrict the entry of the public onto your business premises. The more obvious it is that the public is not free to enter, the better.

a) Fencing around the business property is helpful

b) Lots of signage, clearly and boldly stating:

i. Private property

ii. No trespassing

iii. Employees and registered guests only beyond this point

iv. Posting a speed limit, and

v. Visitors - customers, vendors, guests, agency and law enforcement personnel included - must report to a specific location, such as an office or reception area and register.

4. The employer has every right to deny ICE warrantless access to its employees.

5. The employer has the right to consult with an attorney.

6. Employees should be educated to direct any unaccompanied non-employees or strangers to report to the office or another specified location.

7. Immigrant employees should not run if they suspect unaccompanied "strangers" are law enforcement. Running can provide an exception to the requirement that law enforcement personnel must have the proprietor's consent, a valid search warrant or exigent circumstances. Running could create an exigent circumstance.

8. Once presented with a valid warrant the employer should cooperate with ICE.

9. Employees are not required to answer questions posed by or show paperwork to ICE agents. Employees have the right to consult with an attorney. Employees should tell the ICE agent that they wish to speak with their attorney before answering questions. Employees should state, "I wish to speak with an attorney."

10. Employees should know and understand their rights in their homes

a) Just like at work, typically free and voluntary consent or a warrant are required to enter a home. Letting an ICE agent inside a home subjects everyone in the house to questioning, so everyone in the home should know what to do if someone knocks on the door.

b) Without a valid warrant, there is no requirement to open the door of a home when someone knocks, even if the person knocking identifies themselves as an ICE agent. In fact, the door should be kept closed unless and until an ICE agent can produce a valid warrant. Have the warrant slid under the door to inspect it; do not open the door to get the warrant.

11. Provide immigrant employees with the business card, or several business cards, of an immigration attorney that they can keep in a wallet.

a) In addition to keeping it on their person, immigrant employees should also provide the attorney's information to their family and post the business card where family or friends can easily find it, in the event the employee is detained.

b) If detained entering the U.S., the employee should show the immigration attorney's business card and request representation from their attorney."

Every person within the U.S. has rights, whether that and your employees can and do exercise your rights against warrantless searches and seizures afforded by the Fourth Amendment to the U.S. Constitution. Standing up for, and demanding, your rights is not a sign you or your employees are engaging in any illegal activity. "Things" will not "go better" for you if you merely acquiesce to a warrantless search. In fact, such warrantless search by ICE can be extremely harmful to you and your employees.

Be prepared. Make sure your property is off-limits to the public, keep your I-9s in good order and know your Constitutional rights. Should a day arrive when you or one of your employees needs exercise these rights, you will be ready.

Footnotes

1. Consent must be freely and voluntarily given. Coerced consent and trickery to obtain consent to enter your business amounts to unlawful entry.

2. Unlike persons within the U.S., a person detained while attempting entry into the US. is not considered to be "in" the US., even if such detention lasts months or if the detention facility is nowhere near a border crossing. Such persons detained, who are considered not "in" the US. do not, according to ICE, have their right to an attorney, often denying such person access to an attorney. Having the attorney's information available and requesting to speak to "my attorney" can be helpful to persons needing representation in these situations.

Ms. Eichman is with the EichmanLaw Group, West Grove, PA.

Reprinted from the Pennsylvania Fruit News, State Horticultural Association of Pennsylvania, Vol 97, No. 5, June 2017, with permission by K. Eichmann and The American Mushroom Institute who originally published the article.

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NEWS

Dr. Bill Lamont: Thanks... (continued from page 1)

A few photos from over the years



Picture of George Perry (now a retired County Agent), Terry Simpson, Dayton Resse and John Terwilliger harvesting a drip irrigated potato test at Huntsinger Farms.



One of the high tunnels erected in Philadelphia at the SHARE Food Program site next to the old TASTYCAKE Baking Company. This was part of the Penn State high tunnel initiative into Philadelphia funded by the Specialty Crop Block Grant Funding from USDA and administered by the Pennsylvania Department of Agriculture. I want to acknowledge former Secretary of Agriculture for Pennsylvania Sam Hayes who caught the vision of high tunnels back in 1998 and supported Mike and I as we moved forward with the Penn State High Tunnel Research and Education Center and also Russell Redding the current Secretary of Agriculture who has been a supported all along as he was Deputy Secretary under Sam Hayes. I consider both to be friends.



A second high tunnel being constructed at the SHARE Food Program site. Tommy McCann is in the green shirt and is one of the Extension Educators at the Philadelphia Centre. Tommy was a tremendous help with the high tunnel program in Philadelphia.



The team working on the high tunnel being constructed at the Teens for Good site in Philadelphia. Dr. John Byrnes is in the white shirt and is the Director of the Philadelphia Extension Centre and Bruce Dye who was my research technician in the brown shirt.



Tom Butzler and Tom Ford both excellent Extension Educators helping with a lettuce trial in a high tunnel at Penn State's High Tunnel Research and Education Center.

(continued on page 10)



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NEWS

Dr. Bill Lamont: Thanks... (continued from page 8)

Longtime County Extension Educator Bob Pollock and Dr. Elsa Sanchez on a grower visit in Bob's county. Thanks Elsa for all the road trips and great conversations and work that we did together both in extension and in the Gardening for Fun and Profit class.



A young and dashing Eric Oesterling, now retired County Extension Educator checking the pepper crop out. Notice his Vegetable Extension Team hat. We were so far ahead regarding marketing and building teams.



Dr. Tim Elkner, County Extension Educator, Lancaster County standing beside a high tunnel in India. Tim and I went to India to see if it would be feasible to put up high tunnels to provide shelters for the population after the terrible earthquake in Northern India and then convert them to food production afterward.



Students that took my Vegetable Crops Production class that I taught while at Kansas State University.



Kathy Demchak, Small Fruit Extension Specialist extraordinaire with some strawberries maybe from the high tunnels. Kathy has been a great colleague to cooperate with over the years and is a wonderful person.

(continued on page 12)



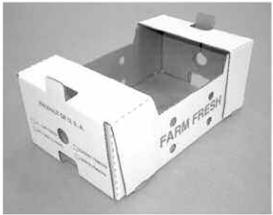
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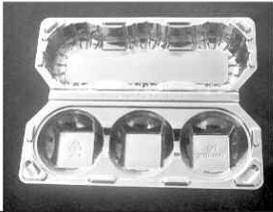
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NEWS

Dr. Bill Lamont: Thanks... (continued from page 10)



Wilfred Singogo, a Ph.D. graduate student that I supervised at Kansas State University with melons that he harvested from his thesis work involving cover crops and plasticulture.

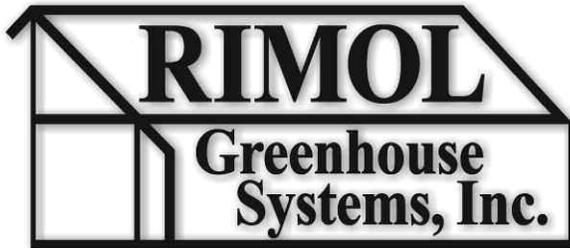


Bill Wolfram a longtime friend and supporter from industry who assisted myself and colleagues around the country with drip irrigation supplies and shared his knowledge of drip irrigation with us over the years at workshops, meetings and on demo with growers. He works for Toro Micro-Irrigation now not T-Tape.

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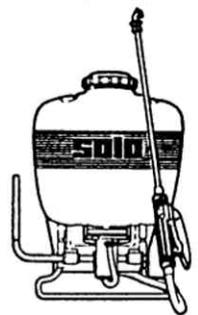
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NEWS

Dr. Bill Lamont: Thanks... (continued from page 12)



A trip that I was involved in to Israel to view history and agriculture especially plastics and drip irrigation. The tall gentleman on the left is Peter Bergholtz a longtime friend from industry and a real supporter of not only my but many of my colleagues' agricultural research and extension work.



A sample of the numerous articles and publications I contributed to over the years that extended my and my colleagues research to growers.



Bill Lamont being interviewed by TV station in Mexico about the workshop on plasticulture we were conducting for growers.



My vegetable colleague and friend Dr. Mike Orzolek for more years than I can remember sharing thoughts on high tunnel production techniques with Dr. Russell Larson, a wonderful man and horticulturalist.



George Perry and Bob Leiby, longtime County Extension Educators both now retired who did a lot of work with potatoes over the years. Bob still is doing a lot of work with potatoes.

Summary

The intensive vegetable production program is an example of the effective use of extension/research programing that can be applied to any commodity program. The active participation and involvement of university personnel, growers, county extension professionals, and representatives from industry in any program is certainly the key to providing the range of information and technology necessary for vegetable producers to be successful in the future.

The program that I worked on most of my career was intensive vegetable crop production and I used this slide to describe how I did it. I believe that it is still the formula for success in the future.

VEGETABLE PRODUCTION

Using Copper Fungicides

S.B. Scheufele and R.Hazzard

Copper products play an important role in disease management in both conventional and organic fields. They are the most effective controls for most bacterial diseases. In organic production, copper products are the main protectant fungicide used in the control of diseases caused by oomycetes such as late blight and downy mildews. There are more copper products becoming available, and it is helpful to understand the differences and benefits of different active ingredients and formulations. Solubility, phytotoxicity, human health risks, impact on soil ecology, labeled crops and diseases, and efficacy are important considerations in using particular copper products.

How copper works. When copper (Cu) is mixed with water, copper ions (Cu²⁺) are released into solution. Modern copper products typically use insoluble or “fixed” forms of copper, creating a suspension of copper molecules in the spray solution. These undissolved copper particles persist on plant surfaces after the spray dries and copper ions are released from these deposits each time the plant surface becomes wet. The gradual release of copper ions from the copper deposits provides residual protection against plant pathogens present on the leaf surface. Copper ions kill pathogens primarily by destroying cell membranes and proteins and by disrupting protein synthesis. Since the mode of action of copper targets such fundamental components of living tissues, it affects a wide range of plant pathogens including bacteria, fungi, and oomycetes, but can also damage plant cells and be toxic to humans and other non-target organisms. Achieving the best control without injuring plant foliage and fruit depends on the concentration and rate of release of copper ions on the leaf surface, which is determined largely by the solubility of the copper formulation.

Solubility Less soluble (fixed) formulations release copper ions more slowly. This slow-release lowers the risk of phytotoxicity and provides longer residual activity. The following are low-solubility active ingredients: copper oxide (e.g., Nordox), copper hydroxide (e.g., Kocide, Champ), copper oxychloride (e.g., COCS and BadgeX2), and copper octanoate (copper ions linked to fatty acids to form a soap, e.g., TennCop, Cueva).

More soluble formulations act rapidly but have higher risk of phytotoxicity and shorter residual activity. Basic copper sulfate and copper sulfate pentahydrate are highly soluble.

Metallic Copper Equivalent (MCE) Product labels list percent active ingredient (e.g., 23.8% copper oxychloride or 98% basic copper sulfate), but this doesn't tell you the actual metallic copper by weight, as the formulation also impacts the total copper present. Look for the “metallic copper equivalent” listed below the active ingredients to determine the amount of actual copper by weight. A product with 40% metallic copper has 0.4 lb metallic copper per lb of product. The range in MCE among products is vast, ranging from under 1.8% to over 50% copper by weight, so it is important to consider the MCE because the effectiveness of a copper spray is highly correlated to the amount of copper applied.

Effects of pH, Spray Additives, and Weather

- Under acidic conditions, copper solubility and the potential for phytotoxicity increases. Spray solutions should be kept above pH 6-7, depending on the formulation, to prevent excessive amounts of copper ions from being released and possibly damaging fruit and foliage.
- Adding maneb or mancozeb to copper products as a tank mix increases the release of copper ions in solution. There are

pre-mixed products (e.g., ManKocide) available, or growers can make their own mixtures. This may be especially helpful for controlling bacterial diseases such as bacterial speck, spot and canker of tomato.

- Using an approved adjuvant or ‘sticker’ may help the product to be more rainfast, but when used with the highly soluble copper sulfate formulations, can cause phytotoxicity.
- Finely ground compounds will be more active than coarser ground materials because the smaller particles result in better coverage of the leaf and are less likely to be removed from the leaf by wind and rain.
- Copper can accumulate to high levels on plant tissue when sprayed repeatedly to cover new growth and there is no rain. In this situation, after a rain event, a large amount of copper ions may be released leading to phytotoxicity.
- The risk of plant injury increases when the spray solution dries slowly due to cool wet weather, as the duration of active release of copper ions on the leaf is increased.
- Always read the label instructions. When mixing, follow the tank mix partner instructions.
- For each product, application rates vary with crop and disease. The recommended rate for a given crop may have a 2-fold difference between the high and low rate. Higher rates are recommended when disease pressure is high or conditions are especially favorable. Most products are labeled for a wide range of vegetable crops.

Safety

Human Health Hazards. Eye exposure is the most serious risk associated with using copper hydroxide. Eye damage can be irreversible. There is moderate risk from skin contact, ingestion and inhalation. Products vary in EPA hazard rating, most are “Warning” or “Danger” but Badge SC has a lower risk “Caution” label. The greatest health risk is to the person who mixes and sprays the material. Proper protective equipment must be worn when handling or applying copper products as with any pesticide or fertilizer. The required protective equipment is specified on the label and usually includes: long-sleeved shirt and long pants, chemical resistant gloves made of any waterproof material such as polyethylene or polyvinyl chloride, shoes plus socks, and protective eyewear. Though not usually required, you may also want to consider wearing a respirator or dust mask, especially for mixing dry formulations. Dry product sometimes comes in a paper bag that has a tendency to leak out of the seams and needs additional containment such as a plastic bin.

Restricted Entry Interval (REI). Most copper products have an REI ranging from 24-48 hours, which means that workers are not allowed to go into treated fields to pick fruit or do any other field work for that duration of time. Plan your spray and harvest schedule to accommodate your marketing needs as well as the REI. Fruit may need to be polished before marketing, to remove the blue residue left on fruit.

Environmental Hazards. Some farmers have expressed concern about copper toxicity in the soil or with respect to soil microbes and earthworms. Additionally, copper can be very toxic to fish and aquatic organisms, if drift and run-off occur. This should be a concern in sandy, acidic soils or near surface water. Copper is actually an essential plant micronutrient and, in

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VEGETABLE PRODUCTION

Using Copper... (continued from page 14)

New England, it is more often deficient than excessive in soils. The amount found naturally in soils in MA ranges from 0.1 to 8 ppm while nationally soils range up to 200 ppm. Crops remove less than 0.1 lb/A copper per year. Copper usually accumulates on the soil surface where it becomes chemically bound to organic matter and clay minerals. In acidic soils, the solubility of copper increases and toxicity or run-off may occur. An application of 1 lb of active ingredient per acre is estimated to raise the copper levels about 0.5 ppm. A single application of Nu Cop at 2 lb per acre with 77% active ingredient adds about 1.5 lb copper per acre to the soil, or could raise the concentration in the soil by 0.5 to 0.75 ppm. Therefore, the level of copper in soil would increase slowly over time, except in perennial planting systems such as apple orchards. In annual rotational systems, where copper applications might only be made every 4-6 years, copper accumulation is less of a concern. Nonetheless, copper use is regulated and certified organic farmers in the US are required to restrict their use of copper products. Regular soil tests should be taken and copper levels in the soil should be monitored.

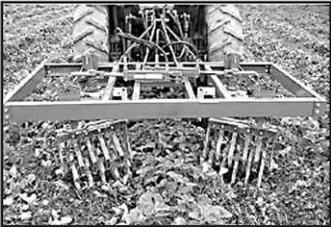
Managing blights in organic tomato and potato using copper. Copper-based fungicides are labeled for use in organic systems and have demonstrated effectiveness in preventing late blight. Copper fungicides do not kill infections that are already present; they must be used preventatively in order to effectively protect plants from initial infections. Most pathogens have latent periods, when the plant is infected but does not show any symptoms. Thus, when symptoms appear, it is too late to protect the crop effectively—especially with late blight.

Some strains of late blight are more aggressive than others and this will also influence the efficacy of copper spray programs. Regular applications of copper will also help protect tomatoes from early blight and Septoria leaf spot, which can progress rapidly and cause plantings to produce far less than their full yield potential.

Several copper products are OMRI-listed for use in certified organic production and are registered for use in Massachusetts including: NuCop 50DF, Badge X2, Basic Copper 53, and Cueva. Check the OMRI website for updates or consult your certifier. As with insecticides, dry formulations are more commonly approved for use in organic systems. Note that OMRI approval is for specific formulations, and there are often multi-

(continued on page 27)

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VEGETABLE PRODUCTION

Fruit Disorders in Watermelon

Gordon Johnson

There are several fruit disorders in watermelons being found across the region currently.

One of the most common is sunscald or sunburn on fruits. This occurs when fruits are exposed to direct sunlight, especially on extremely hot days. Rind surfaces can reach temperatures exceeding 140° F. This kills rind cells and results in sun burnt spots where the cells have died. Fruits with little or no vine cover are at most risk. Also at greater risk are watermelons with dark colored rinds.

Irregular ripening has been a problem in some fields this year. Varieties planted at the same time are not ripening evenly in a field. Fruits that look mature on the outside are not fully ripe inside, often with significant amounts of white flesh.

Watermelons are classified as non-climacteric, that is, they do not continue to ripen significantly after harvest. Other fruits, particularly those that soften, such as peaches, release ethylene gas during the ripening process and will continue to ripen after harvest. It was once thought that ethylene was not involved in watermelon ripening, however, in 2009, USDA

Broken Record: Still No Reports of Late Blight in Pennsylvania

As of July 26, there are no confirmed reports of late blight in Pennsylvania and no new reports across the region. Previous reports of late blight nearby include tomato in Ontario Canada and potato in Michigan, the eastern shore of Virginia and in Erie and Livingston Counties in New York.

Although there are currently no reports of late blight in Pennsylvania it is still important to scout higher risk areas of the field including low lying areas or shaded field edges and potato cull piles for symptomatic volunteers.

Unsettled weather, cooler temperatures and high relative humidity are favorable for disease. Protectants being applied to protect against other summer foliar diseases such as early blight (tomato/potato) and Septoria leaf spot (tomato) can also help protect against late blight if applied preventatively. A chlorothalonil program alone applied preventatively provided over 90% late blight control relative to the untreated plots in multiple fields over the past several years. The key is making the first application preventatively and then ensuring adequate coverage. Straight copper programs were less effective however, still provided a significant amount of disease control relative to the untreated control.

If you suspect late blight on your farm, please contact your local Penn State Extension Office or let Beth Gugino know via email at bkgugino@psu.edu or by phone at 814-865-7328. We are interested in collecting samples so we can better understand how the pathogen population is changing both within and across growing seasons. Also for the information regarding where the latest confirmed outbreaks have been reported and to receive email or text alerts about when late blight has been confirmed with a personally defined radius from your location visit <http://usablight.org>.

Dr. Gugino is with the Dept. of Plant Pathology and Environmental Microbiology at Penn State Univ. From the Pennsylvania Vegetable Disease Update, Penn State Extension, July 11 and 25, 2017.

researchers found that watermelons released a burst of ethylene at the white fruit stage. Watermelon fruit development and ripening also is dependent on the accumulation of sugars. Sugars are produced by photosynthesis in the foliage of the watermelon plant and are translocated to the fruit.

So, what is cause of irregular ripening seen this year? One possible explanation is deteriorating vine health. Loss of foliage or stem tissue due to diseases such as gummy stem blight or insect or mite feeding on leaves and stems can reduce the amount of sugars available to translocate into the fruit. In a field, variability in vine health therefore would lead to variability in fruit ripening.

The burst of ethylene that researchers found could also be an issue. In plants where ethylene production is compromised, this could lead to later ripening or incomplete ripening.

Potassium may also be an issue. Potassium is important in fruit ripening and low or variable potassium levels may lead to irregular ripening. In fields with pre-plant potassium applications only, heavy irrigation could leach potassium out of the root zone creating lower than normal levels in the soil and potential deficiencies leading to irregular ripening.

Hot weather (temperatures in the 90s) can also lead to fruit disorders. Watermelons do tolerate high temperatures but some varieties are less tolerant of extended hot weather, leading to irregular ripening.

Another disorder that can be found is water soaking in fruits. This occurs where excess water accumulates at the bot-

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VEGETABLE PRODUCTION

Late July Weather Favors Cucurbit Downy Mildew

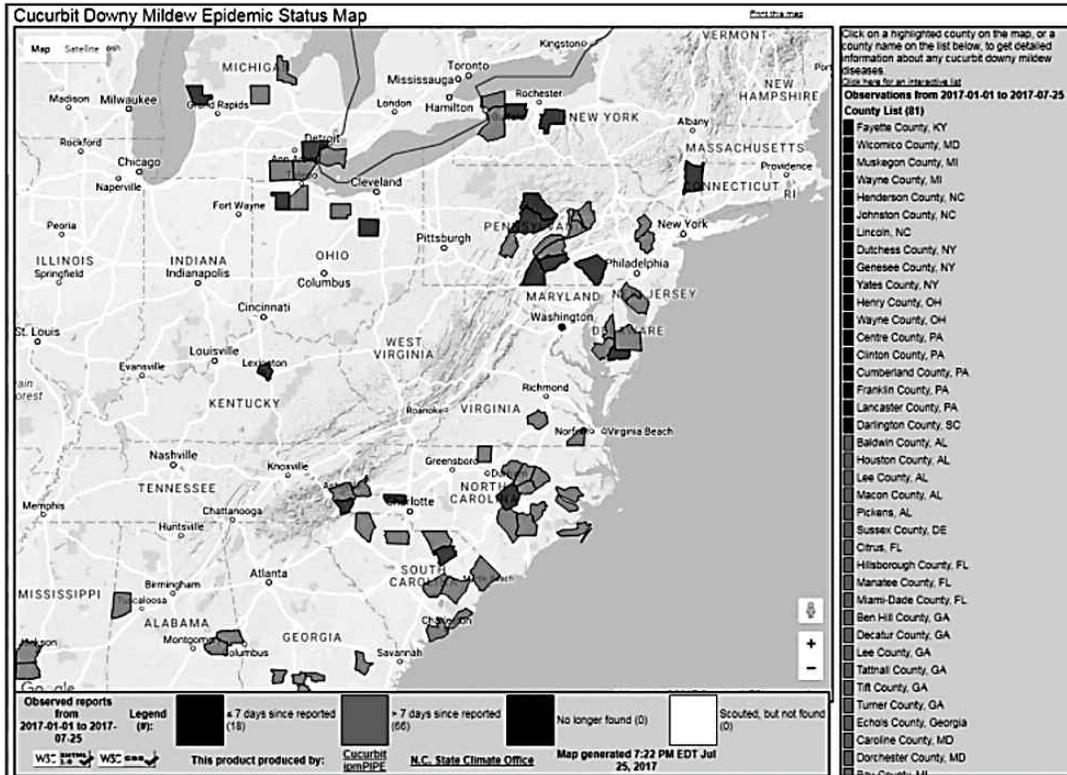
Beth Gugino

As of July 26, the rainy weather is not letting up and neither is downy mildew pressure. Currently it has been confirmed in eleven counties in central and southern Pennsylvania with an unconfirmed report on cucumber in western PA. Cucumber continues to be the primary host however there are also several reports on cantaloupe across the region. The nearest reports on jack-lantern type pumpkin are in South Carolina and Mississippi.

With successive cucumber plantings, once harvest is complete, disk or burn down the crop debris to reduce the further movement of downy mildew inoculum into the younger plantings. As with late blight, once the plant tissue is dead, the pathogen is dead. Also maintain a regular fungicide spray program on the later plantings. Cucurbits are susceptible to downy mildew at any stage of growth.

Also tank mix downy mildew specific fungicides with a broad-spectrum fungicide like chlorothalonil (labelled on all cucurbits with a 0 day PHI) or mancozeb (only labelled on cucumbers, cantaloupe/ muskmelon and summer squash with a 5 day PHI) for fungicide resistance management. Continue scouting all cucurbit crops and if not already, consider using of a broad-spectrum protectant fungicide to help protect against downy mildew as well as other common foliar diseases.

Excellent coverage is especially important for organic growers or others relying primarily on biochemical fungicides like copper or Regalia or microbial biopesticides such as Serenade or Actinovate or a combination of biopesticides. Keep in mind that it is much easier to manage downy mildew when fungicides are applied preventatively and also that the crop is susceptible at any growth stage and can easily move between successive plantings.



Map of cucurbit downy mildew currently reported along the east coast as of 25 July 2017 (cdm.ipmpipe.org).

The continued incorporation of downy mildew specific fungicides is recommended especially on cucumber and cantaloupe. Be sure to rotate among FRAC (Fungicide Resistance Action Committee) code numbers to ensure that you are rotating between different modes of action. There are a number of products including but not limited to Ranman (FRAC 21), Orondis Opti (U15+M5), Zampro (45+40), Previcur Flex (28), whose efficacy has been demonstrated in university research trials. When the source of downy mildew originates from the Great Lakes region, variable efficacy with Previcur Flex has been observed although it has still be effective in recent trials conducted at the Penn State research farm in Centre Co. Due to resistance, Presidio is no longer being recommended in many cucurbit production regions in the eastern United States.

Downy mildew can often be confused with the bacterial disease angular leaf spot (see comparison photos below). The symptoms are very similar; the lesions are initially water soaked in appearance before turning brown or straw-colored and are also vein limited. The lesions will often dry and drop out, leaving irregular shaped holes in the leaves. If you do not see downy mildew sporulation on the underside of the leaf in the field, place several symptomatic leaves in a sealed bag overnight and then check for purplish gray sporulation the next day.

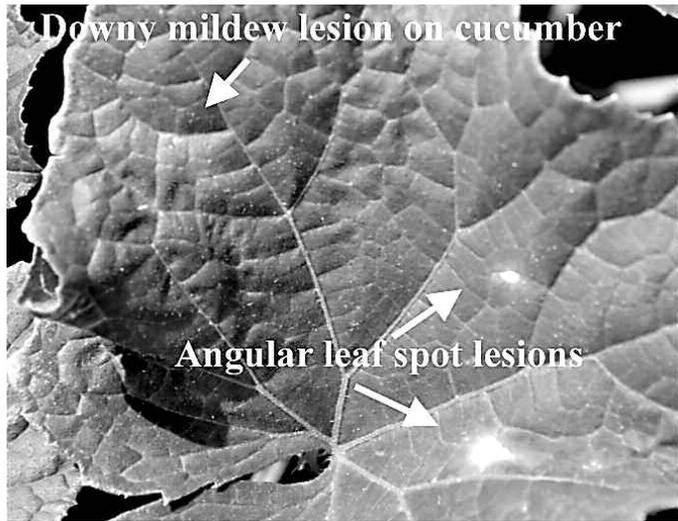
For the latest information on outbreaks and to receive email or text alerts please visit the Cucurbit Downy Mildew Forecasting website (<http://cdm.ipmpipe.org/index.php>). Updates will also be made to the 1-800-PENN-IPM hotline weekly or more frequently if needed to provide growers with information that can be used to help make timely management decisions. The forecasted risk maps are also based on knowing where there are downy mildew infected fields (sources of the pathogen) so it is important if you suspect downy mildew on your farm contact Beth Gugino by email at bkgugino@psu.edu or by phone at 814-865-7328 or contact your local Penn State Extension Office.

Dr. Gugino is with the Dept. of Plant Pathology and Environmental Microbiology at Penn State Univ. From the Pennsylvania Vegetable Disease Update, Penn State Extension, July 11, 18 and 25, 2017.

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VEGETABLE PRODUCTION

Late July Weather... (continued from page 18)



Cucumber leaf showing symptoms of both angular leaf spot and downy mildew. Downy mildew lesions have purplish gray sporulation on the underside of the leaves (upper right) while those infected with angular leaf spot do not (lower right). (Photos: Beth K. Gugino)



Fruit Disorders...
(continued from page 16)

tom of the fruit, leaving a water soaked appearance in the flesh when cut open. Water accumulates during cloudy weather when transpiration from fruits is low. Water soaking in fruits is also found in fields where foliage has deteriorated. In this situation, water is still being translocated in the xylem but there is limited transpiration through the leaves. Watermelon fruits are still transpiring, but due to the nature of the fruit (thick rind, waxy surface); transpiration is lower than in leaf tissue, leading to water buildup in the fruit. A related disorder is watermelon splitting during handling. In fruits with excess water, the high turgor pressure makes the fruit susceptible to splitting as it is handled (i.e. harvested into busses or trucks, grading, and placing in bins). Even small drops can lead to these splits.

Dr. Johnson is the Extension Vegetable Small Fruit Specialist for the University of Delaware. From the Weekly Crop Update, Univ. of Delaware Extension, Vol. 25, Issue 18, July 28, 2017.

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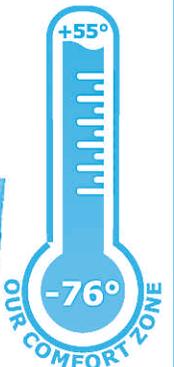
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VEGETABLE PRODUCTION

Reports of Phytophthora Blight and Other Wet Weather Diseases are on the Increase

Beth Gugino

The wet weather has been very favorable for Phytophthora blight on both cucurbits and peppers. Initial symptoms of Phytophthora fruit rot are water soaked or depressed spots typically on the underside of the fruit where it is in contact with the soil. Symptoms can develop on the upper side of the fruit following rain or an irrigation event that splashes infested soil and spores up onto the fruit. Eventually the fruit will become covered with white sporangia and will rapidly collapse either in the field or shortly after harvest. The sporangia form when the soil is at field capacity and the infective zoospores that cause new infections are released when the soil is saturated which explains why the disease is most prevalent poorly drained soil and/or after significant rainfall. Young shoots and leaves will wilt and eventually collapse. The lower crown can turn tan to brown and develop a soft rot.

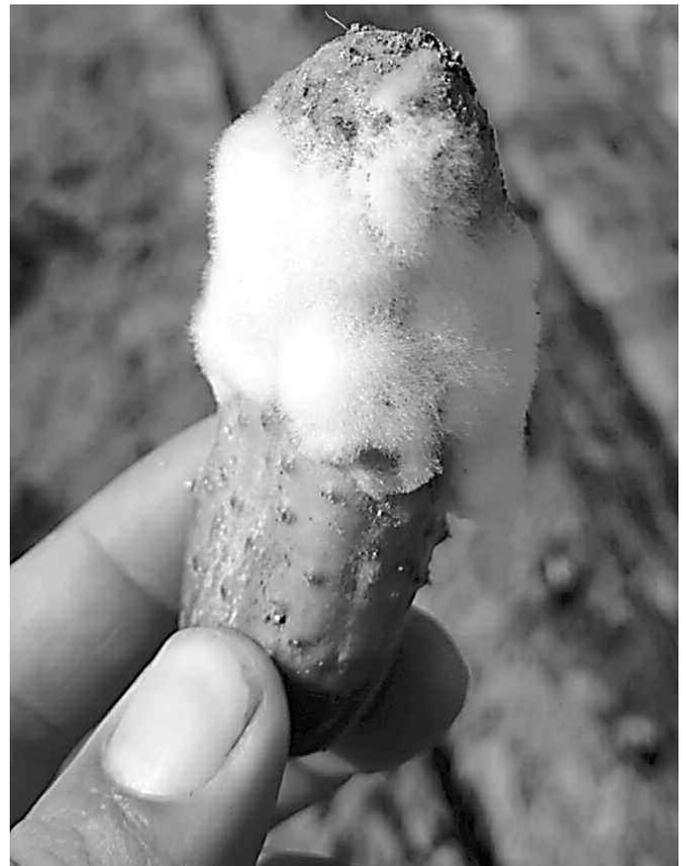
Managing soil moisture by avoiding planting in poorly drained soils or low lying areas, sub-soiling to break-up hard pans, raised beds and avoiding excessive irrigation. Do not irrigate from ponds or surface water sources that may contain water that drained from infested fields. Minimize splash dispersal of spores and surface water movement between rows or fields. In fields where Phytophthora is a problem minimize movement of people and equipment from infested to uninfested fields. Remove diseased plants and fruit from the field. This will reduce the spread of secondary inoculum. If sections of the field are very bad, consider disking these areas under to reduce pathogen inoculum and further spread in the field. Avoid culling infected fruit into production fields.



Characteristic collapsed plant and powder sugar sporulation on infected pumpkin fruit caused by *Phytophthora* blight (Photo: Chris Burkhart).

Under favorable conditions, fungicides will only suppress *Phytophthora* at best. In addition to the recommendations in the 2016/2017 Mid-Atlantic Commercial Vegetable Production Recommendations, new products registered for *Phytophthora* blight on cucurbits include Orondis Gold 200 tank mixed with Orondis Gold B which is oxathiapiprolin (FRAC U15) tank mixed with mefenoxam (FRAC 4), Zampro (ametoctradin + dimethomorph; FRAC 45 + 40) and Omega (fluazinam; FRAC 29).

Pythium cottony leak is another wet weather disease that has been seen in the field recently. Dense white mycelium will develop at the point of contact with the soil under very wet conditions or when the soil is poorly drained. Aside from the application of mefenoxam at planting, management focuses on improving soil drainage and minimizing contact between the soil and the fruit.



Pythium cottony leak on cucumber (Photo: Steve Bogash).

Dr. Gugino is with the Dept. of Plant Pathology and Environmental Microbiology at Penn State Univ. From the **Pennsylvania Vegetable Disease Update**, Penn State Extension, July 25, 2017.

VEGETABLE PRODUCTION

Optimal Storage Conditions for Vegetables

Wenjing Guan

After harvest, storing vegetables in optimal conditions is important to ensure the whole season's hard work has paid off. This article discusses the optimum storage conditions for tomato, pepper, cucumber, watermelon, cantaloupe and sweet corn.

Tomato - Ideal storage conditions for tomatoes depend on the maturity stage of picking. If tomatoes are picked at mature green, store them in 66 to 70°F with 90 to 95% RH would encourage uniform ripening. Temperatures above 81°F reduce intensity of red color and reduce fruit shelf-life. Green tomatoes are chilling sensitive. If the temperature is below 55°F, fruit may develop chilling injury. Red tomatoes are safe to store at 50°F, however, flavor and aroma may be negatively affected compared to storing them at 55°F.

Pepper - Optimum storage condition for peppers is 45 to 55°F with 90 to 95% RH. Temperatures lower than 45°F may cause chilling injury. Colored peppers are in general less chilling sensitive than green peppers. Storage temperatures higher than 55°F accelerate ripening and should be avoided for green peppers. However, if partially colored fruit are harvested, storing them at 68 to 77°F with RH >95% is effective to color peppers. Peppers are sensitive to ethylene. Avoid storing peppers together with ethylene producing fruit such as ripening tomatoes and cantaloupes.

Cucumber - Ideal storage condition for cucumber is 50 to 54°F with RH >95%. Cucumbers are chilling sensitive, chilling injury can develop if fruit is stored below 50°F for more than 2 or 3 days. Storage temperature above 59°F can lead to rapid fruit yellowing and loss of quality. Greenhouse grown cucumbers that have very thin skins are very sensitive to water loss. If they are not shrink-wrapped, storing them in sealed bags can help ensure above 95% RH and prevent fruit water loss. Cucumbers are very sensitive to ethylene that accelerates yellowing and fruit decay.

lowing and fruit decay. Avoid storing cucumbers together with ethylene producing fruit such as ripening tomatoes and cantaloupes.

Watermelon - Although ideal storage temperature for watermelons is in the range of 50 to 59°F with approximately 90% RH. Many watermelons are shipped in unrefrigerated trucks. Watermelons can develop chilling injury when stored below 50°F for more than a few days. The fruit is extremely sensitive to ethylene. Exposing to a low level of exogenous ethylene can cause fruit softening, fading of flesh color, and over-ripeness.

Cantaloupe - Cantaloupe should be cooled right after harvest to delay ripening and retain sugar content. The optimum storage temperature is 36 to 45°F with 95% RH. Full-slip melons are not chilling sensitive, they may be stored for 5 to 14 days at 32 to 36°F. Less mature melons may develop chilling injury when temperature <36°F.

Sweet Corn - Sweet corn loses sweetness rapidly if it is not cooled right away after harvest. If it remains at temperatures around 85°F, more than half of sugar in sweet corn can be converted to starch in a single day. To maintain quality, sweet corn should be cooled immediately after harvest, and stored in temperatures as close as possible to 32°F. Since it is critical to cool sweetcorn to a lower temperature than many vegetables, whenever possible, harvest sweet corn early in the morning when the pulp temperature is the lowest during the day. Sweet corn is not chilling sensitive, and exposure to exogenous ethylene normally is not a problem.

*Ms. Guan is in the Dept. of Horticulture and Landscape Architecture at Purdue Univ. From the **Vegetable Crops Hotline**, Purdue Univ., Issue 632, July 20, 2017.*

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VEGETABLE PRODUCTION

Importance of Leaf Cover in Fruiting Vegetables

Gordon Johnson

July is the month that we see the highest temperatures and often have cloud free, high light intensity days and long day lengths. Under these conditions, good leaf cover is essential for producing high quality fruits. Lack of leaf cover will expose fruits to high levels of radiation and cause excessive heating of the fruit surface. This can lead to a variety of disorders including sunburn, sunscald, fruit yellowing, fruit cracking, and shriveled fruit.

Lack of leaf cover often occurs due to storm damage where high winds or hail damage leaves. After damaging storms, attempts should be made to promote new leaf cover as quickly as possible by sidedressing or fertigating with nitrogen fertilizer and by irrigating.

A second, temporary loss of leaf cover occurs during hot periods when plants are allowed to wilt. Just a few hours without cover under high heat and light can cause severe damage to fruits. This is most severe in dark colored fruit such as peppers and cucumbers. Irrigation management is critical to limit fruit damage due to wilting.

Lack of leaf cover can also be due to lack of plant vigor and poor plant growth which may have a variety of causes such as underfertilization, deficiencies, water stress, wet soil, compacted soil, hot soil conditions or other soil, water, or fertility related issues. Finding the root cause will be critical to address and correct these growth limiting factors and improve leaf cover.

Diseases that reduce leaf production, attack leaves, or cause wilting can reduce leaf cover and lead to fruit disorders. Leaf feeding insects can also contribute to leaf area losses. Protecting plants against expected diseases and insects along with scouting for signs of infections or infestations is critical to maintain canopies. Air pollution damage can also cause losses of leaf cover in sensitive crops and varieties.

Staking and pruning practices are also important to manage leaf cover. Excessive pruning of tomatoes can expose fruits to excess radiation leading to fruit damage. Single or double stem training systems, as are often used in greenhouses and high tunnels, are at most risk. Staking peppers has been shown to reduce fruit damage by maintaining leaf cover over developing pepper fruit.

One common problem in high radiation exposure conditions and lack of leaf cover is sunburn. We commonly see sun-



Sunburn necrosis on pepper.



Photooxidative sunburn on pepper.



Fruit yellowing in cucumber due to loss of chlorophyll with exposure due to inadequate leaf cover.

burn in watermelons, tomatoes, peppers, eggplants, cucumbers, apples, strawberries, and brambles (raspberries and blackberries).

There are three types of sunburn which may have effects on the fruits. The first, sunburn necrosis, is where skin, peel, or fruit tissue dies on the sun exposed side of the fruit. Cell membrane integrity is lost in this type of sunburn and cells start leaking their contents. The critical fruit tissue temperature for sunburn necrosis varies with type of fruit. Research has shown that the fruit skin temperature threshold for sunburn necrosis is 100 to 104°F for cucumbers; 105 to 108°F for peppers, and 125 to 127°F for apples. Fruits with sunburn necrosis are not marketable. Injury may be white to brown in color.

The second type of sunburn injury is sunburn browning. This sunburn does not cause tissue death but does cause loss of pigmentation resulting in a yellow, bronze, or brown spot on the sun exposed side of the fruit. Cells remain alive, cell membranes retain their integrity, cells do not leak, but pigments such as chlorophyll, carotenes, and xanthophylls are denatured or destroyed. This type of sunburn browning occurs at a temperature about 5°F lower than sunburn necrosis (i.e. 115 to 120°F in apples). Light is required for sunburn browning. Fruits may be marketable but will be a lower grade.

The third type of sunburn is photooxidative sunburn. This is where shaded fruit are suddenly exposed to sunlight as might occur with late pruning, after storms where leaf cover is suddenly lost, or when vines are turned in drive rows. In this type of sunburn, the fruits will become photobleached by the excess light because the fruit is not acclimatized to high light levels, and fruit tissue will die. This bleaching will occur at much lower fruit temperatures than the other types of sunburn. Damaged tissue is often white in color.

*Dr. Johnson is the Extension Vegetable & Fruit Specialist at the Univ. of Delaware. From the **Weekly Crop Update**, Univ. of Delaware Extension, Vol. 25, Issue 17, July 21, 2017.*

High Soluble Salts a Problem in Some High Tunnels

Gerald Brust

Over the years several high tunnel (HT) growers have complained to me about how after 4-5 years of growing various vegetables (although tomatoes were the most grown) in their high tunnel they are seeing poorer yields and 'unthrifty plants'. This seems puzzling because they have put a great deal of compost in their HT and the soil looks great. The problem I think is high soluble salts in the soil which will damage overall plant fitness and yield. These excess soluble salts often come from fertilizers applied frequently without sufficient water to leach them through the soil. Besides synthetic fertilizers other soil amendments with high salt concentrations include manure and compost. The most common scenario that results from high soluble salt levels in the soil is plant drought stress as soil water is drawn away from plant roots to the high soluble salt regions in the soil. Root cells lose water resulting in wilted foliage and roots that are badly damaged.

However, another scenario that I think is happening a great deal more often in our high tunnels is when plant roots absorb the excess salts in the soil and are unable to metabolize them. The soluble salts enter the roots and are moved through the water conducting tubes to the leaves where the water evaporates, gradually concentrating the salts to toxic levels. The consequence of this type of salt stress in plants is a myriad of problems such as: poor growth, thin canopy, excessive leaf drop, poor fruit set and poor yields with the next damage level up being brown or necrotic leaf edges especially on older leaves that can curl (Fig. 1).

Some of the practices that can exacerbate the salt problem include: allowing the soil to become too dry for even a short time, frequent brief irrigations, short crop rotations, shallow or minimum tillage and little if any soil flooding. Some of our vegetable crops are much more sensitive to high soluble salts than others. Crops such as green beans, onions and peas are most sensitive while cabbage, cucumbers, peppers and potatoes are a little salt tolerant and broccoli, squash and tomato are moderately salt tolerant. These differing sensitivities may be why if tomatoes are grown most often in the HT and then peppers or cucumbers are grown the soluble salt problem can 'suddenly' appear.

Some of the possible in-season remedies for high salts include stopping the use of all fertilizers until salt concentrations return to acceptable levels, having adequate drainage to help move salts out of the root zone and flushing the soil with as much water as possible for several days (water should be applied slowly so it seeps down into the soil and does not runoff). After the season it may be best to take the plastic off of the HT and allow rain and snow to move the salts out of the growing zone.



Figure 1. Soluble salt damage to peppers in a high tunnel.

Dr. Brust is the IPM Vegetable Specialist, Univ. of Maryland. From the **Weekly Crop Update**, Univ. of Delaware Extension, Vol. 25, Issue 16, July 14, 2017.

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VEGETABLE PRODUCTION

About Phosphorus Acid (PA) Fungicides

Angie Madeiras and Susan B. Scheufele

What are they? Phosphorous acid (PA) fungicides, also referred to as phosphite or phosphonate fungicides, are effective in controlling plant diseases caused by oomycetes such as downy mildews, and species of *Pythium* and *Phytophthora*. They have targeted activity against oomycetes since these organisms contain phosphonate in their cells (fungi and bacteria do not), and have a unique mode of action which directly inhibits growth and development of oomycetes, and may also trigger plant immune response. Because of their broad activity against oomycetes the potential for rapid resistance Figure 3. 2016 ECB trap captures in NH Figure 4. 2016 FAW trap captures in NH Figure 5. 2016 CEW trap captures in NH 5 development is not as strong as with some other oomycete-specific, systemic fungicides, and therefore are great tools to use in rotations with other materials. Furthermore, PA fungicides are systemic within the plant, and unlike most other systemic fungicides, they can be transported by both the xylem and phloem, and therefore can move up and down in the plant. Because of this they are very useful in controlling soil-borne diseases e.g. damping off caused by *Pythium* spp. And *Phytophthora* blight caused by *P. capsici*. Another benefit is that because of their low toxicity, PA fungicides are considered biorational, though they are not approved for use in organic systems.



Consider using phosphorous acid fungicides through drip lines to control *Phytophthora* blight in peppers. Photo R. Hazzard.

How do they work? PA fungicides interfere with phosphorous metabolism in oomycetes by diverting ATP (chemical energy) from other metabolic pathways, resulting in decreased growth, and by inhibiting function of certain enzymes involved in growth and development. The active ingredient in PA fungicides may seem confusing, often going by different names, but basically when phosphonic acid is neutralized with an alkali salt such as potassium hydroxide (KOH), salts of phosphorous acid are produced (trade names include Fosphite, Prophyt, and K-Phite). Alternatively, phosphonic acid can be neutralized with ethanol and aluminum to form fosetyl-Al (trade name Aliette). This is how you get different active ingredients within the PA fungicides group, FRAC Group 33. All of these materials release phosphite when mixed with water, and it is this phosphite (HPO_3^{2-}) that does the work. Phosphite ions interfere with phosphate metabolism in the oomycete, diverting chemical energy from other metabolic pathways and reducing growth. Phosphite ions have also been found to inhibit several key enzymes needed for growth and development in *Phytophthora* spp.

PA products should not be confused with phosphate or phosphonate fertilizers. Despite the similarities, these com-

pounds behave very differently in plant tissues. Phosphate (PO_4^-) is the main source of phosphorus nutrition for plants. Phosphate is not a natural breakdown product of phosphorous acid, nor is phosphorous acid or phosphite transformed into phosphate within plants. Some soil microbes can transform phosphite into phosphate, but this process is very slow and its effects are negligible on crop nutrition. PA products, therefore, do not provide plants with phosphorus in a form that can be utilized as a nutrient.

Using PA Fungicides

Always read product labels thoroughly and follow label directions.

PA fungicides are extremely useful tools in managing development of resistance to targeted, oomycete-specific, systemic fungicides for which resistance development can be rapid. Because of the broad activity, the risk of resistance development is low for PA fungicides; however, resistance has been reported in some *Phytophthora* species (not *P. capsici* or *P. infestans*) so you do still need to rotate chemistries to prevent development of resistant populations.

Phosphite ions are readily taken up and translocated throughout plants. They are very stable and persistent in plant tissues; for this reason, PA products need to be applied less frequently than many other fungicides.

PA has an average pH of 6-7, so it is only slightly acidic, but it is wise to avoid mixing PA products with copper fungicides, as the acidity increases the potential for copper phytotoxicity to occur. Phytotoxicity may also be a concern when PA products are mixed with sulfur, fertilizers, surfactants, or other pesticides. Test tank mixes on a few plants before spraying an entire crop.

Various studies have shown phosphorous acid fungicides to be effective protectants, but like most fungicides, they are not curative.

For information on fungicides for specific crops, consult the [Mid-Atlantic Commercial Vegetable Production Recommendations.]

Examples of Effective Use

Phytophthora blight. Some populations of *P. capsici* have become resistant to Ridomil, which was often used to drench plants in the early season, but may not be effective in fields with a long history of treating the disease this way. PA fungicides offer an alternative. Since they work on *Phytophthora* species and can move easily up and down within the plant, they can be used as soil drenches at planting or in the early season, or as foliar sprays once plants vine out or once fruit is present on the ground. Furthermore, they can be used in drip irrigation systems for row crops like peppers which are also very susceptible to *Phytophthora* blight.

Basil downy mildew. PA fungicides are some of the more effective materials available to control basil downy mildew. Again, because the material can move within the plant, the lower leaf surfaces where sporulation occurs will be well protected. PA fungicides have very low toxicity and are considered biorational, and have no pre-harvest interval.

Ms. Madeiras and Ms. Scheufele are with the Univ. of Massachusetts Extension. From **Vegetable Notes for Vegetable Farmers in Massachusetts**, Univ. of Mass. Extension, Vol. 29, No. 16, July 27, 2017.

Pumpkin Foliar Disease and Fruit Rot Management Considerations

Kate Everts

Pumpkins are attacked by many diseases, which makes designing a spray program very difficult. Below are some guiding ideas for management of pumpkins.

There are three areas that growers should address; 1) a general 'backbone' program, 2) diseases such as downy mildew and *Phytophthora* crown and fruit rot, which are not always present, and 3) fruit rots.

A backbone program should begin at the time that the vines begin to run or at the first sign of disease. This program targets many diseases such as anthracnose, white fleck *Plectosporium* (white speck), black rot, angular leaf spot and bacterial leaf spot. Below is a possible backbone program that can be modified to fit your situation:

Mancozeb + copper/A (sprays 1 and 2)

Once powdery mildew is present, a DMI fungicide (such as Rhyme, Rally, Procure, Proline, etc.) plus chlorothalonil (sprays 3, 5, and 7)

A powdery mildew specific fungicide such as Quintec, Vivando, or Torino, plus chlorothalonil plus copper (sprays 4, 8)

Microthiol Disperss 8 lbs/A (sprays 6)

Note: Sulfur can cause phytotoxicity, so use caution and read the label. Remember that coverage of foliage is important for optimum results.

Downy mildew and *Phytophthora* crown and fruit rot are also challenges and the timing management sprays differ. Downy mildew should be sprayed for preventatively, but does not always occur in our area. To avoid unnecessary sprays, scout fields, keep informed of downy mildew sightings in your area and follow the ipmPIPE for cucurbits (<http://cdm.ipmPIPE.org/>).

There are many foliar fungicides that are available for downy mildew on pumpkin. They include Orondis, Ranman, Presidio, Revus, and others (see [Mid-Atlantic Commercial Vegetable Production Recommendations]). This publication also has information on *Phytophthora* blight, which is managed with alternated sprays of Revus or Ranman and Presidio, Forum or Tanos. If you are planting into a field that has had *Phytophthora* in the past, a mefenoxam application (Ridomil Gold or Ultra Flourish) should have been applied pre-plant. In addition, foliar applications of Revus or Ranman in alternation with Presidio, Forum or Tanos may reduce disease.

Managing Fruit Rot - Because many different fungi cause fruit rots, no single strategy will be sufficient to manage them. However the following are good practices that, when used together, can minimize damage.

- Select well-drained fields for pumpkin production.
- Select cultivars (varieties) that are less susceptible to fruit rot. For example, there are some cultivar differences in susceptibility to white speck.
- Grow pumpkins on a no-till cover crop. No-till pumpkin production reduces several fruit rots and the reduction in rot is related to the amount of soil coverage that the cover crop provides. A hairy-vetch and rye mixture would provide nutrient benefits and improve fruit quality by reducing rot and edema.
- Follow a good fungicide management program in the field. The same fungi that cause white speck, black rot and

anthracnose also cause lesions on the leaves. If the leaves are protected from disease, the fruit will be less likely to become diseased.

- A good fungicide program also will maintain foliage health and keep sunscald at a minimum.
- Bacterial spot on fruit can be controlled with copper fungicide applications that begin when fruit are softball size and continue through fruit set.
- Harvest mature fruit as soon as possible.
- Discard damaged and diseased fruit.
- Avoid wounding the fruit during harvest and transport.
- Store fruit in a cool, shaded and dry location.

One question that I often get is "What about washing fruit?" Because many fungi infect fruit in the field (preharvest) or are seed borne (*Fusarium* fruit rot), a good field fungicide program will be more effective than washing fruit in reducing fruit rot. However if you do wash fruit, remember that untreated wash water is an excellent way to spread the pathogen from fruit to fruit. A solution of 150 ppm sodium hypochlorite, which is approximately 1/3 oz. household bleach per gallon water will minimize fruit to fruit spread. Fruit should be dried following the wash and stored properly.

Dr. Everts is the Vegetable Pathologist at the Univ. of Delaware and the Univ. of Maryland; From the Weekly Crop Update, Univ. of Delaware Extension, Vol. 25, Issue 14, June 30, 2017.



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BERRY PRODUCTION

Spotted Wing Drosophila Season Is Early This Year

Kathleen Demchak



Spotted wing drosophila male under a berry. Photo: K. Demchak

Given the mild winter and earliness of berry crops this year, it's not a big surprise that spotted wing drosophila presence is early, too.

We caught one female in one of our 18 traps the week of June 19, and one female in each in three traps out of 18 the week of June 26. That means that it's time for growers to be

spraying with effective labeled insecticides, weekly if not more frequently, to protect susceptible berry crops from spotted wing drosophila (SWD).

Cultural methods of management that reduce numbers include:

- using exclusion netting if in tunnels
- maintaining narrow rows to reduce humidity and allow better spray penetration
- harvesting more frequently—with raspberries, every day if possible
- refrigerating harvested berries as close to 32 degrees as possible

Growers can monitor with traps, check for larvae in fruit, and watch for juice stains on the receptacles of raspberries during harvest as indications of SWD presence. Or, just assume that SWD is around, because it very likely is.

Thanks to Maria Cramer, our graduate student who is working on SWD management research, for trap deployment and monitoring.

Ms. Demchak is with the Dept. of Plant Science at Penn State Univ. From the **Vegetable, Small Fruit and Mushroom Production News**, Penn State Extension, <http://extension.psu.edu/plants/vegetable-fruit/news/2017/>, July 3, 2017.

Growth Regulator Herbicide Damage to Grapes

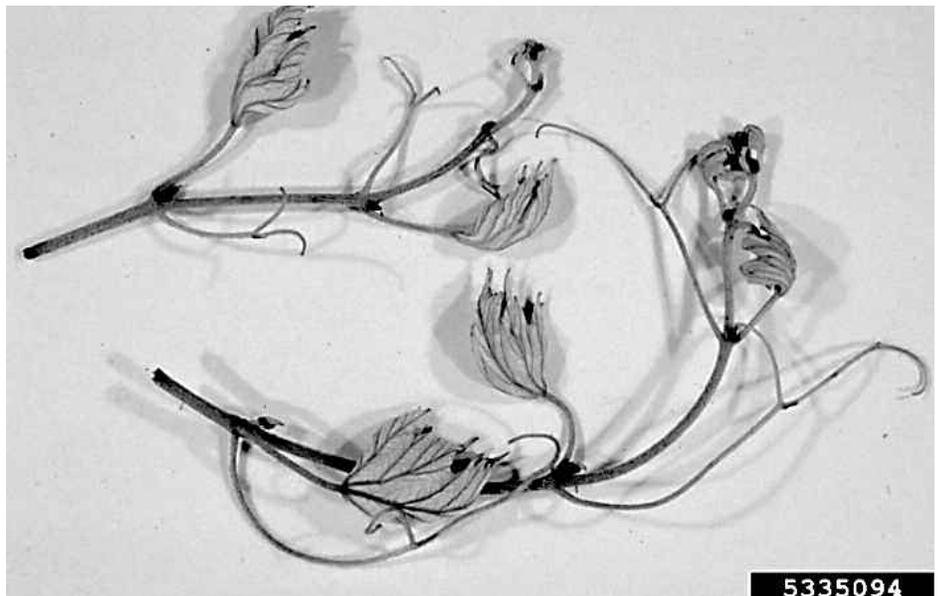
Gordon Johnson

We have recently identified growth regulator herbicide damage in a commercial vineyard.

Late April and May is often the time that we see severe damage to grapes from growth regulator herbicide drift, most commonly 2,4-D, which is used in herbicide burndown programs for no-till field crops (soybeans). Dicamba can also cause severe damage and is often applied to turf, lawns, pastures, and hayfields. Vineyards next to areas where these growth regulator herbicides will be applied will be at high risk of injury from off-target movement (volatilization and drift). Grapes are very sensitive to these compounds and injury can occur at levels 100 times lower than labeled rates.

Grapes are most sensitive when new shoot growth is occurring prior to flowering. When exposed to 2,4-D or dicamba at this critical growth stage, the new growth will show severe leaf distortion and stunted shoots. In the most severe cases shoots will die. Grapes will have poor fruit set and low yield when exposed prior to and during flowering. When grapes are exposed later in the season, while leaf and shoot symptoms may be present, there is usually minimal yield loss. Grapes may eventually grow out of 2,4-D damage and produce normal leaves; however dicamba damage may cause abnormal growth throughout the season.

Grape growers and vineyard managers should work closely with neighboring farmers or property managers and educate



2,4-D damage to grape shoots. Photo from Virginia Tech Learning Resources Center, Virginia Polytechnic Institute and State University, Bugwood.org.

about the need to avoid growth regulator herbicide applications in late April and May near the vineyard. Planted windbreaks and screens can help reduce movement but will not replace distance or vineyard isolation as a management tool.

From the **Weekly Crop Update**, Univ. of Delaware, Vol. 25, Issue 8, May 19, 2017.

VEGETABLE PRODUCTION

CLASSIFIEDS

Using Copper... (continued from page 15)

ple formulations with the same trade name (eg. Badge X2 and Badge SC, of which only Badge X2 is OMRI approved).

High Tunnel and Greenhouse Considerations

- Read the label to be sure that a product is not restricted from use in the greenhouse. Many copper products are.
- The same protective gear and restricted entry interval would apply.
- Apply with sides open for ventilation.
- Most labels require that in addition to the standard REI, an eyewash station and notice of eye risk should be available for 7 days after application.
- If you suspect late blight, have the disease identified. Fulvia leaf mold, powdery mildew, and Botrytis gray mold or ghost spot are common diseases in high tunnel tomatoes and can look very much like late blight.
- If tomatoes (or other crops on which copper is used) are grown in the same area year after year, and copper is used, build-up in the soil is more likely. Include copper levels in your annual soil testing. Rotate to other crops!

Ms. Scheufele and Ms. Hazzard are or formerly were with University of Massachusetts Extension. Adapted from T. Zitter & D. Rosenberg, Cornell Plant Pathology, E. NY Commercial Horticulture Weekly Vegetable Update. June 26, 2013.

Reprinted here from the Vegetable Notes for Vegetable Farmers in Massachusetts, Univ. of Mass. Extension, Vol. 29, No. 14, July 13, 2017.

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