

Herbicide Drift and Specialty Crops

By Justin Keay

A statewide interview of Missouri specialty crop growers occurred in 2019, as part of a research project titled *The Economic Viability of Expanding Fresh and Processed Fruit and Vegetable Production in Missouri*¹. Growers indicated that herbicide drift is a serious barrier to fruit and vegetable production expansion in Missouri and emphasized the investment risk associated with high-value specialty crop acreage. Some growers mentioned losing markets for their specialty crops because they couldn't guarantee their clients that their produce was free of herbicide drift.

MU Extension Horticulture Specialists receive calls from across Missouri every year related to suspected herbicide damage in home gardens and fruit and vegetable farms. The cost of an herbicide drift event can be substantial even on small plots of high-value specialty crops.

Protecting Crops from Drift

Communicating with neighbors is a key step in preventing herbicide drift. Inform neighbors of the presence of sensitive high-value crops, and that crop damage or total loss can occur from drift events.

Specialty crop growers are encouraged to use the website *driftwatch* <https://driftwatch.org/>, to register the location of their specialty crop fields. Pesticide applicators are encouraged to view the *driftwatch* website prior to application of pesticides, to locate sensitive sites that may be impacted by their application. However, pesticide applicators are only required to consult with *driftwatch* if using approved over the top herbicides containing dicamba, including Engenia, Xtendimax, and Tavium. The *driftwatch* website also sells signage to put at field borders to alert neighbors and applicators of the presence of sensitive crops. The high-contrast signage contains language such as "Specialty Crop DO NOT DRIFT".

If assistance is needed in registering specialty crop fields on *driftwatch*, contact the local MU Extension office.

Windbreaks may be planted at field borders to reduce wind speeds across the landscape. It is possible that windbreaks may offer some protection from herbicide drift, however best management practices related to species selection and windbreak design for herbicide risk mitigation have not been extensively studied. The USDA Natural Resource Conservation Service offers technical resources related to windbreak design, as well as cost-share practices for windbreak plantings that protect soils and crops from wind effects. Contact the local USDA office for more details.

Identifying Signs of Drift

When a drift event occurs, it is common to see an abrupt change in crop appearance across an entire planting of a crop, and possibly across several or all crops. The two most common culprits are the broadleaf herbicides Dicamba and 2-4,D. An occurrence of a drift event on a specialty crop farm can cause a major loss of investment and income, especially when considering perennial fruit crops.

Some of the crops that are most sensitive to common broadleaf herbicides include tomatoes, as well as legumes such as green beans and peas. Growers might notice that leaves of plants begin cupping upward and appear distorted in shape. Plants may die, and surviving plants are likely to have decreased yields. Following an herbicide drift event, leaves on a tomato plant may be curled upward, and new growth may show leaf elongation and parallel veination.

The source of Dicamba and/or 2-4,D may include drift from neighboring crop fields, pastures, utility right-of-ways, ditch/shoulder maintenance on highways and roads, as well as lawns and turf.

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There are 2 ways that Dicamba and/or 2-4,D can move off-site and damage neighboring crops. One way is known as particle drift, where spray-droplets are moved across the landscape in wind, this happens at the time of application. The 2nd way is what is known as volatilization, where herbicide residue turns into a gaseous vapor that moves across the landscape. This occurs most commonly during inversion events. Inversion occurs when air near the soil surface is cooler than air higher in the atmosphere. As the vapor rises from the foliage or plant residue it is trapped in cooler and denser air near the soil surface. The vapor then travels across the landscape where it can damage sensitive crops and plants. This contrasts with non-inversion conditions, where vapor travels upwards into the atmosphere. Herbicide drift is most likely to come from adjacent/neighboring fields, while volatilized herbicide can travel much farther offsite.

If it suspected that crops might have been impacted by herbicide drift, reach out to the local MU Extension office to connect with the Horticulture Specialist. The Horticulture Specialist will assist in ruling out other potential causes affecting plant appearance, such as physiological leaf roll, an environmental disorder caused by high winds that can cause tomato leaves to curl upward.

Documentation and Recordkeeping

When suspected drift occurs, it is recommended that several actions be taken as soon as possible to record information related to the event. Gathering information is important whether seeking to only discuss with a neighbor, the incident is reported to the Missouri Department of Agriculture and/or pursuit of civil action is taken. Information recommended for records includes the date of application (if known), weather conditions at the time of application, and the date symptoms of drift were identified. It is suggested to take time-stamped and geo-tagged photographs of affected crops. Consider record the quantity of crops affected, as well as expected yields and sales revenue. Gather historical data from the affected farm related to yields and sales prices. Broadleaf herbicides can degrade in the environment within several weeks and may become undetectable when analyzed. Samples of plants damaged by drift need to be taken as soon as possible and placed in a zipper storage bag in the freezer.

Talk to Neighboring Farmer(s)

Prior to filing a pesticide incident with the Missouri Department of Agriculture, or pursuing civil action, growers may choose to talk to neighboring farms that they suspect may have been the source of a drift event. In some cases, identifying the site where pesticide drift has occurred can be challenging. Talk openly with neighbors about concerns and inquire what herbicides were applied to neighboring fields, and when they were applied. These conversations will allow for a better understanding of the possible sources of a drift event, prior to laying blame on a neighboring farmer. Affected growers may work with neighbors to resolve the

situation through financial compensation related to the loss of investment and income from affected crops. Working with neighbors can lead to a resolution both parties are satisfied with, and lead to better communication in the future about application events. Resolving issues with neighbors negates the need to hire an attorney, saving legal costs that may surpass the value of the lost or damaged crop.

Reporting Drift Events to the Missouri Department of Agriculture

To file a Pesticide Incident Report with the Missouri Department of Agriculture, visit <https://agriculture.mo.gov/plants/pesticides/incidentreport.php> for an electronic submission portal, or call (573) 751-5504 to request that a form be mailed. If it is suspected that 2-4,D or Dicamba is the culprit, communicate this specific information to the Missouri Department of Agriculture within the report submission. Pesticide incidents must be reported within 30 days of the suspected drift event. If through investigation Missouri Department of Agriculture staff determine that herbicide drift is likely to have occurred, plant samples will be taken for laboratory analysis of suspected pesticides. If a pesticide applicator is found to be in violation of the Pesticide Use Act², warnings or fines may be issued. Missouri Department of Agriculture does not work with affected parties to obtain restitution for damages and/or losses.

Pursuing Civil Action

If a resolution cannot be made with a farm that is the source of a drift event, growers may choose to pursue civil action. The costs and benefits of pursuing civil action against a neighboring farm for crop losses related to drift, need to be weighed prior to taking action. Considerations related to the value of the crop loss and the cost of attorney fees are part of this decision process. If a decision is made to pursue civil action, it is recommended that consultation with an attorney proceed as soon as possible. An attorney may request that collected samples from affected plants be sent to a private lab for analysis, contact the lab prior to shipment to determine costs and best practices for shipping plant samples. If assistance is needed in identifying a lab, contact the local MU Extension office.

Resources

¹The Economic Viability of Expanding Fresh and Processed Fruit and Vegetable Production in Missouri – Interview Summaries, Marketing, Outlook, and Next Steps - John Kruse and Peter Zimmer University of Missouri – Columbia <https://fapri.missouri.edu/wp-content/uploads/2023/05/Part-1-The-Economic-Viability-of-Expanding-Fresh-and-Processed-Fruit-and-Vegetable-Production-in-Missouri.pdf>

²Missouri Pesticide Use Act - <https://agriculture.mo.gov/plants/pdf/pesticideuseact.pdf>

Produce Safety and Pesticide Safety Update

By Londa Nwadike

The safety of the produce you grow, as well as the safety of those who grow the produce is always important. University of Missouri (MU) Extension is happy to help produce growers with both of these areas.

Produce safety is important to the buyers of your produce, to ensure that it is meeting market as well regulatory requirements. MU Extension can offer a number of different produce safety trainings in your community if you are interested. We can work with you to schedule a time that works for your community. To schedule a training program, please contact Patrick Byers with MU Extension by phone 417-859-2044, email byerspl@missouri.edu, your local MU Extension office, or send a letter to Patrick Byers 800 S. Marshall St, Marshfield, MO 65706.

Contact MU Extension if you are interested in organizing any of the following produce safety trainings:

FDA Food Safety Modernization Act (FSMA) Produce Safety Alliance (PSA) grower training. This is an 8 hour training that will provide trainees with a certificate from the Association of Food and Drug Officials (AFDO) and will meet FSMA Produce Safety rule training requirements.

Produce Safety Annual Supervisor training. This is a ~90 minute training that will meet the annual training requirements of the FSMA Produce Safety rule. This training will also provide the latest updates on water quality and other

aspects of the produce safety rule, which is useful if you have taken the full FSMA PSA training in the past or if you have not taken the FSMA PSA training yet.

Some of you may have heard that in December 2021, the US FDA proposed revised FSMA Produce Safety Rule requirements for water used on produce farms. Those requirements have not been finalized yet. However, testing the microbial quality of the water that you use both pre-harvest and post-harvest in your produce operation is still important for meeting regulatory requirements and produce safety audits will also require microbial testing. MU Extension is continuing to provide free microbial water testing for produce growers throughout all of 2023. You can get the test kits from your local public health department and can also return the water samples to your local public health department. Please check with your local public health department to ensure that you get the sample there at the right time of day and ideally on a Monday-Wednesday to be sure that the laboratory accepts and tests the sample.

If a buyer is asking that your produce be GAP certified, MU Extension has a program where MU can directly pay the auditor up to half the cost of your USDA or Quality Fresh GAPs audits. You will pay the other half of the audit cost to the audit company. At this point, this program will last until August 2024. If you are interested in this, you can just tell your GAPs auditor that you would like to participate in MU Extension's GAPs cost share program.

Example of WPS-labeled pesticide product statement

AGRICULTURAL USE REQUIREMENTS

Use this product only in accordance with its labeling and with the Worker Protection Standard 40 CFR part 170. This Standard contains requirements for the protection of agricultural workers on farms, nurseries, and greenhouses and handlers of agricultural pesticides. It contains requirements for training, decontamination, notification, and emergency assistance. It also contains specific instructions and exceptions pertaining to the statements on this label about personal protective equipment (PPE) and restricted-entry interval. The requirements in this box only apply to uses of this product that are covered by the Worker Protection Standard.

Do not enter or allow workers to enter treated areas during the restricted-entry interval (REI) of 12 hours.

PPE required for early entry to treated areas that is permitted under the Worker Protection Standard and that involves contact with anything that has been treated such as plants, soil, or water is:

- Coveralls,
- Chemical resistant gloves made of any waterproof material,
- Shoes plus socks and
- Protective eyewear.

Special Eye Irritation Provisions: Chlorothalonil in this product is a severe eye irritant. Although the restricted entry interval expires after 12 hours for the next 6.5 days entry is permitted only when the following safety measures are provided:

1. At least one container designed specifically for flushing eyes must be available in operating condition at the WPS required decontamination site intended for workers entering the treated area.
2. Workers must be informed, in a manner they can understand:
 - that residues in the treated area may be highly irritating to their eyes
 - that they should take precautions such as refraining from rubbing their eyes to keep the residues out of their eyes
 - that if they do get residues in their eyes they should immediately flush their eyes using the eyeflush container that is located at the decontamination site or using other readily available clean water
 - how to operate the eyeflush container

Figure 1 Example of “Agricultural Use Requirements” found on a pesticide label.

MU Extension can also help answer any questions that you may have related to produce safety. Please contact Londa Nwadike at (913) 307-7391 or Patrick Byers at (417) 859-2044 or mail at 800 S. Marshall St., Marshfield, MO 65706 if you have questions related to produce safety.

MU Extension is working with Kansas State University Extension to offer a new training course and technical assistance on the US Environmental Protection Agency (EPA) Worker Protection Standard (WPS) Pesticide Safety regulations. WPS requirements are to protect those people working on your farm from exposure to pesticides that could be harmful to worker health. Farmers must comply with the EPA WPS if all three of the following apply:

- You own or manage an agricultural establishment (i.e., farm, orchards, nurseries, greenhouses, etc.), and
- Your work is directly related to producing agricultural plants, and
- WPS-labeled pesticides (herbicides, insecticides, fungicides, miticides, etc.) have been applied on your establishment within the last 30 days. WPS-labeled pesticides may be restricted-use pesticides or general-use pesticides. Look for the “**Agricultural Use Requirements**” box on the pesticide label (**Page 3, Figure 1**).

MU and KSU Extension are offering a WPS pesticide safety train-the-trainer at the Great Plains Growers Conference in St Joseph, MO, on Jan 11, 2024, from 10AM-5PM.

This training is important so that agricultural employers – including farms, orchards, nurseries, greenhouses and others – know what is expected of them related to pesticide applications and how to train their workers to be safe with pesticides. Participants will earn certification as a WPS trainer in order to train the people working on their farm to comply with EPA regulations for working with pesticides.

The WPS also provides information the specific pesticides used in the farm, where they are used, and what must be done to protect workers from exposure. The protections required include relevant Personal Protective Equipment, how to read and understand pesticide labels, signage and clear safety procedures. For more information on WPS and on the WPS Train-the-Trainer or to register for the free January workshop, contact Cal Jamerson of Kansas State University at 913-709-0281, email to agri@ksu.edu, or send a letter to Cal Jamerson, 22201 W Innovation Dr, Olathe, KS 66061. The workshops are available for free due to support by grant from the USDA Extension Risk Management Education program.

Timber Rot of Tomato

By David Trinklein, University of Missouri and Zelalem Mersha, Virginia State University

Timber rot is a sporadic but devastating disease of tomato that can cause significant plant and yield loss if cool weather and high humidity prevail for a long duration. The increasing number of greenhouses and high tunnels that grow tomatoes year-after-year has made the disease much more prevalent today, compared to decades ago.

Timber rot (sometime called “white mold”) is a stem rot disease that is caused by the fungus *Sclerotinia sclerotiorum*. The fungus has a wide host range of over 300 crops and frequently vegetables such as beans, cabbage, lettuce, sunflower, carrots, cucumbers, peas, pumpkins and squash. A number of common weeds such as lambsquarters, pigweed, Canada thistle, and wild mustard also are susceptible and can serve as a source of infection.

Symptoms of timber rot mostly begin as water-soaked areas from the stem axils or in stem joints, either at or above the soil level. The fungus enters from the plant at the soil level if senescent tissue is present. Once established, the disease progresses from these areas. In time, the stem becomes covered with white “cotton-like” fluffy mycelium and girdled; later, the water-soaked area becomes dry, discolored (bleached appearance) and hard; and the plant (eventually) wilts, collapses, and dies.

As the disease progresses, hard, grayish-black sclerotia about the size of a plump grain of rice develop inside the stem. Sclerotia are hardened masses of mycelium containing food reserves. Their role in the life cycle of the disease organism is to detach from the host and remain dormant (in the soil) until environmental conditions favorable for infection occur. Slicing the diseased stem longitudinally reveals these embedded structures, making positive identification fairly easy.

Timber rot infection usually does not occur until after flowering has begun. At this time soil moisture usually is high and soil temperature low because of the shading provided by leaves. Under this combination of cool, moist conditions, the above-mentioned sclerotia produce mycelium that infect the stem of the plant.

These sclerotia also produce sexual spores called ascospores from structures called apothecia (cup or little mushroom like structures). Ascospores of timber rot are wind-borne and can cause infection within several days after landing on the leaf of a plant. Again, cool (e.g. 60-70° F), moist conditions favor infection.

Timber rot in greenhouses and high tunnels that produce tomatoes year-after-year is problematic because of the buildup of sclerotia in the soil from diseased plants of previous crops. Crop rotation along with less favorable environmental conditions makes timber rot on outdoor tomato plantings much less of a problem.



Typical symptoms and signs of timber rot disease on tomato plant (right), and close-up pictures of the infected stem showing mycelia (middle) and sclerotia (right). Photo credit: Z. Mersha, LUCE

Control of timber rot should follow an IPM approach. First, rotating tomatoes with non-susceptible crops can reduce disease inoculum. Unfortunately, this is not an option for most greenhouse or high tunnel tomato growers. Even then, the fact that this fungus attacks a broad range of crops makes the smart rotation option very difficult. For field plantings, however, rotating grasses like corn or small grain will help slow down the inoculum buildup.

Deep plowing (e.g. at least 12 inches) can help to reduce disease severity by reducing the number of sclerotia at the surface of the soil. However, disturbing the soil through tillage will reduce the effectiveness of this practice by bringing the sclerotia back up to the surface.

Strict sanitation is helpful in managing the disease. This includes carefully removing, burying and destroying diseased tissues and plants, thereby reducing the number of sclerotia allowed to remain in the soil to infect next year's planting. Also, maintaining a "plant free zone" around the perimeter of the greenhouse is recommended. This practice will make it more difficult for ascospores from infected host species surrounding the greenhouse to enter. Additionally, it helps control insect entry into the greenhouse.

Pyraclostrobin (Cabrio®) and fluxapyroxad + pyraclostrobin (Priaxor®) are two materials labeled for the suppression of timber rot on tomato for outdoor plantings only. Both are labeled use on a number of crops for the control of a wide variety of fungal diseases.

For greenhouses that already have an established history of timber rot, the beneficial fungus *Coniothyrium minitans* sold under the brand name of Contans® holds a promise. This biocontrol agent colonizes the soil of a greenhouse and feeds on timber rot sclerotia in the process. According to label directions, Contans® should be applied at least three months prior to planting to allow the fungal organism to destroy sclerotia in the soil. Since Contans® is a living organism, proper storage conditions, handling, and proper timing of its application are needed to maintain its effectiveness. For any further information as to the rate and frequency of applications, growers are highly encouraged to read and follow the label of this product.

Currently, there are no varieties of tomato known to be resistant to timber rot.

Growing Lavender in Missouri

By Kelly McGowan



Left: State Horticulture Specialists Patrick Byers, Jennifer Schutter and Kelly McGowan. Right: Lavender research plot

2023 is the third year of lavender research being conducted by specialists from University of Missouri Extension. This research was in response to both commercial growers and homeowners inquiring about growing methods specific to Missouri, which are currently unavailable. Research plots are located at four locations: Springfield, Kirksville, Ste. Genevieve, and Mt. Vernon. The Mt. Vernon planting is in a standard high tunnel.

Lavender can be a viable crop for Missouri, but can also have some challenges. Lavender requires well-drained soil, both in winter and summer. This can be achieved by planting on raised rows or raised beds. Although lavender needs well-drained soil, it will also need supplemental irrigation for at least the first two to three years. New plants are becoming established during this time and will need this water during the hot, dry part of the summer. Spider mites can also be an issue during summer. Spider mites thrive during hot and dry weather and populations can quickly explode and spread throughout lavender plantings. Close monitoring for this pest is necessary. Winter protection is also recommended for lavender plantings in northern Missouri.

Lavender plants are typically rooted plugs that are planted in either spring or early fall. Site prep, including soil testing, should be done before plants are sourced.

Cultivar trials have been a part of this research on both *Lavandula* and English varieties. *Lavandulas* that have been successful include Provence, Phenomenal, Super, Gros Blue, and Grosso. English varieties include Hidcote, Munstead, Royal Velvet, and Folgate.

English varieties are the earliest to bloom anywhere between May and June, followed by *Lavandulas* throughout the rest of summer. Most plants will provide a heavy first bloom flush, followed by smaller yields throughout the growing season. Harvesting is done by cutting the flower spikes down to the plant's foliage. Drying can easily be done by hanging bundles upside down in a dry location.

Commercial grown lavender can be utilized many different ways. Agritourism is very popular with on-farm events consisting of you-pick days, crafts, and workshops. Essential oil distillation is also very popular with lavender producers. Many other value-added products can also be made from lavender including lotions and bath products, culinary items, dried floral arrangements, sachets, and many types of crafts.

For new lavender operations, sourcing plants in large quantities can sometimes be difficult and often have to be purchased online. Unfortunately, the plants sometimes struggle during the shipping process. More local production of lavender plants are needed. Fortunately, lavender is fairly easy to propagate from cuttings and growers are encouraged to learn to propagate their own replacement plants.

For more information on growing lavender in Missouri, contact Kelly McGowan at mcgowank@missouri.edu, call 417-874-2955, or mail inquiries to 2400 S. Scenic Ave. Springfield, Missouri 65807.

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The Missouri Produce Growers (MPG) bulletin is published by the University of Missouri with funding support from the U.S. Department of Agriculture's Agricultural Marketing Service (grant AM22SCBPMO1152) and the USDA NIFA (National Institute of Food and Agriculture) CPPM – Extension Implementation Program. Its contents are solely the responsibility of the authors and do not necessarily represent the official views of the USDA.



Issued in furtherance of the Cooperative Extension Work Acts of May 8 and June 30, 1914, in cooperation with and funded in part by the U.S. Department of Agriculture. Director, Cooperative Extension, University of Missouri, Columbia, MO 65211. • MU Extension provides equal opportunity to all participants in extension programs and activities, and for all employees and applicants for employment on the basis of their demonstrated ability and competence without discrimination on the basis of race, color, national origin, ancestry, religion, sex, sexual orientation, gender identity, gender expression, age, genetic information, disability, or protected veteran status. • 573-882-7216 • extension.missouri.edu