Integrated Pest Management
University of Missouri

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Keeping Your Garden Healthy: Simple Tips for Preventing Plant Diseases

By Peng Tian

Gardening brings much satisfaction, providing good food for our families. It can be discouraging when plants get sick, especially when the weather makes it worse. Here are some ways we can help our plants stay healthy and produce well:

Choosing Wisely What to Plant

It's important to think about what you plant in your garden. If certain diseases affected your plants last year, it's often best not to plant the same ones, or ones related to them, in the same spot. This is called crop rotation. This means planting a different kind of crop in that area. This is because some of the things that make plants sick can live in the ground for several years. If these diseases are in the soil, planting the same plants there again can cause diseases and make the problem worse. For example, some soilborne diseases that affect tomatoes can stay in the soil for as long as 3 years and on stakes and tools for many months. So, it's good to plant something different like corn or beans in that spot for at least 3 years. Tomatoes are also related to potatoes, peppers, and eggplants, so it's often wise to avoid planting those in the same area too.

Pathogen-free Seed and Transplants

Pathogen that resides in the soil is hard to get rid of. Controlling diseases that are both soil borne and seed borne is extremely difficult. Therefore, gardeners should avoid saving seeds of the plants that had disease history from the previous years. It's wise to use good quality seeds, perhaps from a trusted source, or seeds that are known to be healthy. Transplants need to be purchased from reliable nurseries and examined thoroughly before planting.

Choosing Resistant Varieties

Among all the disease management strategies, the use of resistant varieties is considered the most effective and efficient. Yes, why not solve all the problems in the beginning?

When purchasing resistant varieties through the garden shop, gardeners should read labels to see what disease resistance is listed and corresponding level of resistance.

Finding the Right Place to Plant

Choosing the right spot for your garden is very important for healthy plants. A place where water drains well and that gets plenty of sunshine is best. Too much wetness can cause roots to rot, and shady spots can encourage disease on the leaves. If you're using a garden spot from last year, be sure to clear away all the old plants and roots, as these can hold onto things that make plants sick.

Vegetable Raised Garden Beds. Photo: Columbia Center for Urban Agriculture

Planting at the Right Time

Even though the weather may start to feel warmer in April and May, it's important to be patient. Young plants can be harmed by frost or cold weather. Also, cold ground can hurt the roots and make them more likely to get sick. It's best to be patient and plant according to the right time for each kind of plant and pay attention to the weather forecast.

Also in this Issue:

Giving Plants Enough Space

We all like a full garden, and it's good to share what we grow. But if plants are too close together as they grow, it can stop the air from moving around them well, which can lead to sickness. So, giving plants enough space and using things like stakes or supports can help keep the leaves off the ground and let the air flow better. Also, using mulch helps to keep weeds down and the soil moist.

Watering and Feeding Your Plants

We all know plants need water, but too much water can make them look like they're not getting enough. This is because the roots need air too. Too much water can weaken the plants and lead to problems like rotting seeds or young plants dying. When you water, try not to splash water onto the leaves, as this can spread pathogens. If you do need to water the leaves, it's best to do it in the morning so they have time to dry during the day. Besides water, plants also need good nourishment. Feeding them properly helps them stay strong and fight off sickness. You can also have your soil tested to see what it needs to help your plants grow well.

Keeping the Weeds Down

Weeds not only take away from your plants, but they can also bring pathogens and bugs. Besides using mulch, it's important to keep an eye out for weeds and pull them out. Keeping weeds down helps air move around the plants better and prevents too much wetness.

Dealing with Bugs

Dealing with bugs is like dealing with plant diseases. It helps to check your plants regularly for common garden bugs, so you can take care of them early before they cause too much trouble. Turning the soil in the spring can help get rid of some bugs that live in the ground.

Take home message

Just like people get sick easier when they are under stress, healthy plants are better able to fight off diseases and bugs. So, taking good care of your plants from the start, using good seeds, and choosing resistant varieties are very important for a healthy garden and a good harvest for your family.

If you are interested in submitting a plant sample to MU Plant Diagnostic Clinic to identify the disease problem, please drop it off to your local extension office or mail it to the following address:

MU Plant Diagnostic Clinic
1100 University Avenue, Mumford Hall Room 28
Columbia, MO 65211

We are happy to announce that the clinic is currently collaborating with North Central IPM center to offer FREE diagnostic services to all Missouri Amish and Mennonite clients in 2025.

Rodentia get off my property: Rodent Control for Farms and Home Landscapes By Eliza Pessereau

Have you ever sunk your tractor tire into a groundhog hole, or tripped over a vole tunnel? Or maybe you came across a tree in your orchard or yard that was girdled just above the soil line? Chances are this is due to one of a few gnawing rodents we have in Missouri: groundhogs, gophers, and voles. While other rodents like mice and rats can be an issue, these larger, native rodents tend to cause more damage in agriculture. Each type of rodent has a slightly different life cycle and can cause different damage specialty crop production by directly eating plant leaves, seeds, fruit, and roots, or indirectly by digging burrows that can displace soil and damage farm equipment.

Voles

(prairie vole – Microtus ochrogaster, woodland vole – Microtus pinetorum, meadow vole – Microtus pennsylvanicus)

- Small rodents (3-5.5 inches woodland vole, 4.5-7 inches for prairie and meadow voles) with short tails and legs and stocky bodies.
- Prairie voles are the most common in Missouri, while meadow voles mainly occur in the northern half of the state in upland sites near water, and woodland voles (also known as pine voles) are found in or near timbered areas.
- Life cycle: Voles prefer habitats with dense ground vegetation or leaf litter. They do not hibernate, and breeding occurs year-round, leading to large populations that peak every 3-4 years. Female prairie and meadow voles have 5-10 litters per year with 3-5 young per litter, while woodland voles have 1-6 litters per year with 2-4 young per litter. Voles live in colonies that often contain multiple generations and spend their time either mostly underground (woodland voles) or in constructed aboveground runways through vegetation that lead to underground dens prairie and meadow voles).
- Damage:
  - o Woodland voles
    - Girdling of trees and shrubs just below the soil surface, usually in fall and winter (look for irregular gnawing marks)
  - o Prairie and meadow voles
    - Tree or shrub girdling at ground level (differentiated from rabbit girdling, which occurs several inches above the ground level)
    - Clipped vegetation in runways

Image shows a gopher. Credit: Shutterstock

Gophers
(plains pocket gopher – Geomys bursarius)

- Small rodent (5-14 inches long) with cheek pouches used to store and transport food and nesting materials
- Primarily in western and northern Missouri
- Life cycle: Live in solitary burrows, breeding period is January through June, with young gophers being born April to the end of June. Females can have between 1 to 5 young.
- Damage:
  - o Soil disturbance in the form of mounds that are the result of tunnel digging
  - o Reduced plant vigor from feeding on and harvesting roots and vegetative growth of grasses and forbs (most noticeable on rangelands)

Refer to Kansas State University info sheet MF770, Managing Pocket Gophers (https://bookstore.ksre.ksu.edu/download/managing-pocket-gophers_MF770)

Image of voles.
Credit: Missouri Department of Conservation

Image shows vole runway. Credit: Kate Kammler

Image of a woodchuck. Credit: Missouri Department of Conservation

Groundhogs or woodchucks (Marmota monax)

- Medium-sized rodent (16-27 inches long) with a flattened tail about ¼ the length of its body
- Common across Missouri except in the Mississippi Lowland
- Life cycle: adults hibernate in burrows in wooded or brushy areas from October to February. After emergence mating occurs and young are born in the end of March. Females can have between 2 and 9 young each year. Young groundhogs may begin digging their own temporary burrows in midsummer.
- Damage: Soil disturbance due to tunnel systems provide the greatest damage.
  - o Summer tunnel systems occur along fencerows and have 2-3 entrances with a mounded "porch". Entrance holes are 8-12 inches wide. Tunnels lead to a large chamber 3-6 feet underground that houses the nest. Excessive weight above the chamber can cause the ground to collapse.
  - o May feed on vegetable and fruit crops such as peas, beans, corn, apples or pawpaws

Refer to MU Extension info sheet G9452, Managing Woodchuck Problems in Missouri (https://extension.missouri.edu/publications/g9452)

Using Integrated Pest Management for rodents

Prevention

More than one type of prevention should be used because rodents can adapt to some of these methods. Avoid frightening devices intended to scare rodents with ultrasonic noise or flashes or light. Most studies have found these tools to be ineffective, as rodents can adapt to the device over time.

- Reduce available habitat by removing tall vegetation
- Increase predation by installing raptor perches to encourage birds of prey to visit your farm
- Protect trees with cylinders of hardware cloth
- Repellents:
  - Essential oils such as black pepper, bergamot, fennel, geranium, neem, and pine needle oils
  - Products with capsaicin from hot peppers (i.e. chili flakes)
  - Feces or urine from predators (predators should be species-specific, for example bobcat, Lynux rufus, urine to repel groundhogs)

Refer to MU Extension info sheet G9445, Controlling Voles in Horticulture Plantings and Orchards in Missouri (https://extension.missouri.edu/publications/g9445)

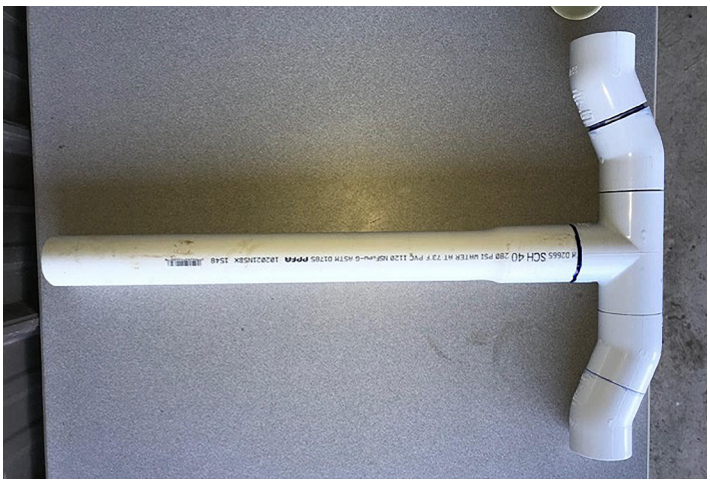
Monitoring

Monitoring the rodent populations on your farm can save you time and money in the long term by helping you establish a level of rodent damage that is negligible to your operation, and alerting you if damage begins to impact your bottom line. Depending on the size of your operation and type of crop/s you are producing, some amount of rodent damage may be acceptable. Scout for vole runways and signs of rodent burrowing in spring and fall. To look for signs of woodland voles, probe the ground around affected plants for tunnels 3 inches below the soil surface, using a ½ to ¾ inch stick. The apple test can be used to monitor where vole populations may become a problem, by excavating vole tunnels or runs and placing cubes of apple as bait. Follow up with control methods near test sites where apple is removed or partially eaten (for specific instructions see MU Extension info sheet G9445). Trapping without bait can also be used for monitoring (see more on traps in the next section).

Control

Similar to prevention, cycle through different methods of control to prevent rodents from adapting to one method. Avoid fumigating burrows because this is more likely to impact non-target wildlife.

- Traps
  - Cinch Traps and Trapline products are lethal traps that work well for voles and pocket gophers. These can be inserted into excavated tunnels or on above ground runways.
  - Wire-mesh box traps should be used for groundhogs because they are strong enough to escape from leg-gripping traps.
- Rodenticides
  - Home gardens: anticoagulants like chlorophacinone formulated as paraffinized pellets (sold as Rozol Rat and Mouse Bait Pellets) can be used. These products need to be used multiple times to kill the animal/s.
  - Orchards and farms:
    - Zinc phosphide (Prozap Agri-Brand or zinc phosphide Rodent Bait AG) can be used as a one-time rodenticide. Products with this active ingredient are restricted use pesticides and can only be purchased and used by a certified pesticide applicator. These products may impact other wildlife if not applied properly.
    - Anticoagulant baits with chlorophacinone and diphacinone can also be used in agricultural settings to control rodents with a lower risk to non-target wildlife.
  - Alternatives to rodenticides
    - Powdered plaster mixed with oats and sugar can be used as an alternative to rodenticides. This mixture is delivered in an inverted T bait station, first without plaster and then plaster is added to the mixture when the bait station needs to be refilled. Use 2 part oats, 2 part plaster, and 1 part sugar.
  - Rodenticide bait should be placed near the entrance of burrows and partially hidden to prevent non-target wildlife from consuming it.
    - Homemade inverted T bait stations can also be inserted into tunnels to deliver bait. Bait can be added to the base of the T (above ground), and capped to prevent water from entering.



Inverted T bait station used to control voles. The inverted T is created with the following PVC pipe sections: 1 tee, 4 22.5 degree elbows, 4 2.75in pieces of piping, 1 cap, 1 2ft pipe, and held together with cement. Credit: Philippe Pessereau, Atlas Vineyard Management

- Hunting
  - o Hunting during the prescribed hunting season is an acceptable mode of control for groundhogs, and damage-causing groundhogs can be hunted outside of this season.
  - o Damage-causing voles may also be shot or trapped to prevent further damage.
  - o Contact your local Missouri Department of Conservation staff person with questions.

Recommendations for the use of agricultural chemicals are included in this publication as a convenience to the reader. Any mention or listing of commercial products or service in this publication does not imply endorsement by MU Extension nor discrimination against similar products not mentioned. Individuals who use agricultural chemicals are responsible for ensuring that the intended use complies with current regulations and conforms to the product label. Be sure to obtain current information about usage regulations and examine current product labels before applying any chemical. For assistance, contact your local Extension office.

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Chemical Injection Calculations

By Juan Cabrera-Garcia

Often growers need to dose products to the irrigation system using injectors. How do you know how much sanitizer or product to add to the water to reach the desired concentration? In this article we give examples to show calculations to determine how much sanitizer to use with or without injectors.

Making these calculations is easy and you only need to know the following equation:

$$Ci \times Vi = Cf \times Vf$$

- ***Ci*** is the initial concentration of the active ingredient in the sanitizing product.
- ***Vi*** is the volume of the product that will be added to make the final solution.
- ***Cf*** is the desired concentration in the final solution.
- ***Vf*** is the final volume which includes the volume of product plus the water used to mix the product

***Tip:* The units for the concentration and volume must be same on both sides of the equation.**

For the examples below, we will assume that we need a final concentration of chlorine dioxide (ClO_2) of 2ppm and that the original concentration of the product is 2%. While chlorine dioxide is used as an example, the calculations can be used to determine proper dosage of other products such as pesticides and plant growth regulators.

1. Batch solutions with no injector

Assume you need to make 10 liters of water with a concentration of 2ppm Chlorine Dioxide (ClO_2). Usually, ClO_2 comes in tablets and the manufacturer will provide instructions on how much water to dissolve the tablets in to reach a desired concentration. Assume that the ClO_2 product gives a 2% product concentration when dissolved according to the manufacturer's instructions. To convert from % to ppm we use the conversion ratio of 1%=10,000ppm. Also, remember that 1ppm is the same as saying 1mg dissolved in 1 liter of water (1mg/L). We can start inserting our known variables to the previously shown equation.

- ***Ci:*** 20,000mg/L ClO_2 (from manufacturer's instructions to dissolve the tablets, 2% in this example)
- ***Cf:*** 2mg/L ClO_2 (our target concentration)
- ***Vi:*** ? (we don't know how much of the concentrated product we need to use)
- ***Vf:*** 10L (the final volume of product that we want to make)
- **Equation: 20,000mg/L x Vi = 2mg/L x 10L**

In this case we do not know how much of the sanitizing product to add to water to reach the final concentration. We need to solve the equation for Vi, which is the right side of the equation divided by Ci.

Vi = (2mg/L x 10L) ÷ 20,000mg/L
Tip: always do the calculations inside the parenthesis first

Vi = 0.001L or 1mL

Add 1mL of the product to 9,999mL of water.

2. Proportioner injector set at 1:100

Injectors take solution from a concentrated stock tank and inject the concentrated solution into the irrigation system. In this example the proportioner is set to 1:100, meaning that of 100 parts of a final solution 1 part came from the concentrated solution. This tells us that the final volume is 100 and the initial volume of concentrated solution is 1. In this case we need to figure out two things, 1- what is the concentration in the stock tank (concentrated solution)? and 2- how much product to dissolve to make the concentrated solution in the stock tank? We make the calculations in two steps:

Step 1: Stock tank concentration

Input the variables in the equation:
- ***Ci:*** ?
- ***Cf:*** 2mg/L
- ***Vi:*** 1L
- ***Vf:*** 100L

Equation: Ci x 1L = (2mg/L x 100L) → Ci = (2mg/L x 100L) ÷ 1L → Ci = 200mg/L

We just calculated that the stock tank that will feed the injector needs a concentration of 200mg/L. The next step will tell us how to make the stock tank solution.

Step 2: Product to add to make the stock tank solution (assume that the stock tank has 10L)

Input the variables into the equation. Notice that this one is similar to the batch solution example discussed previously. Your stock tank is your final solution, and you need to know how much of the product to add:

- ***Ci:*** 20,000mg/L
- ***Cf:*** 200mg/L (result from previous step)
- ***Vi:*** ?
- ***Vf:*** 10L (the stock tank volume)
- **Equation: 20,000mg/L x Vi = (200mg/L x 10L) → Vi = (200mg/L x 10L) ÷ 20,000mg/L → Vi = 0.1L or 100ml in 9.9L of water**

3. Peristaltic or positive displacement pump

These types of injectors operate using a different principle than mechanical proportioners or venturi injectors. The peristaltic pump pushes concentrated stock solution into a pressurized system. The volume added in each injection stroke will vary depending on the pressure inside the pipes. Peristaltic pumps also have a rated limit on how many injection strokes they can do per minute, and some allow you to change this value. The manufacturer must provide documentation showing how much **volume the pump injects per minute at different pressures (this is pump specific)**. Also, it is recommended that you test and calibrate this value on your farm. To do so, have a known volume of stock solution, run the system and injector for 10 minutes, measure how much stock solution is used, and divide the used volume by 10 minutes which will give you the injection rate per minute.

For this example, assume that your irrigation system has a flow rate of 10L per minute and 29psi. For this example, the pump's documentation shows that the pump can deliver 0.56 to 7.92mL per minute (depending on system's pressure) and that it can do 120 strokes per minute. The pump injects water to a pressurized system and the higher the pressure the lower the volume it delivers. For this example, we will use the manufacturer charts:

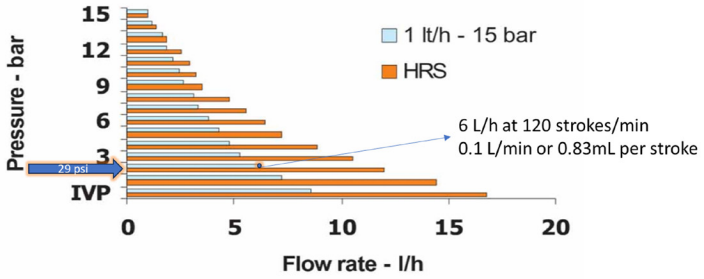


Figure 1 *Peristaltic pump flow rate at different pressures.*

For this specific pump, at 29psi it delivers 6L per hour or 0.1L per minute. Now that we have collected information, we can make the calculations the same way we did with the proportioner injection.

Step 1: Stock tank concentration (assume a 1-minute run time)

Input the variables in the equation
assuming a one-minute run time:

- ***Ci:*** ?
- ***Cf:*** 2mg/L
- ***Vi:*** 0.1L (from the pump manufacturer or the calibration step)
- ***Vf:*** 10L (from the system's flow rate, the system's flow rate is assumed to be 10L per minute)
- **Equation: Ci x 0.1L = (2mg/L x 10L) → Ci = (2mg/L x 10L) ÷ 0.1L → Ci = 200mg/L**

Step 2: Product to add to make the stock tank solution (assume a 10L stock tank volume)

- ***Ci:*** 20,000mg/L
- ***Cf:*** 200mg/L (result from previous step)
- ***Vi:*** ?
- ***Vf:*** 10L (the stock tank volume)
- **Equation: 20,000mg/L x Vi = (200mg/L x 10L) → Vi = (200mg/L x 10L) ÷ 20,000mg/L → Vi = 0.1L or 100 mL in 9.9L of water**

Consult with the manufacturer about compatibility of the injector with certain chemicals. Abrasive materials can increase wear of injector components.

4. Checking injector performance

Injectors wear out over time, impacting their accuracy. Manufacturers will provide replacement parts to maintain the injectors in shape. It is a good practice to check injector performance. The following steps show how to check the performance injector:

- Turn off water flow through the injection system
- Set the injector to 1:100. See table below for different injection ratios
- Disconnect the injector outlet from the downstream irrigation system
- Attach a hose to the injector outlet and place it in an empty 5-gallon bucket
- Measure 6.5 ounces of water in a cup
- Remove the strainer from the edge of the suction line
- Insert the suction line to the cup with the 6.4 ounces of water
- Turn on water flow through the injector
- The injector should suck the 6.4 ounces when the 5-gallon bucket is full

%	Ratio	Ounces of stock per gallon	Ounces of stock per 5 gallons
2	1:50	2.6	13
1	1:100	1.3	6.5
0.78	1:128	1	5
0.5	1:200	0.65	3.25

Table 1 *Ounces of stock solution injected at different injection ratios for every gallon and 5 gallons of solution exiting the injector.*

Service the injector if the values deviate from expected values. Injector manufacturers sell maintenance kits and gaskets to service the injectors.

Don't Let Contaminated Amendments Spoil Your Soil and Your Season

Justin Keay

Herbicide contamination of garden amendments is not a new problem, but it's one that impacts growers across Missouri every year and has the potential to cause major losses for those not aware of the issue. The problem originates with the use of several common broadleaf herbicides that are sprayed onto pastures (and sometimes fields of small grains such as wheat) to control broadleaf weeds. The active ingredients that are the most persistent and will be the subject of this article are picloram, aminopyralid and clopyralid.

Tomato plant from southeast Missouri showing signs of severe herbicide damage. This plot was amended with manure that was contaminated with persistent herbicides. Photo Credit: Katie Kammler

When hay or straw from fields treated with these products is harvested, the herbicide residue persists on the plant material, in some cases for several years after harvest. When hay is fed to livestock such as horses and cattle, the herbicide passes through the animal's digestive tract and is excreted in urine and manure. Even if the manure is composted thoroughly the herbicide can still persist. If manure or compost containing these active ingredients is applied to the soil, any broadleaf plant (most vegetables and all fruits) can suffer damage or total decline. In some cases, these herbicides can persist for several years in soil after the application of contaminated manure or compost. This can be a devastating situation for a grower, especially when growing space is limited or the application is made in a fixed structure, such as a high tunnel.

Close-up image of leaf distortion on a potato plant. The potatoes were planted in soil where contaminated manure had been applied. Photo Credit: Katie Kammler

There have also been incidents where hay or straw applied as mulch has caused damage to vegetable crops. One notable example in Missouri occurred when wheat straw and hay, applied as mulch in several high tunnels, released these persistent herbicidal compounds in a gaseous form (outgassing). The damage was noted several weeks after planting, when the high tunnel environment grew much warmer and expedited the outgassing process. In a field and greenhouse experiment, contaminated straw leached herbicides into the soil, causing dramatic yield reductions in strawberry crops. I don't know of any colleagues that have encountered issues with herbicide leaching from straw. This might be due to the fact that the levels of herbicide leached might be quite low, and to the untrained eye, no damage may be visible to crops.

Grass clippings from turf farms and golf courses can also be of concern. Products containing picloram, clopyralid, and aminopyralid are no longer labeled for homeowner use but are commonly used in commercial turf settings. However, homeowners might still use herbicidal products that can cause issues, such as broadleaf over the top sprays, or weed and feed products. Herbicides in these products can also cause problems for gardeners and growers.

Pepper plants showing signs of leaf distortion, note the "parallel venation" on the right, and normal venation on the left. Parallel venation is an indicator of herbicide damage. These peppers were planted in a high tunnel where hay was applied as mulch between the rows. The outgassing of herbicide from the hay affected the pepper plants. Photo Credit: Katie Kammler

It's hard to understand the true scope of the problem of herbicide contaminated inputs, but every year MU Horticulturists get reports from across the state from home gardeners and growers experiencing issues with herbicide contamination in amendments. The issue has been highlighted in many publications by various state's Extension services as a concern for both growers and home gardeners.

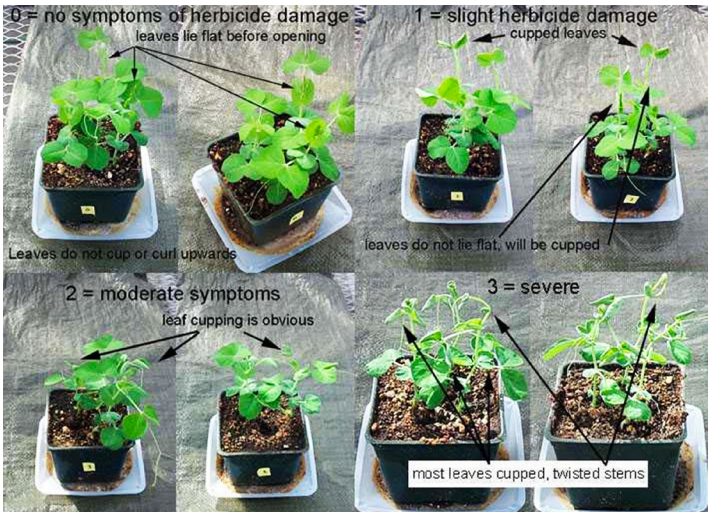
This issue of herbicide contamination might cause growers to question the use of inputs they have come to rely on. However, manure and compost remain valuable sources of plant nutrients and organic matter. Organic mulches such as straw and hay can moderate soil temperatures, retain moisture, provide weed suppression, and build soil organic matter. Use of these agricultural by-products can be a great way to reduce costs, eliminate waste, and retain valuable plant nutrients that take a lot of energy to mine, synthesize and transport.

There are several steps growers can take to protect themselves. First, ask questions of the suppliers of inputs and amendments such as; Do you know what herbicides were sprayed on this straw or hay?, Do you know if the hay fed to the livestock producing this manure was sprayed with herbicides, and if so what kind of herbicides?, Is your compost produced with manure, and do you know if the livestock producing the manure were fed hay sprayed with herbicides?. It should be noted that poultry litter and manure are generally free of persistent herbicides.

In some cases, suppliers of inputs and amendments might not know the answers to your questions about the use of the herbicides of concern listed in this article. If they don't know or are unwilling or unable to answer your questions, consider finding another source. Many herbicide applicators will know the brand name of the product, such as Grazon used on hay fields or Curtail used in wheat crops. However, they might not be familiar with the active ingredients found in a branded product. You can use a searchable database to quickly identify the active ingredients found in a product or contact your local MU Extension office for assistance.

Searchable databases can allow you to quickly search the brand name of a product and identify the active ingredients. The above example contains the active ingredient picloram, one of the persistent herbicides highlighted in this article.

The second way growers can protect themselves is to utilize a green been or pea bioassay test. Plants in the legume family, such as green beans and peas, are particularly sensitive to broadleaf herbicides and can be used to indicate whether they are present in amendments. To perform a bioassay test you need to have a sample you want to test (compost or manure) and a control (unamended peat-based potting mix). Fill several pots with only potting mix, and several pots with 2/3 potting mix and 1/3 compost. Plant the legume seeds into the pots and place a saucer under each pot so no water running through one pot contacts another pot. If herbicide residue is present in the sample, visible symptoms of damage will occur within 2-3 weeks. You can compare the plants in control and the sample pots for any morphological differences such as stem curling or leaf cupping. From my review of literature, there has not yet been developed a standard procedure to perform a bioassay of hay or straw mulches.



Peas showing symptoms of varying severity of herbicide damage from contaminated compost used in a bioassay test. Photo Credit: Washington State University

The last source of contamination I will touch on doesn't involve the use of inputs, but the use of land previously tended for crops, hay, or forage. Herbicides used on row crops and hay or forage crops sometimes have what is commonly called a "plant-back" or rotation restriction. These rotation restrictions are found on an herbicide label and indicate how long you should wait before you plant certain crops in a field previously sprayed with certain herbicides. For example, one of the herbicides highlighted in this article and labeled for wheat crops lists an 18-month rotation restriction for potatoes, beans, or peas. The restriction is in place to avoid crop injury and the potential for illegal herbicide residue levels in a harvested crop. If you are looking to rent land or purchase land for growing vegetables, ask the landowner questions about the use of the herbicides of concern on the land.

This tomato was planted in a high tunnel that was sited on land that was previously in pasture. The herbicide "carried-over" in the soil, causing the herbicide damage. Photo Credit: Katie Kammler

The moral of the story is to investigate the source of your amendments to protect yourself from the risks of herbicide contamination. If you know a grower that might benefit from this article, please share it with them to help protect them from the risk of herbicide contaminated inputs and amendments.

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