OREGON STATE UNIVERSITY EXTENSION SERVICE

Herbicide-Contaminated Compost and Soil Mix

What You Should Know — and What You Can Do About It

Photo: Howard F. Schwartz, Colorado State University, Bugwood.org

Bean leaves damaged by growth regulator herbicide. Herbicides in soil products can cause a range of injuries to plants.

Photo: Wastebusters, CC-BY-NC-ND 2.0

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OVERVIEW

- Compost and soil mix products sometimes contain herbicide residue. This residue can damage certain vegetable, fruit and flower crops.
- The residue likely comes from contaminated hay, grass clippings or manure. These materials may make their way into the regional composting system.
- Clopyralid and aminopyralid are examples of herbicides that persist through the composting process.
- Gardeners and landscapers should be aware of symptoms of plant injury from herbicides. Watch for stunted growth and distorted, curled leaves.
- If you applied purchased compost or planting mix and notice these symptoms, follow the guidelines below.
- Be wary of getting mushroom compost, animal manures and bedding to make your own compost. How will you know if the materials are contaminated or not?

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Photo: Mary Ann Hansen, Virginia Polytechnic Institute and State University, Bugwood.org

Figure 1. Distorted, cupping tomato leaves. This is a symptom of growth regulator herbicide injury.

Photo: Howard F. Schwartz, Colorado State University, Bugwood.org

Figure 2. Growth regulator herbicides distort the growing points of beans.

Photo: Doug Doohan, Ohio State University/ OARDC, Bugwood.org

Figure 3. Cucumber leaves elongate and cup following exposure to growth regulator herbicides.

SECTION 1

Identify herbicide damage

Herbicide damage from contaminated compost or soil mix is caused by growth regulator herbicides. These herbicides more often affect broadleaf plants. Look for distorted or cupped leaves. The damage occurs in new growth, including the ends of the shoots.

Crops prone to damage from this group of herbicides include (grouped by plant family):

- Beans and peas
- Tomatoes, peppers and potatoes
- Squash (summer and winter)
- Lettuce, sunflowers and dahlias
- Spinach, chard and beets
- Carrots and parsley
- Roses
- Grapes
- Hemp (*Cannabis sativa*)
- Other broadleaf plants

Look-alikes: nutrient deficiencies, plant diseases and insects

Rule out other causes of plant damage. Plant injury from nutrient deficiencies, plant diseases and insect pests can look similar to herbicide damage.

Suspect damage from herbicides when:

1. More than one type of plant is affected.
2. Damage appears on only one part of the plant(s).
3. You've ruled out other causes of plant damage.

5 KEYS TO SUCCESS

1. Before you purchase a bulk load of compost or soil mix, contact the vendor. Ask how they handle herbicide contamination risk. Have they reduced potential sources of contamination? Bioassay tests use plants such as peas grown in the compost or soil mix to check for abnormal growth caused by herbicide contamination. Chemical lab testing might not indicate herbicide contamination.
2. Perform your own bioassay test. Ideally, test the material before you apply a compost or soil mix product to your garden or landscape. See instructions in Section 3, page 4.
3. Watch your plants for herbicide injury such as distorted growth and cupped leaves.
4. If you observe these symptoms, rule out other sources of herbicide damage. Were herbicides applied nearby? Could that have damaged your plants?
5. Contact the vendor if you determine that contaminated compost or soil mix is the cause. Letting them know about the situation helps others avoid the problem.

Plants show signs of stress when they don't have the right nutrients at the right time in their growth.

For example, tomatoes with magnesium deficiency have yellow leaves with green veins. Damage affects the older leaves (at the bottom of the plant) (Figure 4, page 3).

Symptoms of nutrient deficiencies show in one kind of plant and not another. Herbicide damage often

presents in more than one type of plant.

Plant diseases such as viruses also cause stunted growth, distorted leaves and a mosaic pattern. The damage looks similar to herbicide damage (Figure 5).

To tell the difference, virus diseases usually affect several plants of one kind such as tomatoes or grapes. Herbicide injury will affect different kinds of plants.

Also, plant viruses don't cause distinct cupping, which is a symptom of herbicide damage.

Insects or mites also cause leaf distortion. The photo shows damage from erineum mites on grape leaves (Figure 6).

Insect damage occurs randomly on some leaves and not others.

Herbicide injury often presents on the tips, or growing points, of a plant's shoots.

Rule out other sources of herbicide damage

Is the herbicide injury a result of contaminated compost or soil mix, or another cause?

- Did you recently apply herbicides in the area?
- Did a road maintenance crew or your neighbors recently apply herbicides?
- Herbicides can be carried by the wind.
- Some products become a vapor on hot days and can injure nearby plants.

REPORT PESTICIDE COMPLAINTS

To report suspected contamination or file a complaint about an unresponsive vendor, contact the Oregon Department of Agriculture. ODA investigates pesticide complaints in Oregon. *ODA doesn't assist in the pursuit of damage reimbursements.*

Submit a pesticide complaint form as soon as possible after the incident. Complaints received after 30 days of when damage was first noticed will be filed, but may not be investigated.

English: Pesticide Incident Complaint Form, *https://www.oregon.gov/oda/shared/Documents/Publications/PesticidesPARC/PesticidesComplaintForm.pdf*

Español: Formulario de Queja de Pesticidas, *https://www.oregon.gov/oda/shared/Documents/Publications/PesticidesPARC/PesticidesComplaintFormSpanish.pdf*

Send your completed incident complaint form via email, postal mail or fax.

Oregon Department of Agriculture
635 Capitol St. N.E.
Salem OR 97301-2532
Email: pestx@oda.state.or.us
Phone: 503-986-4635
Fax: 503-986-4735

Photo: Bruce Watt, University of Maine, Bugwood.org

Figure 4. Magnesium deficiency symptoms in tomato leaves.

Photo: Gerald Holmes, Strawberry Center, California Polytechnic State University, Bugwood.org

Figure 5. Damage to tomato leaves from tobacco mosaic virus.

Photo: Lesley Ingram, Bugwood.org

Figure 6. Erineum mite damage on grape leaves.

Photo: normanack, CC BY 2.0

Figure 7. Compost ready for use in the garden.

SECTION 2

Take action

If you observe distorted growth or cupped leaves on your plants, determine the cause of the damage.

If you have applied compost or soil mix *and* ruled out other sources of herbicide damage, you may have herbicide-contaminated compost or planting mix.

What damage does herbicide-contaminated compost or soil mix cause?

Herbicide-contaminated compost affects plants prone to injury from growth regulator herbicides. It causes distorted or cupped leaves and growing points.

Do I need to do anything?

Yes. Don't eat produce from plants showing damage from herbicide contaminated compost or planting mix.

If the herbicide contaminated compost or soil mix has already been applied, don't plant crops prone to damage.

Take steps to remediate the soil as detailed in Section 3.

Can I eat produce from plants showing herbicide damage?

- The risks of ingesting produce showing signs of herbicide injury are unknown if you don't know the exact herbicide affecting your produce.
- For the lowest risk, discard any produce with signs of herbicide injury if the exact herbicide affecting your produce is unknown.

If you know the exact herbicide ingredient that caused herbicide injury, call the National Pesticide Information Center at 1-800-858-7378 to discuss potential risks and learn more about your options.

SECTION 3

Explore your options

Overview

- Perform a bioassay test to determine if you have herbicide-contaminated compost or planting mix. See instructions below.
- If you haven't yet applied the herbicide-contaminated compost or soil mix, use it for plants that aren't harmed by growth regulator herbicides. Turf grass, ornamental grasses, lilies, and other nonbroadleaf plants (monocots) aren't affected.
- If you've already applied herbicide-contaminated compost or soil mix to your vegetable garden, plant corn in the area. It likely won't be affected.
- To remediate herbicide contaminated soil, your options include:
  - **Do nothing.** Wait until the herbicide breaks down to plant crops prone to damage.
  - **Encourage soil life** (microbes) to hasten the breakdown of the herbicide.
  - **Plant a cover crop** to bioaccumulate the herbicide. Remove the cover crop and dispose of it in the trash. Or, put it where it will not cause further contamination.
  - **Apply activated carbon** or biochar to the affected area.
  - **Physically remove** the contaminated soil. Dispose of it in the trash or landfill.

Perform a bioassay to test compost or soil mix for herbicide contamination

Perform a bioassay test to determine if a compost or soil mix is contaminated with growth regulator herbicides. Compare plants grown in clean potting soil (the control group) with plants grown in the compost or soil mix in question.

How to perform a bioassay test

Follow the instructions below to test potentially contaminated compost or soil mix. The procedures were developed by Washington State University Extension, Whatcom County and adapted by Montana State University.

This procedure is also used to test for contaminated manure or animal bedding. Test unknown materials before you make your own compost.

Materials

- Test material (compost or soil mix)
- Potting soil (purchased, peat-based mix without compost as an ingredient)
- New 4-inch plastic planting pots
- Plant tags to label each pot
- Garden pea seeds
- Plastic bags
- Disposable gloves (use them for handling the soil)

Instructions

1. **Set up control pots.** Fill three pots with potting mix. Gently lift and drop pots to settle the soil. Label pots "Control."
2. **Prepare test pots.** Fill three pots with test material. If testing compost, mix two parts test material to one part potting mix in a clean plastic bag. Gently lift and drop pots to settle the soil. Label pots "Test."
3. **Plant three pea seeds in each pot.** Plant the seeds 1 inch deep. Record the planting date.
4. **Grow the pea plants.** All the pots should have similar growing conditions. Ensure all plants have consistent light, temperature and water.
5. **Evaluate plants.** Record germination dates for each pot (Record only if two of three pea seeds sprout). Grow the pea plants until three sets of leaves appear (14–21 days after seeds germinate). Compare plants grown in test material to the control pots grown in potting soil. Use Figure 8, Figure 9 and Figure 10 to determine the level of herbicide damage.

If you observe damage, the compost or soil mix is likely contaminated.

Don't use it to grow broadleaf plants prone to damage from growth regulator herbicides.

See below for more information about your options if you already have a contaminated product.

Figure 8. After three weeks of growth, pea leaves show slight cupping.

Photo: Washington State University Extension, Whatcom County

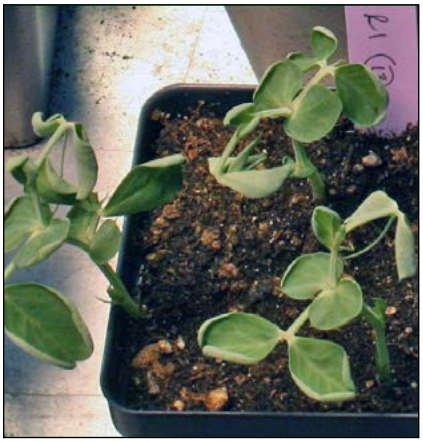

Figure 9. After three weeks of growth, pea plants are stunted and leaves show severe cupping, a sign of herbicide damage.

Photo: Washington State University Extension, Whatcom County

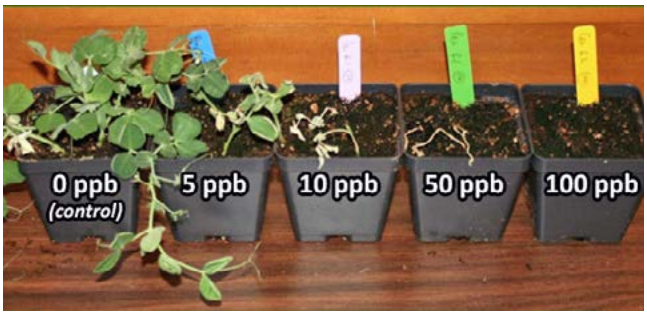

Photo: Washington State University Extension, Whatcom County

Figure 10. Results of bioassay text using known concentrations of growth regulator herbicide.

Use contaminated compost or soil mix for your lawn or in other areas

If you have a load of contaminated compost or soil mix, apply it to your lawn. Or, put it in planting beds intended for nonbroadleaf plants (monocots).

Herbicide-contaminated compost or soil mix affects broadleaf plants. The herbicides that cause the contamination don't harm monocots. Turfgrass, ornamental grasses, lilies and irises are all monocots.

For soil already contaminated, plant alternate crops

If you've already applied contaminated compost or soil mix to your vegetable garden area, remove damaged plants. Don't plant additional broadleaf plants prone to injury from growth regulator herbicides.

Instead, plant monocots such as corn. Corn may accumulate the herbicide residue just like damage prone crops such as tomatoes and beans. But corn doesn't show symptoms.

If you know the exact herbicide ingredient that caused herbicide injury, call the National Pesticide Information Center for assistance at 1-800-858-7378 to determine if you can eat the produce.

Perform the bioassay test one to two times per year until there are no signs of damage. When a bioassay test shows no damage, it is likely you can grow broadleaf crops such as tomatoes and beans without damage from the contaminated soil.

How to remediate herbicide-contaminated soil

▶ Do nothing and wait for the herbicide to break down on its own

If you've already applied herbicide contaminated compost or soil mix to your garden area, it will eventually break down. It can take from two to five years for the herbicide to completely degrade.

Perform bioassay tests before planting crops prone to damage from growth regulator herbicides. Keep performing the bioassay test one to two times per year until there are no signs of damage. When a bioassay test shows no damage, it is likely safe to plant broadleaf crops.

▶ Increase soil biological activity

Naturally occurring microbes in the soil eventually break down persistent growth regulator herbicides. You can speed this process by increasing the soil's biological activity.

Soil microbes including bacteria and fungi feed on the herbicides in the soil. The microbes need air, water and energy to live. You can increase these factors with the following methods:

- Incorporate air into the soil by digging or tilling.
- Water the area.
- Add noncontaminated organic matter such as compost, leaves or cover crop residue.
- Add fertilizer to encourage the soil microbes. Fertilizer also feeds any plants that are growing in the area. Follow the instructions on the fertilizer label.

Additionally, products designed to promote microbial growth, such as Soil Diva and Algae AquaCulture Technologies, might help. These products may or may not be available in your state. Scientific evidence on the effectiveness of these products isn't available. Anecdotal evidence suggests that they could hasten the decomposition of growth regulator herbicides in soil.

▶ Plant cover crops

Plant a cover crop to bioaccumulate the herbicide. Use broadleaf plants such as sunflowers, peas or radishes. Grow the crops. Remove the stems and roots.

Put the material in the trash or take it to a landfill. Don't put it in your yard debris bin or take it to a compost facility.

If you don't want to remove the contaminated cover crop residue from your site, you could compost it. Then apply it to your lawn. Or, use contaminated cover crop residue as a mulch for ornamental grasses, lilies, irises and similar plants.

Don't use the cover crop residue or its compost for broadleaf plants prone to damage from growth regulator herbicides.

Another option is to plant a monocot cover crop such as sudangrass. Sudangrass and other grasses aren't damaged by the herbicide-contaminated soil.

A Sudangrass cover crop produces a lot of biomass. In this case, incorporate the cover crop into the soil. The organic matter will increase soil biological activity.

▶ Apply activated carbon or biochar

Activated carbon and biochar bind to herbicides in the soil, making them inactive.

To apply activated carbon, mix 1 pound activated charcoal in 1 gallon of water. Sprinkle the mixture over 150 square feet of soil surface.

Follow the application rate on the label instructions for biochar products. Biochar may contain pollutants that are hazardous to human health. Further research is needed about using biochar in garden soils and soil remediation.

Both additives can increase soil pH. Increasing the soil pH could be an issue for areas that already have alkaline soils.

Also, both additives could reduce the efficacy of future pesticide applications. The carbon from the products could bind with soil-applied products.

▶ Remove the soil from the site

Some people may want to remove herbicide contaminated soil.

For a small volume of contaminated soil, put the material in the trash or take it to a landfill.

For a large volume of contaminated soil, rent a dumpster from a waste management company. Notify the drop box company that it contains herbicide-contaminated soil for the landfill.

Call the landfill ahead of time to get disposal instructions and costs.

The cost to remove contaminated soil and properly dispose of it is very high. Consider other options to remediate the soil.

SECTION 4

Avoid herbicide-contaminated products

Do some research before you purchase a load of material from a vendor. You can avoid problems with contaminated compost or planting mix.

- Visit the vendor and get a sample of the material you want to purchase.
- Perform the bioassay test described above. It takes three to four weeks to get results.
- If the test results don't show signs of herbicide damage, then the material is likely not going to cause problems.
- Talk to the vendor to make sure the material you tested is from the same batch you purchase.

References

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