e-GRO Alert


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Volume 14 Number 29 July 2025

Herbicide damage to greenhouse plants and residue testing

Diagnosing herbicide symptoms can be challenging, especially when there has been no direct application near a crop. More information is usually needed about local spray applications and there are labs that can test for pesticide residue when all other avenues have been explored.

When plants come into a diagnostic lab, they are quickly assessed for biotic or abiotic injury. Leaf necrosis, curled, or crinkled leaves can all be trademark damage from herbicides. According to MSU Extension's "Weed Management Strategies in Greenhouses – Part 2: Chemical Control Strategies," there are very few herbicides labeled for use in the greenhouse, much less with a crop growing inside. Unfortunately, due to the nature of herbicides, they can cause damage to present and future crops.

Photo 1. Damage on poinsettia from pelargonic acid (Scythe). Photo: W. Garrett Owen

Herbicides Applied with Crops Present

Every year, diagnostic clinics receive plants that have been damaged by herbicides. For example, Photo 1 shows leaf curling and dieback on poinsettia foliage that encountered the spray application pelargonic acid (Scythe) when the main target area was under the benches. In another example, Marengo and Roundup were applied to weeds directly near a crop of hydrangeas (Photo 2).

Herbicides Applied to Non-crop Areas without Crops Present

Often, herbicides are sprayed to manage weeds under benches, to gravel, to gaps in weed mats, and other non-crop areas. For example, this spring a grower applied indaziflam (Marengo) to gravel areas prior to the crop being brought inside and then glyphosate and flumioxazin (Sureguard) around the house perimeter. The sample sent into the lab was an echinacea with curled leaves, epinasty of stems, and crinkled leaves (Photo 3). The damage was uniform among the crop (Photo 4). The injury to the coneflowers were consistent with foliar contact with indaziflam which results in leaf distortion, chlorosis, leaf curling, and stunted growth. In this case, the phytotoxicity from the herbicide might have resulted from spray tank contamination, drift from another area, or contamination of a watering source.

Herbicide injury can also be caused by the off-label use of an herbicide. A grower reported stunting, necrotic lower leaves (Photo 5), and death of entire flats of lettuce seedlings (Photo 6).

Photo 2. Roundup and Marengo spray drift and volatilization resulted in leaf necrosis, loss of the apical meristem. Photo: W. Garrett Owen

Photo 3. Curled, crinkled leaves on echinacea from a suspected indaziflam exposure. Photo: Plant Diagnostics, MSU

Photo 4. Uniform damage to echinacea from a suspected indaziflam exposure. Photo: Plant Diagnostics, MSU

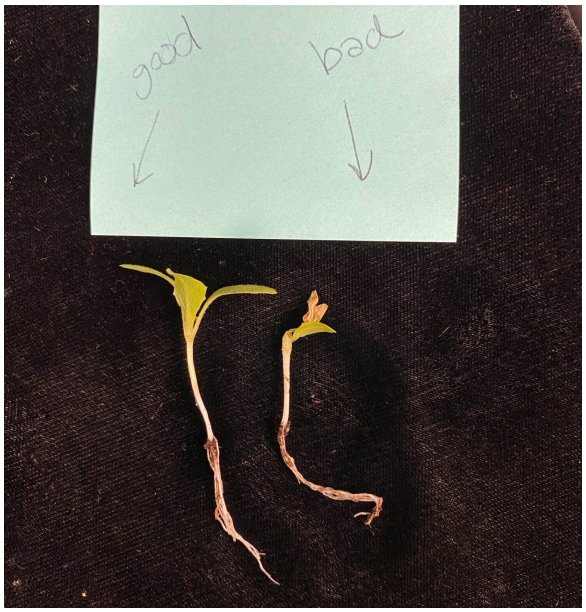

Photo 5. Normal lettuce seedling (left) and herbicide-damaged seedling with twisting and reddening foliage (right). Photo: Plant Diagnostics, MSU

Photo 6. Pattern of seedling plant death from suspected bromacil (Hyvar X-L) exposure. Photo: Plant Diagnostics, MSU

Photo 7. Potting mix possibly came into contact with floor treated with bromacil (Hyvar X-L) and returned to the hopper for planting. Photo: Plant Diagnostics, MSU

Between the lettuce crops the grower reported spraying the greenhouse floors with bromacil (Hyvar X-L) for weed control, which is not labeled for use in greenhouses or food crops. Based on the crop damage and pattern among the crop (entire death of flats), the hypothesis is that the herbicide-contaminated potting media that fell onto the floor and then was returned to the hopper for planting (Photo 7).

In a similar case, the diagnostic lab received a sample of zinnias with distorted, thickened, chlorotic leaves (Photo 8) with some distorted stems (Photo 9). In this instance, topsoil that may have been treated with an herbicide was mixed in with the potting mix. The damage is suspected synthetic auxin injury and the lab recommended running a bioassay (seeding other plants in that topsoil) to confirm that hypothesis.

Photo 8. Curled, forked, thickened leaves from suspected synthetic auxin exposure. Photo: Plant Diagnostics, MSU

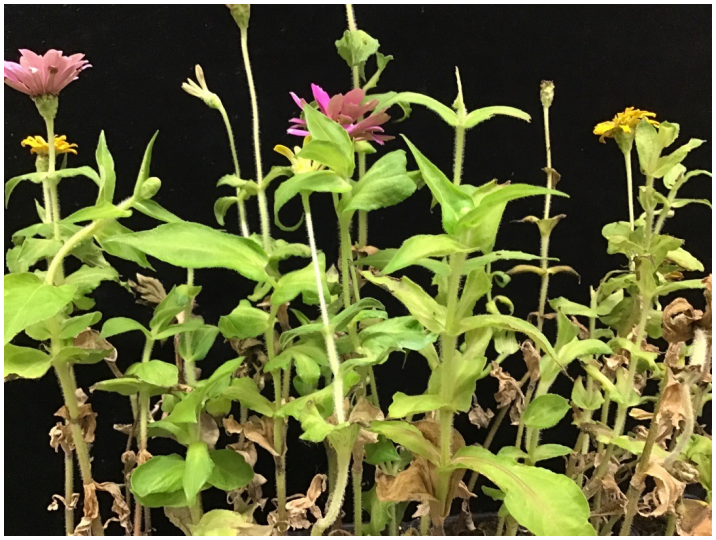

Photo 9. Abnormal stems and necrotic lower leaves from suspected synthetic auxin exposure. Photo: Plant Diagnostics, MSU

Herbicide Injury Modes

Diagnosing herbicide injury in cases where the plants were not present in the greenhouse at the time of application takes a bit of detective work and out-of-the-box thinking. When direct application does not appear to be the cause, there are other ways that the plants could encounter the injurious herbicide which include:

- **Spray tank contamination.** If any pesticide applications have been made in the area (even outside the greenhouse) check to see if any herbicides were sprayed previously with the same sprayer to rule out possible tank contamination. Minute amounts of an herbicide applied to a sensitive crop can result in significant damage.
- **Drift.** Herbicides can move with the wind from neighboring areas to affect plants not originally intended. Herbicides can also move into greenhouse structures through vents, windows, and other openings. In some cases, growth regulator herbicides can injure very sensitive plants (such as tomato) when they are applied miles away, with only a minute amount causing distortion.
- **Volatilization.** Some herbicides can be re-released as vapors from applied surfaces shortly after application. Volatilization can be particularly problematic if the products are applied under low wind conditions with low cloud cover and/or in the evening or early in the morning. High temperatures at the time of application can also increase the chances of volatilization and is often cautioned on the label. Herbicides can then move with wind to affect off-target plants. Some herbicides and formulations are more prone to volatilization than others.
- **Nearby chemical applications in greenhouse.** Plant growth regulators and pesticides can move to neighboring areas within a greenhouse through drift or volatilization depending on the ventilation and environmental conditions.
- **Contamination of watering source or water movement.** With herbicides that are highly soluble in water, consider whether or not contamination of the water source is possible, particularly if there is surface exposure. Some herbicides have also been shown to move with lateral water movement to effect off-target plants when heavy rain events follow application.
- **Soil amendment/media/surface contamination.** Examples of this form of contamination include: contaminated field soil and wood fiber from materials such as pallets that have been exposed to an injurious substance. In addition to these examples, impervious surfaces and landscaping fabric can also be a source of exposure if any herbicides applied in the area do not photodegrade or get rinsed off prior to moving plant material into the area.
- **Chemical storage nearby in the greenhouse-** Some chemicals can be released as vapors from spills or open containers within storage facilities. Consider the proximity of the injured plants to the storage area and the types of chemicals being stored.
- **Adjuvant injury.** If any pesticide or plant growth regulators have been applied to the crop, consider if any adjuvants may be causing phytotoxicity under the given environmental conditions, particularly on stressed plants.

If a diagnostic lab has ruled out causes of plant damage and suspects that the cause might be from an herbicide or pesticide drift from an unknown cause (Photo 9), there are other labs that can test for pesticide residue, depending on the chemical. **Be sure to discuss your issue and the questions you are hoping to answer with the lab you choose before sending a sample.**

The following labs can test for pesticide residue on soil, water and/or plant tissue:

- **Columbia Food Laboratories, Inc.**
  12423 NE Whitaker Way
  Portland, OR 97230
  503-254-1794
  https://www.columbialaboratories.com/
  Email: info.cfl@tentamus.com
  *Soil, water, and plant tissue- Offers screens covering multiple active ingredients

- **Matrix Sciences International**
  dba Pacific Agricultural Laboratory
  21830 SW Alexander Ln.
  Sherwood, OR, 97140
  503-626-7943
  http://pacaglab.com
  Email: Contactus@pacaglab.com
  *Soil, water, and plant tissue samples- Offers screens covering multiple active ingredients

- **Matrix Sciences International**
  dba South Dakota Agricultural Laboratories
  1335 Western Ave
  Brookings, SD 57006
  605-692-7325
  http://sdaglabs.com
  Email: SDCS@sdaglabs.com
  *Soil and plant tissue samples, call regarding other substrates- Offers screens covering multiple active ingredients

- **Midwest Laboratories**
  13611 B Street
  Omaha, NE 68144
  402-334-7770
  https//midwestlabs.com/
  Email: environmentalteam@midwestlabs.com
  *Soil and water samples only

- **Microbac Laboratories, Inc.**
  3809 Airport Drive
  Wilson, NC 27896
  (252) 237-4175
  Email: info.WNC.LS-Chemistry@microbac.com
  *Plant tissue. Call/email first

Photo 9. Zinnia with suspected herbicide injury with unknown exposure method. Photo: Plant Diagnostics, MSU

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Purdue University

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In cooperation with our local and state greenhouse organizations

Maumee Valley Growers — Choose the Very Best.

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NC Flower Power

Western Michigan Greenhouse Association

Connecticut Greenhouse Growers Association

Indiana Flower Growers Association

LIFGA

Cincinnati Flower Growers Association

Michigan Greenhouse Growers Council

NYSFI — New York State Flower Industries, Inc.