The Plant Doctor's LANDSCAPE TIPS

By David L. Roberts, Ph.D., *Senior Academic Specialist, College of Agriculture and Natural Resources, Michigan State University*

DIAGNOSING HERBICIDE INJURY ON LANDSCAPE PLANTS

INTRODUCTION:

Herbicides are frequently used for managing weeds in landscapes, golf courses, athletic fields, crop production and right-of-ways … among many uses. Herbicides are designed to kill plants. As such, damage to non-target plants is not an uncommon occurrence (Photos 1, 2 & 3).

Herbicides affect non-target plants for a variety of reasons: spray drift, volatility during or after application (Photo 4), persistence, and movement or translocation in water (Photo 2), on tools or equipment (Photo 5), in soil (Photo 6) and other media such as mulch. Obviously, misapplication and/or applicators' failure to follow and understand label directions is also a major contributor to herbicide toxicity to our non-target, desirable plants (Photo 7). And, occasional mistakes occur with herbicide labeling or imprecise prescriptions by manufacturers/marketers/suppliers (Photos 8, 9 & 10).

Damage to non-target plants is a "growing" concern. Hence, I thought it might be useful to relate some of the incidences of common herbicide problems I have encountered over the last 30+ years. As plant health providers, it is important we understand the general groups of herbicides as well as learn to recognize symptoms of herbicide injury, which can then subsequently lead to an accurate diagnosis of herbicide injury to plants. Obviously, herbicide injury to plants is a huge topic that could occupy volumes of books. The following is a very brief summary.

TYPES OF HERBICIDE INJURY SYMPTOMS:

Depending on sensitivity and dose, herbicide symptoms on plants may range from mild to deadly. Herbicides may be classified according to a variety of factors. Perhaps the two most general classes are systemic vs. contact herbicides. Another

Continued on page 18

Photo 1: The application of herbicides sometimes results in damage to non-target or desirable plants. In most instances, the damage is minimal and plants will return to normal health with sufficient time, as was the case with this growth regulator herbicide damage on wisteria. (Photo credit: Denise Schroeder, University of Michigan)

Photo 2: In some cases, unintended consequences of herbicide applications can be lethal. At this landscape site, imazapyr was applied to mulch rings for "long-term" weed control the year before. These shrubs had great difficulty recovering (Inset) over the next couple years. Leaching of the herbicide not only occurred downward into the tree and shrub root zones but also into the turf. The Austrian Pine (left) did not produce new shoot growth for two years.

Photo 3: Herbicide injury on maple due to contaminated "fill dirt" (see Photo 6).

Photo 4: A novice plant lover might identify this as a "White Pine" or "White Spruce." In reality, white or black spruces are not named for their color, both of which are green. This spruce tree is affected by Command herbicide, which volatilized from a nearby soybean field.

Photo 5: A landscape maintenance company applied Roundup (glyphosate) to the mulch area near these shrubs. Before allowing the herbicide to dry sufficiently, mowing crews transferred the herbicide to large areas of lawn, resulting in severe discoloration and death of large patches of turf.

The Plant Doctor's LANDSCAPE TIPS

DIAGNOSING HERBICIDE INJURY ON LANDSCAPE PLANTS

Photo 6: After delivery and distribution, "Fill Dirt," contaminated with an unknown herbicide, killed many trees and shrubs in this landscape at a property in southeast Michigan. Also note inability to establish turf. Piles of fill dirt at the storage facility were undoubtedly treated with a broad spectrum, persistent herbicide to control weeds until the fill was needed.

Photo 7: This crabapple tree will probably die due to a heavy dose of glyphosate (Roundup, etc) to suckers (inset) emanating from the tree's lower trunk and roots. The applicator apparently didn't understand that a systemic herbicide such as glyphosate would translocate throughout the tree whereas a contact herbicide would not.

Photo 8: A supplier recommended that a commercial applicator apply Milestone herbicide to the cracks in the pavement (not applied to mulched areas) at this strip mall. All honeylocust trees died near treated areas. Upon recollection, the label for this herbicide, originally developed for pastureland, contained no warnings about damage to trees. Further investigation of Dow's website disclosed that leguminous plants (redbud, honeylocust, black locust, alfalfa) may be severely harmed.

Photo 9: DuPont apparently did not sufficiently test its new Imprelis herbicide before releasing it to turf and ornamental markets in 2010. Severe toxicity to many landscape plants, especially conifers, ensued as the herbicide was readily translocated to the meristematic tissues in the shoots. Due to inhibition of growth by the herbicide, many trees died or were severely affected. Some recovered with time.

Continued from page 17

general classification is pre- vs. post emergent herbicides. Other classifications are more definitive and may include "mode of action" (examples: photosynthetic inhibitor, amino acid synthesis inhibitor and growth regulator) and/or effects upon plants. Following is a brief discussion of classes of herbicides arranged according to their symptoms and impacts on plants.

Growth Regulator: Tip chlorosis, leaf chlorosis, shoot dieback, leaf/shoot distortions such as twisting and curling, epinasty (outward or downward bending), and abnormal leaf development/appearance are some of the most common symptoms of this group (Photos 1, 2, 5 & 9). Included in the group are some very commonly used herbicides such as 2,4-D, 2,4-DP (dicloprop), MCPP (mecoprop), dicamba, triclopyr (example Garlon), picloram (Tordon), imazapyr (examples: Sahara, Arsenal, etc.) and glyphosate (examples: Roundup, Kleenup, etc). Some of these herbicides (examples: glyphosate, imazapyr, triclopyr) offer total vegetation control but in sublethal doses may cause various other symptoms as described for this class. Some formulations of these herbicides tend to be more volatile (example: ester form of 2,4-D) than other formulations (example: amine form of 2,4-D). Some products contain two or more herbicides and are sold under various trade names (examples: Roundup Extended Control and 365, Ortho Ground Clear, etc). This large group undoubtedly contributes to the majority of the herbicide problems we witness in landscapes.

Leaf Bleaching: A few herbicides cause leaf bleaching in plants and hence are called "bleachers." They "bleach" because they inhibit pigment synthesis in plants; pigments (red, yellow, etc) are produced to protect chlorophyll from oxidation. Herbicides in this class include amitrole (Amitrole, Amizine) and clomazone (Command), among others. The author has occasionally seen leaf bleaching from herbicides external to this group:

example glyphosate. As with other classes of herbicides, some formulations may become volatile after application (Photo 4).

Leaf Spotting: This group includes the pre-emergence herbicides such as oxyfluorfen (trade names Rout & Ornamental Herbicide 2) and oxadiazon (trade name example, Ronstar). The group also contains the postemergent herbicides such as paraquat, diquat, fluazifop (trade name example, Fusilade) and sethoxydim (trade name example, Poast). Direct application of these herbicides may lead to death of plants but drift and other unintended avenues of exposure will lead to the most commonly observed symptom of stem or leaf spotting (Photo 11).

Root Inhibitors: The dinitroanaline family inhibits root development; examples include triflualin (Treflan, etc), benefin (Balan), oryzalin (Surflan), pendimethalin (Prowl, etc), prodiamine (Blockade, etc) among others. These are often combined with other members of the group or other groups (oxyfluorfen) for enhanced pre-emergence activity (examples: oryzalin + oxyfluorfen = Rout, pendimethalin + oxyfluorfen = OH2, oryzalin + benefin = XL). These herbicides are used commonly in nursery production and landscape maintenance for controlling annual grasses and broadleaf plants. Symptoms on affected plants may include root stunting/swelling. Shoots may also be affected as a direct consequence of root inhibition. Because these herbicides do not readily move through soil from the application area, larger woody plants such as trees and shrubs are generally not affected… at least from what is generally believed. Small herbaceous weeds or annual and perennials are most likely affected.

Root & Shoot Inhibitors: There are herbicides that can inhibit shoot development, but may also inhibit root development. Hence, this group may occasionally be confused with the root inhibitors (above). This group essentially affects meristematic (cell division) tissues in the apical regions. Included in this group are: the Amides, such as diphenamid (trade name example, Enide) and napropamide (trade name example, Devrinol); the Anilides, such as alachlor (trade name example, Lasso) and metolachlor (trade name examples, Dual and Pennant); and the Thiocarbamates, such as Eptam, Sutan, etc. The Amides cause general stunting of roots and shoots. The Anilides cause stunting and shoot twisting in herbaceous plants. The thiocarbamates may cause stunting and in some cases "leaf seal", where leaf edges are bound together (Photo 12). Established woody plants are not usually affected by this group of herbicides.

DIAGNOSING HERBICIDE INJURY:

There are several key steps to diagnosing herbicide injury. It is important to understand that in order to increase the efficacy or provide for a broader spectrum of activity, marketed weed control products may contain two or more herbicides, possibly confounding our ability to accurately diagnose herbicide injury. Complicating chemical injury to plants is the fact that certain pests, diseases, nutritional deficiencies and other issues can mimic herbicide injury.

Several steps might assist us in making accurate diagnosis of herbicide issues.

1. Carefully examine the symptoms of suspect plants; check them for signs of pests, diseases, nutritional deficiencies (soil pH) and causes other than herbicide activity … at least initially. Herbicide injuries will most likely, but not always, show up in the foliage.
2. Scrutinize other plants in the vicinity; herbicides will usually affect multiple species of plants (herbaceous plants, shrubs, trees, weeds, etc) while diseases and pests usually do not (Photo 13).
3. Determine through inquiry and investigation whether any herbicides were applied at the impact site. Applicators, whether private homeowner or commercial, are sometimes reluctant to admit the use of herbicides.
4. Ascertain whether the observed plant symptoms could be caused by the class(es) or type(s) of herbicide(s) utilized.

Continued on page 20

Photo 10: Many herbicides such as Imprelis exhibit differential toxicity to plants. At this location, many honeylocusts (left) died while maples and oaks were unaffected.

Photo 11: Contact herbicides in large doses often kill plants, as they were designed to do. With low dose drift, contact herbicides may cause leaf or stem spotting, similar in appearance to many plant diseases.

Photo 12: "Leaf seal" can be a symptom of various herbicides. In this case, Imprelis, a carboxylic acid growth regulator, impacts spruce.

The Plant Doctor's LANDSCAPE TIPS

DIAGNOSING HERBICIDE INJURY ON LANDSCAPE PLANTS

Continued from page 19

AMELIORATING HERBICIDE INJURY:

There are several options for addressing potential issues with herbicide injury to non-target, desirable plants. They are summarized below.

Avoidance: Obviously, the Numero Uno option is to avoid any potential for herbicide injury to desirable plants. In some cases, it might be best to NOT use an herbicide unless absolutely needed. Herbicides are often over-utilized in lawns, gardens and landscapes. If an herbicide is slated for application, be sure to follow label directions, paying particular attention to precautions, rates, application techniques, weather conditions and so forth. If the applicator is not experienced with the proposed herbicide, it might be best to seek additional advice before a serious error is made.

Soil Amendments: If a problem is encountered with a soil-applied herbicide, the application of activated charcoal and other compounds to soil can sometimes absorb unwanted herbicides or reduce their residues.

Leaching: Some herbicides, for example those in the carboxylic acid/growth regulator group, are soluble in water. This solubility can not only lead to problems (Photo 2, 9 & 10), but can also help us resolve the issue to some extent by leaching the herbicide beyond the root zone of affected plants.

Watching & Waiting: Depending on sensitivity, many unintended herbicide issues are not lethal to plants. Plants may recover with time as the herbicide dissipates or is processed by the plant and/or by other avenues (example-microbial) of breakdown in the environment. Provided there is live cambial and bud tissue, there is hope of recovery (Photo 14).

For more information or if anyone has questions or comments, please feel free to contact the author at robertsd@msu.edu or at (248) 320-7124.

The author, MSU and MGIA do not endorse any particular products. If using pesticides, be sure to read and follow label directions.

Photo 13: The symptoms on this plant resemble herbicide damage after the plant had put on earlier growth (note normal foliage, left). Actually, this issue is imported honeysuckle aphid damage on honeysuckle.

Photo 14: Live cambial (green) and bud tissues indicate viability in this denuded (leafless) oak tree after Imazapyr application. Survival is possible with time. Note shoots trying to emerge—a good sign.

Booth # 420