

SP-02-08

## WEED KILLERS - THEIR EFFECTS ON PLANTS

Angela M. O'Callaghan, Ph.D.

Area Extension Specialist, Social Horticulture

### INTRODUCTION

Weed killers (herbicides) can save considerable labor in the yard and garden. Some of these kill plants selectively, so the manager can control weeds but not injure desirable plants. Others are not selective and may kill all plants in an area. They must be applied directly to weeds carefully to avoid damaging nearby plants.

Like many powerful tools, weed killers cause serious harm if used incorrectly.

When using an herbicide, or any pesticide – **Read The Label!** The label will state whether protective clothing needs to be worn when applying the weed killer.



Roundup® damage on tomato plant.  
Photo ML Robinson, UNCE

Make sure that any equipment (such as a sprayer) used is free of other pesticide before adding a new one. It is important always to shower after applying herbicides. Wash clothes separately that have been worn when spraying. Failure to follow label directions can result in damage to other plants, or to animals or people. It is also illegal.

Different herbicides work on different types of plants, on different components of plant metabolism, and at different times in plant growth cycles. Some are translocated (taken up into the plant's vascular system), while others affect the plant on contact. Some pose a risk of moving as a vapor to other sites, while others remain in the soil for long periods, injuring crops planted in those locations at a later time. In either case, non-target plants can be damaged.

It can be difficult to determine whether a plant has been damaged by herbicides or other causes, such as insects or disease. Careful examination of the plant is essential before making any decision about plant damage.

## CLASSIFICATION OF HERBICIDES

Several different terms are used to describe the actions of weed killers, and these may overlap.

**Nonselective herbicides** destroy or prevent plant life in general regardless of species.

**Selective Herbicides** are more toxic to some species than to others.

- *Broadleaf* herbicides are effective against broadleaf (dicot) plants, and are not generally effective against weedy grasses (monocots). They are often used in lawns.
- *Grass* herbicides kill grassy (monocot) plants, and usually do not kill broadleaf plants.

The difference between selective and nonselective herbicides can be a matter of how concentrated the weed killer is, and when it is applied, rather than its formula. For instance, if a planting of an ornamental grass is damaged when a nearby patch of bermuda grass is sprayed with weed killer designed to kill grasses, then the selective herbicide would be acting as a non selective one.

Categories may be based on **when** in the plant's life cycle herbicides are applied:

- *Pre-emergent herbicides* are applied to the soil to kill germinating weed seeds or weed seedlings before they emerge.
- *Post-emergent* herbicides are generally applied to foliage while plants are growing.

Herbicides are grouped by **where they act** within the plant:

- *Contact* herbicides kill the growing tissue that comes in contact with the spray. There is no plant uptake or translocation.
- *Systemic* herbicides are **translocated** from the point where they are absorbed by the plant to growing points within it.

They are also organized by **how long they remain active** in the soil after application:

- *Residual* herbicides are applied to the soil before weeds emerge and are taken up through the roots. They are designed to remain effective in the soil for long periods. Some, but not all, are considered to be soil

sterilants, which kill all vegetation in the area where they are applied

- *Nonresidual* herbicides are applied directly to weeds (contact). They are not effective over long periods, often because they become bound to soil particles. Although nonresidual, some herbicides may remain active in the soil for a few weeks ("carryover"). Be careful not to place sensitive plants in treated soil until sufficient time has passed. This time period will vary with the herbicide. The information is found on the label.

## How do herbicides cause damage to non-target plants?

1. In general, herbaceous (non-woody) plants are more susceptible to herbicides than woody plants (trees and shrubs). Younger plants, both herbaceous and woody, tend to be more sensitive than older ones.
2. When an herbicide is sprayed, the applicator needs to keep the spray from hitting non-target, desired plants. Herbicide mist can fall on ornamentals or even edible plants.
3. If an herbicide is sprayed on a windy day, there is a good chance that the mist will travel. This unintentional drift can injure desirable plants.
4. A large number of herbicides volatilize (become a gas) at high air temperatures. If applied on hot days, the gaseous herbicides can actually move through the air to a different location and can damage or kill a non-target plant. It is usually best not to apply weed killer when at temperatures above 85°.
5. Herbicides that are carried by water into the soil profile may be taken up by roots of nearby sensitive trees or shrubs. If, for instance, a "weed and feed" product is applied too frequently, or in too high a concentration to a lawn where trees or shrubs are present, those plants may be damaged or killed.
6. Roots of trees and shrubs may grow into areas that have been treated with herbicides.
7. If an herbicide remains in the soil from year to year, the residual weed killer may damage susceptible plants installed at or nearby that site in subsequent years. This residual effect

and movement will depend on the soil type, moisture and amount of soil organic matter.

8. Herbicides that remain in the soil can be carried on soil particles via wind, water or human activity to other locations.

### **Before determining that plant symptoms are due to herbicide damage:**

1. Learn the history of the site where the plant is located – pest problems and the horticultural practices that have been used.
2. Examine all parts of the plant for other possible causes of the problem, such as insects, disease, nutrient deficiency, mechanical damage.
3. Find out if herbicides or other pesticides have been sprayed in the area recently.
4. Take into account how an herbicide could have reached the damaged plant. (It may be that a weed killer was sprayed on a driveway but affected nearby plants, for example.)
  - a. Direct application
  - b. Drift
  - c. Residue from previous application
  - d. Incorrect herbicide, incorrect application time or method, incorrect dosage
  - e. Interaction with other pesticides.

### **Cases of possible mistaken identity**

Symptoms of herbicide injury may be very similar to symptoms of other problems. For example:

- Drought may cause a wide variety of discolorations and leaf death.
- Soil compaction or flooding may cause root stunting.
- Mites and insects frequently cause leaves to become distorted.
- Many nutrient deficiencies (such as nitrogen, iron, manganese, molybdenum) cause chlorosis, either of the whole leaf or the tissue between veins. Phosphorus deficiency will cause plant leaves to look purple or bronzed. Potassium deficiency will cause the margins of older leaves to become brown.
- Nutrient excess (for example, boron) can cause leaf distortion, stem tip death, and stunting.
- Air pollution may cause leaf bronzing.

- Some viral infections cause leaf veins to become colorless.
- Improper soil pH can cause nutrient deficiency or other physiological disorder.

### **If an herbicide has been applied to a non-target plant,**

through drift or use of a wrong chemical, some methods may help to alleviate the damage. These must be attempted in a timely fashion, i.e. within a couple of hours.

- Compounds that drift onto non-target plants may be washed off foliage with a large volume of water, applied by sprinkler. This should not be attempted with soil-active herbicides that may be moved by water deeper into the root zone.
- Certain systemic herbicides that are taken up through roots may be inactivated or absorbed by use of activated charcoal. The recommendation is 1 to 2 lbs. activated charcoal per 100 sq. ft. and incorporate it to a depth of 6 inches.



Growth inhibitor damage on oak. Photo R. Morris,

## RECOGNIZING HERBICIDE DAMAGE

Weed killers vary in their mode of action (MOA), i.e., what plant system they attack. Herbicides with the same MOA are grouped as a family and will cause similar symptoms or plant responses, before resulting in plant death. In many commercial products, more than one herbicide may be included in a preparation. The examples of herbicides in this table are readily available at home centers. (The University of Nevada does not endorse brands; examples are for identification only). In case of accidental application to a plant, foliage must be washed BEFORE any symptoms appear.

Symptom	Example of commercial product	Suggestions if applied to non target plants	MOA and action of herbicide
		It may not always be possible to amend or prevent damage; see page 3 for details.)	
<ul style="list-style-type: none"> <li>Grasses are stunted, purplish, and roots have a "bottlebrush" appearance</li> </ul>	Ground Clear® Triox®		<i>Non Selective Amino acid synthesis inhibitor</i> Interferes with protein synthesis
<ul style="list-style-type: none"> <li>Broadleaved: leaf veins appear red or purple. Leaf tissue becomes yellow, and leaf tips may become blackened.</li> </ul>			"
<ul style="list-style-type: none"> <li>Both broadleaved and grassy plants – growth stops. Plants show yellow and blackened areas, new leaves are twisted, curled and malformed. Plants become straw-colored, turn brown, and then die.</li> </ul>	Roundup® [and others like it]	Spread dust or soil onto foliage (This must be done BEFORE any symptoms appear – within a couple of hours.)	"
<ul style="list-style-type: none"> <li>Symptoms show first on young leaves and stems. The stems of broadleaved plants are twisted and bent. Leaves may look crinkled, stretched out into a "strap", or cupped (up or down).</li> </ul>	"Green Sweep"® "Weed Stop"® "Brush b Gone"®	Wash foliage IMMEDIATELY  Use activated charcoal as advised on page 3.	<i>Growth regulator</i> (Found in many weed and feed products) Plant cells grow at abnormal rates Controls broadleaved weeds in lawns
<ul style="list-style-type: none"> <li>Leaves turn yellow or white but veins may remain green; yellowing and browning of leaf margins appear on older leaves first</li> <li>Spotting, speckling and bronzing, followed by leaf death.</li> </ul>	"Grass and Weed Killer"® "Total Vegetation killer"®	Wash off foliage IMMEDIATELY	<i>Photosynthesis inhibitor</i> Stops broadleaf growth. Hampers process in which plants convert energy of the sun to carbohydrate

Symptom	Example of commercial product	Suggestions if applied to non target plants	MOA and action of herbicide
(It may not always be possible to amend or prevent damage; see page 3 for details.)			
<ul style="list-style-type: none"> <li>Leaf bleaching to nearly white may be on the whole leaf, appear on the veins first, or in the tissue between veins. Seedlings emerge green, but turn white and die soon after.</li> </ul>			<p><b><i>Pigment inhibitor</i></b> Prevent plants from making leaf color compounds.</p>
<ul style="list-style-type: none"> <li>Grasses appear stubby, and broadleaved plants to have swollen or cracked root tips. The stems of affected plants may be weak, with the result that the plant falls over.</li> </ul>	“Weed Preventer”®	Activated Charcoal	<p><b><i>Seedling growth inhibitors</i></b> Root inhibitors</p>
<ul style="list-style-type: none"> <li>Leaves open improperly, or leaf midvein becomes shortened, so leaf is “puckered”.</li> </ul>			<p><b><i>Seedling growth inhibitors</i></b> Shoot inhibitors</p>
<ul style="list-style-type: none"> <li>Leaf area may look water soaked before becoming yellow, then black.</li> </ul>	“Grass and Weed Killer”®	Wash off foliage <b>IMMEDIATELY</b>	<p><b><i>Cell membrane disruptors</i></b> Plant cells burst</p>
<ul style="list-style-type: none"> <li>Youngest leaves turn yellow. Leaf bases become mushy. Leaves are easily pulled from the plant. Leaves, leaf margins or stem sheaths may have a reddish-blue tinge.</li> </ul>	“Grass and Weed Killer”®	Wash off foliage <b>IMMEDIATELY</b>	<p><b><i>Fatty acid synthesis inhibitors</i></b> Cell membranes do not develop properly</p>

## Summary

Different herbicides affect different plant systems, resulting in a range of symptoms from discolored or distorted leaves and stems to a lack of seedling emergence. When landscape plants come into contact with herbicides, major problems can ensue. Effects may be mistaken for indications of insect infestation, disease, nutritional deficiency or environmental disorder.

Identify the plant problem before putting on any pesticide

Weed killers useful tools for gardeners, but they can cause unanticipated damage if not used properly. Use herbicides when and where they will work best. Those that are not designed for soil application should be applied to aboveground parts of the plant. If they remain active in the soil after killing weeds, then sensitive plants should not be placed in that area. Herbicides should not be applied at high temperatures nor on windy days, as these increase the risk of drift.

While there are techniques to alleviate the damage caused by accidental contact with herbicides, it is best to avoid incorrect application.

Read labels carefully, and follow directions exactly. This is the law, and the way to get the best results when using an herbicide.

## **REFERENCES**

- Ayeni, A.O. and J.A. Meade. Herbicide Injury to Trees. Rutgers Coop Ext. NJ Ag. Expt. Station. FS 121
- Baumann, P.A., P.A. Dotray, and E.P. Prostko. 1999 Herbicides – How they work and the symptoms they cause. Texas Agricultural Extension Service. Texas A&M University system. B-6081.
- Derr, J.F., and B.L. Appleton. 1988. Herbicide Injury to Trees and Shrubs: A pictorial guide to symptom diagnosis. Blue Crab Press. Virginia Beach, VA.
- Pike, D.R., and A. Hager. How Herbicides Work. Dept. of Crop Sciences, University of Illinois. PIAP. 95-4.
- Putnam, M. D. Childs, G. Ruhl, and B.R. Lerner. Diagnosing Herbicide Injury on Garden and Landscape Plants. Coop. Ext. Svc. Purdue Univ. W. Lafayette, IN ID-484.
- Ross, M.A., and D.J. Childs. Herbicide Mode-Of-Action Summary. Coop. Ext. Svc. Purdue University. WS-23
- <http://www.unce.unr.edu/publications/factsheets/FS%2000/FS00-19.htm> (12/6/02)

The University of Nevada, Reno is an equal opportunity affirmative action employer and does not discriminate on the basis of race, color, religion, sex, age, creed, national origin, veteran status, physical or mental disability, or sexual orientation, in any program or activity it operates. The University of Nevada employs only United States citizens and aliens lawfully authorized to work in the United States.