14. Herbicides (Air Pollution)

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The greatly increased use of herbicides since the mid-1950's has also increased the hazard to nontarget vegetation. Disorders or mortality caused by herbicides are particularly prevalent where susceptible tree species (table 14–1) are located near crops or areas where herbicides are frequently used. Windbreaks are especially vulnerable to exposure because they are generally located in or around cultivated fields. Trees near right-of-ways, railroads, roadsides, or areas treated for noxious weed control also have a high risk of exposure.

Table 14–1. Sensitivity of various tree species to broadleafed weed-killers.

Sensitive	Intermediate or unknown	Tolerant
boxelder	mulberry	catalpa
elm	honeylocust	linden
ash	soft maple	pine
hackberry	oak	e. redcedar
Amur maple	cottonwood	
hard maple	cherry	
Ailanthus		
hickory		
apple		
sycamore		
redbud		
walnut		
Amur cork tree		
willow		
birch		
horsechestnut		

Symptoms

The more common expressions of phenoxy or hormonal-type herbicide injury include cupped leaves, parallel leaf venation on normally net-veined leaves, chlorosis, nastic growth, and wavy or curled leaf margins (figs. 14–1, 14–2, 14–3). Redbud and boxelder are indicator tree species that readily exhibit these effects. Leaves of some trees, such as pin oak, become waxy and stiff, while maples may develop pebbled foliage that appears weather-beaten. Studies with 2,4-D applied to Siberian elm have shown that bark abnormalities may result from relatively heavy exposure. A single 2,4-D exposure may produce injury for 2 years or more.

Loss of apical growth is typical of phenoxy or hormonal herbicide injury. Affected trees may suffer a gradual crown dieback and eventually die. Lateral leaf development may also be hindered. Exposure to 2,4-D

Figure 14–1. Phenoxy herbicide injury to boxelder. Affected foliage is chlorotic, leaves are cupped, and chlorophyll in leaves appears variegated.

Figure 14–2. Foliage of Siberian elm becomes cupped when damaged by herbicides.

Figure 14–3. Green ash severely damaged by herbicides in a young windbreak. Note distortion of new growth and cupping of foliage.

may result in the production of fewer normal leaves, flowers, and fruits.

Leaf scorch can indicate herbicide injury, particularly when exposure is heavy. Ash and cottonwood may exhibit scorched leaves without expressing the more common effects of herbicide exposure.

Evergreens are generally resistant to phenoxy herbicides, but they may be injured under certain circumstances. Exposed fir trees may develop curled leader growth, burned needle tips, and needle cast. Spruce may also show terminal growth damage and needle cast (fig. 14–4). Pine trees are most susceptible to damage during periods of active growth, and candles exposed to phenoxy herbicide may develop nastic growth.

The non-hormonal type herbicides generally do not induce abnormal growth, but cause chlorosis and eventual death of affected tissue. With contact herbicides, such as paraquat, this damage is restricted to areas contacted.

Diagnosis of herbicide damage can be aided by careful collection and analysis of residue samples. It is important that the samples be collected as soon as possible following exposure. It is necessary to specify the herbicides the laboratory should evaluate. With some herbicides, such as 2,4-D, it is necessary to specify the exact kind of 2,4-D. When possible, residue samples should be kept frozen until they reach the laboratory. It may be advisable to contact an analysis laboratory for specific instructions on collection and care of samples.

Damage

All possible sources of chemical exposure should be considered when dealing with suspected herbicide damage. Harmful exposure to herbicides can result from drift of the spray particles, movement of volatiles, application to the soil or movement in soil (or water) resulting in root exposure, and direct application. Spray drift volatiles can move considerable distances, resulting in damage several miles from where the herbicide was applied. Direct application may cause damage if sensitive desirable trees are not carefully avoided, or if selective herbicides are misapplied directly over trees.

In urban areas, desirable plants are most likely to be damaged by lawn sprays or fertilizers that contain herbicides. Damage is also commonly associated with soil-applied herbicides used around driveways, sidewalks, and structures. In situations where damage has resulted from an apparent misuse of herbicides, it may be appro-

Figure 14–4. Colorado blue spruce with symptoms of MCPA herbicide damage. Affected foliage is necrotic and some needles have been cast prematurely.

priate to contact the state pesticide regulatory agency or the U.S. Environmental Protection Agency.

Control

Desirable trees located where herbicide exposure is likely will require protective effort. Persons who apply herbicides should be informed of where desirable trees are located, and products that pose a minimal risk to the trees should be used. Extra caution should be exercised to ensure proper calibration and application. Once exposure has occurred, little can be done to minimize the initial effects. Washing herbicide off foliage can be effective if it is done during or immediately after exposure. Soil-active herbicides can be deactivated on a limited scale with activated charcoal or similar products. Generally, any effort that promotes tree vigor should help minimize the effects of the spray, except that regrowth of foliage should not be stimulated. Trees weakened by herbicides may be predisposed to insects, pathogens, and other types of environmental damage.

Selected References

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