

AGRICULTURAL GUIDE

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Herbicides

Herbicide damage to sensitive crops

The problem

Over the past several decades in Missouri and other states, the greatest and most widespread uses of herbicides have been in the production of row-crops and forages and in the clearing of brush for pasture improvement.

Oversight and carelessness in the use of herbicides on these crops and pastures have often resulted in unwarranted crop damage and substantial economic loss to growers or users of herbicides. This is especially true where small scale, high-value crops of sensitive nature are involved.

Sometimes farmers and landowners unknowingly apply hazardous herbicides in such close proximity or under such unfavorable climatic conditions that they injure their own crops or those of their neighbors.

Herbicide hazards

Whether there is herbicide injury to crops depends upon several factors:

- the chemical nature of the herbicide,
- the sensitivity of the plant species,
- the methods of application,
- the proximity of target and non-target crops, and
- the behavior of the herbicide in the environment.

All herbicides can be classified as either selective or non-selective. Selective herbicides kill certain weeds with little or no injury to the crop. It is the difference in plant response that determines the effectiveness of the herbicide and safety to the crop.

Non-selective herbicides are those which will kill or injure virtually all kinds of vegetation. The risk of drift is great when the application is by foliar spray. When the soil is treated, a hazard may arise from the herbicide persisting in the soil longer than intended and interfering with growing a crop at some later time. The movement of a non-selective herbicide by runoff or by soil erosion to non-target areas is another possibility.



Typical 2,4 D injury symptoms on grape leaves.

Drift hazards

There are two ways herbicides drift to non-target areas.

1. Mist droplets are generated by the sprayer nozzles. The size of droplet depends upon the nozzle pressure, the size of nozzle orifice, and the surface tension of the spray solution.

2. Vapor may be generated depending upon the volatility of the herbicide. The amount of vapor varies with the chemical and the conditions of application.

Droplet drift. The distance of droplet drift depends upon the size of the droplets, the velocity of the wind, and the height above the ground where the herbicide is discharged. In general, larger orifices and lower pressures result in larger droplets. Conversely, the smaller the orifice and the greater the pressure, the smaller will be the size of the droplets. The smaller the droplet, the farther it will drift with wind of any particular velocity.

Vapor drift. Volatility refers to the ability of a herbicide to vaporize and to mix freely with the air. Volatile herbicides may produce vapors that can be carried great distances from the target area to other crop sites. Such herbicide volatility can also reduce the rate of application to the target area.



A row of grapevines severely injured by herbicides used to clear the nearby railroad.

Phenoxy herbicides

The phenoxy group of herbicides has been most often involved in crop injury by off-target drift. The phenoxy group includes 2,4-D, 2,4,5-T, 2,4-DB, 2,4,5-TP (Silvex) and MCPA. These herbicides are most commonly used for the control of broad-leaved weeds in crops and for the control of undesirable woody species.

Phenoxy herbicides are more or less volatile. Vapors can arise from the herbicide while mixing, during, and after application.

Phenoxy herbicides in general are formulated in two ways, as esters or amines. Esters are more effective in controlling hard-to-kill weeds but are the most hazardous in terms of volatility and consequent drift to sensitive crops.

There are two categories of esters: the regular form and the low-volatile form. The latter form is less likely to cause problems. The amine formulations are safer to use than are the esters, but they are less effective in their performance.

Susceptible crops. Although most kinds of broad-leaved plants are susceptible to injury by phenoxy herbicides, grapes and tomatoes are the most sensitive. Cotton, soybeans, potatoes, other vegetables, legume crops, and many ornamental trees, shrubs, and flowers can also be severely affected.

Because grapes are one of the crops most sensitive to phenoxy herbicides, these herbicides should not be applied in an area where vineyards are established. Great distances between the site of application and the location of a vineyard, tomato field, melon patch or greenhouse may not afford protection against injury from drift.

Problems of drift are common and often result in hardship for the grower of the susceptible crop, judgments against the applicator for crop losses, and a bad reputation for the herbicide.



Typical leaf-curl symptoms of soybeans exposed to phenoxy herbicides.

Symptoms of injury. Mere traces of a phenoxy herbicide may cause sensitive plants to produce abnormally large leaves, exaggerated distances between leaves, and multiplied or enlarged flowering or fruiting parts.

Greater concentrations of the herbicide can cause stunting and cupping of leaves, spiraling growth of soft shoots, clearing and enlargement of major leaf veins, and severe distortion of flowering or fruiting parts.

After severe exposure, leaves may be fan-shaped or severely stunted and curled, with extensive development of small teeth along leaf margins.

When grapes are visibly affected, there will generally be uneven or delayed coloring of the fruit. Reduced production of sugars within the fruit can render the crop worthless. Shoots grow either excessively long or may be stunted, and the canes may lose their ability to survive normal winter temperatures. Leaves exhibit the characteristic fan shape with saw-tooth margins.

Affected tomato plants exhibit cupped or elongated leaves with enlarged pale veins and toothy margins. Stem twisting, severe stunting of plants, puffy fruits, or abortion of flowers commonly occur.

Soybeans usually exhibit leaf distortion at lowest

levels of exposure while higher levels can result in yellowing of foliage and defoliation.

Greenhouse crops, vegetables, ornamental plants, and desirable native vegetation are affected in various ways. The leaves and stems of shrubs or trees may become stunted, stretched, twisted, or spindly to the extent of being unsightly or worthless.

Long-term effects. Woody plants such as grapes, apples, and peaches which show substantial stem and leaf distortion usually fail to produce a marketable crop. If the symptoms are sudden or severe, one to three years may be required for recovery. Severe cases of phenoxy herbicide injury may result in stunted growth and poor ripening for two to four years after exposure. Growers seeking monetary compensation should be aware of these long-term effects and not be too quick to settle damage claims.

Annual crops of herbaceous plants such as florist crops, field crops, and vegetables do not have the same potential for long-term losses. But the value of a single season's crop can constitute a major economic loss to either the grower or the user of the herbicide.

Other herbicides

Several herbicides other than the phenoxy can also injure sensitive crops. Some of those applied to soils to control woody plants or weeds in crops may be absorbed by the extensive roots of nearby plants such as fruit trees, nut trees, and grape vines.

Certain non-phenoxy herbicides used to kill woody plants by application to the foliage can cause problems when they drift to economic crops.

Preventing crop injury

Awareness is the key to preventing damage by phenoxy and other herbicides. Once applicators are aware of the hazards and possible consequences of misuse they can take several steps to prevent problems:

- Learn the locations of sensitive crops in the area.
- Avoid use of ester formulations of phenoxy herbicides in any area near sensitive crops.
- Use amine forms of phenoxy herbicides to reduce the risk of vapor drifting to nearby sensitive crops.
- Apply pesticides, especially herbicides, on a calm day or when a light breeze is blowing away from sensitive crops.

- Spray when temperatures will remain below 90 degrees F to prevent or reduce vaporization.
- Use sprayer nozzles with larger orifices and operate at lower pump pressures to reduce the production of fine droplets.

Resolving problems

User responsibility. Registration and labeling of a particular pesticide clearly give individuals the right to apply the pesticide as long as they follow the directions for use and the precautions stated on the label. The use of a pesticide in any way contrary to the label is a violation of federal law. Misuse of a pesticide may make the user liable to either criminal prosecution or to civil proceedings or both.

Although there is no legal obligation for herbicide applicators to take stock of sensitive crops in the area of application and to consult and cooperate with neighbors in matters of herbicide use, it is advisable to do so.

Further information about pesticide use and hazards can be obtained from any University of Missouri Extension Center.

Rights of injured parties. Those who grow specialty crops, which may be injured as a result of pesticide misuse, have rights protected by law. Through civil proceedings, injured parties may attempt to regain financial losses or to secure punitive judgments.

Growers of sensitive crops are not obligated to inform operators of surrounding farms and local industries of the presence and sensitivity of their crops, but it is advisable to seek the cooperation of neighbors in the use of hazardous pesticides.

Reporting incidents of pesticide damage. Two governmental agencies may exercise regulatory powers in situations of herbicide misuse. The Environmental Protection Agency functions at the federal level. The Missouri Department of Agriculture Bureau of Pesticide Control acts at the state level. Either of these agencies may investigate and collect evidence to be used for prosecution of violators.

Injured parties may initiate an investigation by filling out a pesticide incident report form. Forms can be obtained from an area pesticide inspector or from the Bureau of Pesticide Control, Missouri Department of Agriculture, P.O. Box 630, Jefferson City, Missouri 65101.

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