# 58. Pesticide Injury

*John W. Taylor, Jr., and David South*

## Hosts

Pesticide injury can occur on seedlings of all species.

## Damage

Injury can range from slight seedling stunting to mortality.

## Diagnosis

By maintaining untreated check plots, the nursery manager can determine if seedling injury is due to pesticides. Without check plots, diagnosis can be very difficult, even for a specialist. Successful diagnosis without check plots requires a thorough knowledge of the modes of action of the pesticides employed as well as the characteristic symptoms of injury for each pesticide.

## Types of Pesticide Injury

The injury varies with the chemical used; the concentration contacting the seedling; the species, age, and physiological condition of the seedling; the soil texture; and other environmental considerations. Pesticide damage is most likely to occur when seedling tissue is young and succulent.

**Foliage**—Newly formed needles may be burned as a result of oxyfluorfen application (fig. 58-1). Nitrogen fertilization treatments can increase the succulence of newly emerged tissue, thus increasing susceptibility of the plant to herbicide injury. In the South, glyphosate contact on foliage can kill young pine seedlings (fig. 58-2). Northern conifers are apparently more tolerant of glyphosate.


***Figure 58-1***—Burning of new needles on pine seedlings, caused by misapplication of oxyfluorfen.

**Root System**—The root system of seedlings can also be severely damaged by certain pesticides. Trifluralin can cause severe injury to root systems when it is incorporated into the soil, but root injury may be less severe if the material is applied only to the soil surface. Napropamide, for example, may cause root injury if applied to the surface of soils low in organic matter.

**Growth**—Reduced seedling growth may occur when soil fumigants or fungicides reduce or eliminate mycorrhizal fungi that normally colonize root systems. Recolonization by endomycorrhizal fungi is considerably delayed following soil fumigation with methyl bromide. Survival and growth of hardwood species such as sweetgum, which depend on this kind of mycorrhizae, may be significantly reduced (fig. 58-3).

## Causes of Injury

Damage caused by pesticides usually results from one of the following situations.

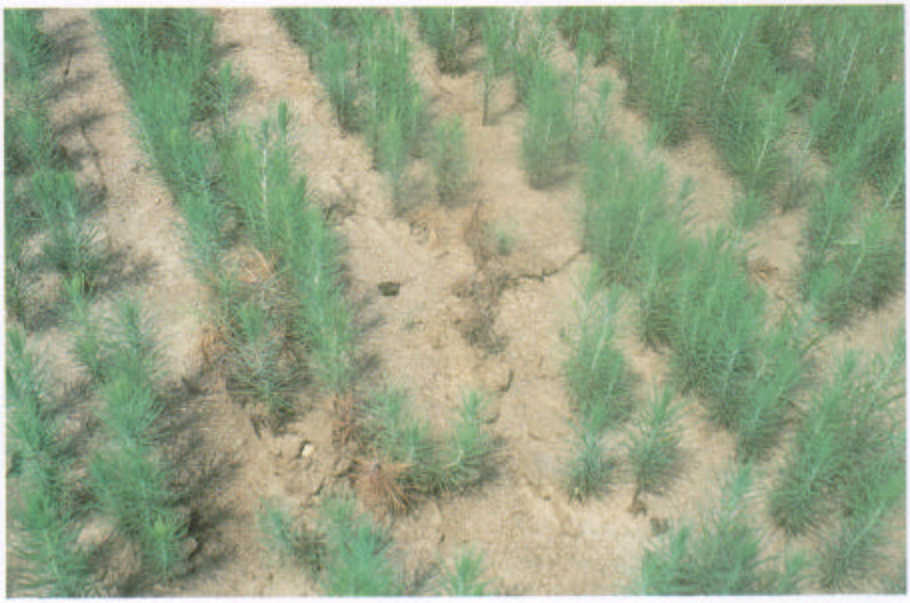

***Figure 58-2***—Young pine seedlings killed by glyphosate.

***Figure 58-3***—Reduced growth and stand in bed of sweetgum fumigated with methyl bromide, due to lack of endomycorrhizae.

**Misapplication**—The application of a pesticide formulation that is toxic to plants is normally the result of failure to read the pesticide label carefully, failure to clean equipment properly, improper mixing of formulation, improper calibration of equipment, or improper timing of application.

**Drift**—Pesticide drift is the movement of airborne droplets of a toxicant away from the intended point of application. The degree of drift is influenced by droplet size, microclimate, chemical formulation, and adjuvants.

Selection of nozzle type and size is critical. In general, the smaller the spray droplets, the greater the drift. Hence, when applying highly phytotoxic pesticides like glyphosate, a coarse spray (large droplets) should be chosen.

When phenoxy herbicides are applied on areas adjacent to seedlings, esters with low volatility are preferred. Significant drift can result from use of highly volatile esters. Thickeners, additives, foaming agents, and emulsifying agents can be added to the herbicide mixture to affect droplet size and lessen drift.

Weather profoundly influences drift. An inversion layer can suspend and move pesticide droplets considerable distances before they settle on sensitive seedlings.

**Incorrect Chemical Formulation**—Careful choice of pesticide formulations can minimize the chances for plant damage when the toxicant is applied directly to seedlings. Granules and wettable powders are less likely to cause damage than are emulsifiable concentrates. Formulations and adjuvants containing oil can also injure foliage of certain species.

**Adverse Weather**—Temperature, rainfall, inversion layers, and cloud cover can affect pesticide injury. Some pesticides cause damage if applied during damp or cool weather; others are most likely to cause injury when temperatures are high. During heavy rains, water-soluble pesticides can be carried in surface runoff (fig. 58-4). With certain herbicides, injury may result when cloudy conditions occur during emergence of seedlings.

## Prevention of Injury

When properly used, pesticides can protect the nursery crop against pests that would otherwise destroy it. However, pesticides must be used according to label instructions, with proper methods and equipment, and under optimum environmental conditions to control pests and to minimize damage to seedling crops.

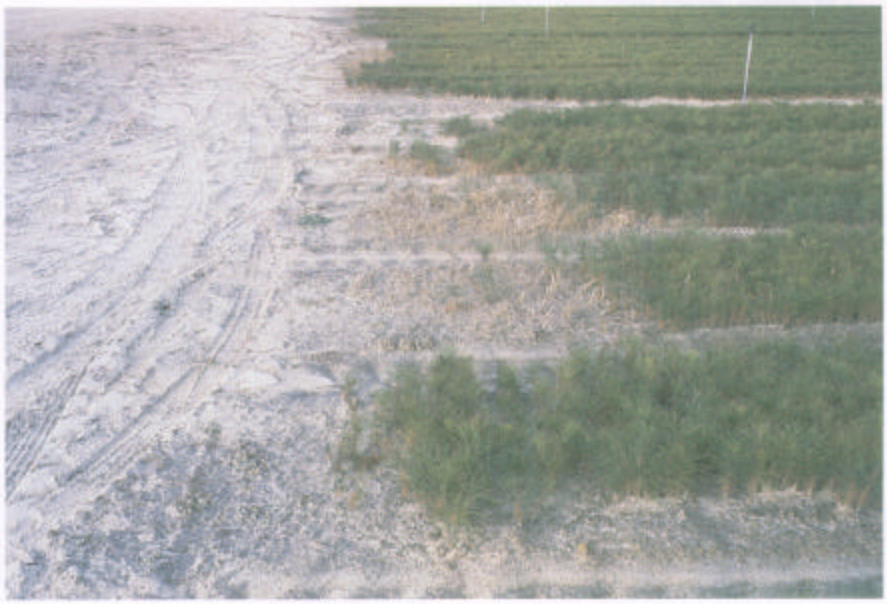

***Figure 58-4***—Damage to seedlings when hexazinone applied to roadway washed downslope to seedbeds.

## Selected References


Abrahamson, L.P. 1980. Glyphosate, a selective herbicide in conifer seedbeds. In: Abstracts-1980 meeting of the Weed Science Society of America; 1980 February 5-7; Toronto, ON. Champaign, IL: Weed Science Society of America: 52-53.

Boyer, James N.; South, David B. 1984. Forest nursery practices in the South. Southern Journal of Applied Forestry. 8(2): 67-75.

Marx, D.H.; Cordell, C. 1986. The effects of triadimefon on growth and ectomycorrhizal development of loblolly and slash pines in nurseries. Phytopathology. 76(8): 824-831.

Marx, D.H.; Morris, W.B.; Mexal, J.G. 1978. Growth and ectomycorrhizal development of loblolly pine seedlings in fumigated and nonfumigated nursery soil infested with different fungal symbionts. Forest Science. 24: 193-202.

Riffle, Jerry W. 1980. Growth and endomycorrhizal development of broadleaf seedlings in fumigated nursery soil. Forest Science. 26(3): 403-413.

Rowan, S.J. 1978. Treflan injury of loblolly pine seedlings. Tree Planters' Notes. 29(3): 25-26.

South, D.B.; Gjerstad, D.H.; Campbell, S.J. 1980. Comparison of methyl bromide and herbicide effects on endomycorrhizae formation, seedling production, and weed control in sweetgum seedbeds. European Journal of Forest Pathology. 19(6): 371-377.

South, David B. 1980. Nurserymen must leave herbicide check plots. In: Proceedings, 1980 southern nursery conference; [date of conference unknown]; Lake Barkeley, KY. Atlanta, GA: U.S. Department of Agriculture, Forest Service: 123.

South, David B.; Kelley, Walter D. 1982. Effects of selected pesticides on short-root development of greenhouse-grown *Pinus taeda seedlings*. Canadian Journal of Forest Research. 12: 29-35.

South, David B.; Mexal, John G. 1983. Effect of bifenox and oxyfluorfen on emergence and mortality of loblolly seedlings under growth chamber conditions. In: Jones, Earl P, Jr., ed. Proceedings, 2d biennial southern silvicultural research conference; 1982 November 4-5; Atlanta, GA. Gen. Tech. Rep. SE-24. Asheville, NC: U.S. Department of Agriculture, Forest Service, Southeastern Forest Experiment Station: 418-426.