

Too much Water Kills More Plants than too little Water

by Mark Halcomb, UT Extension Area Nursery Specialist
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General Statement: Plants can tolerate drought much longer than they can swim or hold their breath. My big lesson on this came during the mid and late 80's here. We had a three year drought followed by a so-called average year and then a wet year. I witnessed more plants dying during the wet year than during the entire three dry years combined.

There were two big reasons the heavy rains in early May killed more plants than normal. Twelve inches of rain in 3 days caused flooding. The high water covered many plants with new, tender growth. The high water remained 3 to 4 days. Our floods generally come in late winter while the plants are still dormant and goes down in two days or so.

Much of the nursery stock in the northwest quadrant of Warren County is planted on a Dickson soil. Dickson soils did not flood but became totally saturated because the fragipan holds or perches the water.

Plants that are not killed outright, may linger for months. Reddening foliage and drooping leaves are stress symptoms that will show up on plants that have suffered root loss from excessive moisture. Their future depends greatly on the future temperature and moisture. Excessive heat or drought would further stress the already weakened plants, as would more excessive rain. Reddening burning bush is an exception as they begin to harden in the late summer.

Do not give stressed plants extra fertilizer, especially plants suffering a loss of roots. They cannot utilize or benefit from any extra; less would be better.

It seems to surprise people to see a plant leaf out in the spring and then die overnight. This is common after a late summer drought, major freeze damage or saturated soils for too long, like we just had. If the roots or most of the roots die overwinter, and the top does not dry out, the plant will bud or leaf out on stored energy. When those reserves are depleted, it is all she wrote. The top wilts rapidly. The cambium may still be green, but check the roots or stem at the soil line. A green top with dead roots is a dead plant -- merely a matter of drying out.

The following information is from page 486 of "Diseases of Trees and Shrubs" by Sinclair, Lyon & Johnson, 1987. They were professors at Cornell University. It is a bit technical, but more accurate than I could write it.

"Roots in flooded or waterlogged (saturated) soils often die of anoxia (oxygen deficiency). Most trees and shrubs cannot grow for long in waterlogged soil, and some perish if flooded for only a few days during the growing season. Plant roots and soil organisms quickly use up gaseous oxygen in waterlogged soil.

Oxygen deficiency in roots causes a switch from aerobic to anaerobic respiration, which is much less efficient in utilization of organic compounds as energy sources and results in accumulation of toxic end products such as ethanol. Roots soon lose some of their permeability to water, retarding uptake of water and minerals.

After a few days, internal water shortage, stomatal closure, and depressed photosynthesis and translocation of organic compounds occur. Stomata either remain closed or reopen only after root absorption resumes. If the plant remains alive, diminished root function soon causes foliar nitrogen deficiency.

Synthesis and translocation of growth regulators (giberellins and cytokinins) in roots slows, and concentrations of auxins and ethylene in stems increase. Mycorrhizal fungi, which associate with plant roots symbiotically, are also adversely affected, further suppressing plant uptake of mineral nutrients, especially phosphorus.

Internal water deficit in some plants increases until they die, but many kinds of plants regain the normal degree of hydration while their stomata remain closed during flooding. Stomata of some tolerant plants reopens as the plant adapts to flooding.

External symptoms of injury include variations of the following: downward bending of leaf petioles, stem swelling (particularly in small plants), chlorosis; edema, red or purple pigmentation in leaves (of pear and some other plants), browning of leaf margins, reduction or cessation of growth (more pronounced in roots than stems), twig dieback, death of roots, wilting, leaf drop, and death of the entire plant.

Seedlings develop symptoms more quickly than do large plants. Plants with roots injured by waterlogged soil may subsequently suffer drought stress or death when, after the soil drains, the root system is unable to meet transpirational demands of the top.

Plants stressed or injured by water logging also become abnormally susceptible to certain fungal pathogens. *Phytophthora* species cause root rot most often in soils that are periodically waterlogged.

Dormant woody plants can tolerate flooding or water logging for several weeks without much harm. This tolerance is usually associated with low oxygen demands of roots and organisms in cold soil, but dormant roots also display tolerance at moderate temperatures.

Edema develops in such plants as hibiscus, privet, and yew when soil is waterlogged and transpiration is impaired.

The following classification of trees and shrubs according to tolerance of flooded or waterlogged soil has been compiled from several published sources. Where available, the ratings are for established trees rather than for seedlings.

Relative tolerance of plants to flooded or waterlogged soils

Tolerant: black, green, and pumpkin ash; buttonbush; bald cypress; redosier dogwood; tupelo gum; water hickory; deciduous holly; eastern larch; water locust; red maple; overcup oak; swamp privet; black and sandbar willows.

Intermediate: speckled alder; eastern arborvitae; arrowwood; white ash; trembling aspen; Japanese barberry; red bay; sweet bay; river birch; box elder; Atlantic white cedar; cornelian cherry; eastern cottonwood; `Dolgo' crabapple; American cranberry bush; paniced dogwood; American and cedar elms; balsam fir; sweet gum; hackberry; Pfitzer juniper; honey locust; silver maple; nannyberry; bur, swamp chestnut, Nuttall, pin, water, and willow oaks; osage orange; callery, common, and Oriental pears; persimmon; loblolly, lodgepole, pond, and slash pines; balsam poplar; Regel's privet; black spruce; sycamore; pussy willow; white willow.

Intolerant: European mountain ash; basswood; American beech; gray, paper, and European white birches; Oriental bittersweet; yellow buckeye; eastern red cedar; black and Higan cherries; crabapples; flowering dogwood; red, Siberian, and winged elms; forsythia; black gum; Lavall's and Washington hawthorns; eastern hemlock; mockernut, pignut, and shagbark hickories; American holly; Morrow and tatarian honeysuckles; American hornbeam; hop hornbeam; black locust; saucer and southern magnolias; Norway and sugar maples; red mulberry; ninebark; blackjack, cherrybark, chinkapin, laurel, southern live, post, Northern red, southern red, shumard, and white oaks; mock orange; pawpaw; pecan; peach; jack, red, shortleaf, Virginia, and eastern white pines; Amur and common privets; redbud; sassafras; sourwood; blue, Norway, Sitka, and white spruces; sugarberry; tulip tree; black walnut; wintercreeper; yellowwood; Japanese and hybrid yews."

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