GIRDLING ROOTS: Prevention and Management

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Strange as it may seem, trees occasionally girdle themselves with their own roots. Some die as a result. Inasmuch as the phenomenon of "girdling roots" seems to be exclusively one of cultivated trees, with symptoms appearing 15-40 years after they are transplanted, constant vigilance by those who plant and maintain trees is a must. This fact sheet describes symptoms of girdling roots and suggests steps to be taken to prevent their occurrence.

Symptoms - Some species of trees seem to sustain a greater amount of injury from girdling roots than others do, but it is unclear why that might be the case. As a group, maples are especially notorious for developing girdling root problems. Red oak, honey locust, zelkova and spruce occasionally suffer, but incidence of problems with these species is best rated as rare. Shallow rooted species such as beech and willow never seem to be affected, even though intermingling of the roots within a single tree is common. The first symptoms of girdling root injury resemble those caused by any number of other root problems. Branch and stem growth slow down, leaves may turn their autumn color a few weeks earlier than normal, and various secondary insects and fungi kill random branches in the crown. At ground level, there is usually no direct evidence of a problem other than that the stem usually goes straight into the ground with no visible root flare. Upon excavation, the first offending root can usually be found anywhere from 6-18 inches below ground level. Often, there are others at greater depths.

Cause - An undisturbed tree in an unrestricted site produces roots that radiate out away from the main stem such that they rarely contact each other. Growth is presumably regulated by hormones produced in the apical meristem of each major root to keep them growing away from the stem and away from each other. However, in the process of growing and transplanting trees, there are plenty of opportunities for aberrant root growth and development to occur.

First, roots may become distorted during cultivation or root pruning in the nursery. The hazard is especially high if equipment designed to sever roots is not sharp enough or if it hits a branch too large to be cut cleanly. In those cases, the roots may be pulled around so that they grow perpendicular to their intended path and may thus cause problems years later as the stem and root grow large enough to contact each other. Similarly, roots of container grown plants often exceed the space afforded by the container and end up growing in a circular fashion. Careful scrutiny of root systems during planting of bare root and container stock accompanied by judicious pruning or straightening of potential girdlers can do much to prevent problems later on.

Also, when planting it is important to be sure that the sides of planting holes are not cut too smooth (especially in heavy soils) and that the holes are big enough to eliminate the need to "screw" the plant into the hole. Failure to consider either of these will result in distorted roots destined to eventually contact the stem at some later time in a tree's life.

Planting in sites with limited space for roots to grow, such as is characteristic of many urban tree lawns, may also lead to eventual girdling. However, development of girdling roots in such sites seems to be a much less likely threat than other limitations posed by those sites.

Excavation of trees in various stages of decline suggests that deep planting may also contribute to development of girdling roots. The idea originates with knowledge about differences between root wood and stem wood. They are anatomically different from each other with roots having larger diameter cells with thinner cell walls and a greater number of pits connecting the cells. Thus, root wood can conduct water and nutrients across virtually its entire cross-section. If it is "girdled" by another root, the effect is similar to putting a dent in a pipe. There is ample cross-sectional area to compensate for the obstruction.

Conduction of material in stem wood, however, is different inasmuch as it is limited to the outer 1-3 growth rings. When that tissue is girdled by pressure from a root or anything else, conduction in that part of the tree ceases. For a root to girdle a tree, it must actually girdle the stem, and that cannot happen unless the stem is underground as a consequence of deep planting or excessive after-planting backfill.

Management - Prevention is the best approach to dealing with potential girdling root damage. Be sure root systems are growing away from the stem before planting trees, "unwind" pot bound container stock, and dig holes that are wide enough to allow for good radial development of the root system. At the same time, be sure those holes aren't too deep. If holes that are too deep are backfilled to compensate for the error (or to "improve" the quality of the site), the backfill will settle in ensuing years and so will the tree. Thus, it may still end up too far below grade. It's better to dig the hole right the first time.

Where trees are already large enough to have developed girdling roots, removal of the offending roots is possible. However, it is important to remember that the same root that is girdling one part of a stem is nourishing another part. Thus, as removal of a girdling root relieves pressure on one part of the stem, it robs another of water and nutrients it was once getting. Be sure to water trees and protect them from other potential threats (such as defoliating insects) in the year or two following girdling root removal. If more than one girdling root has to be removed, extend the operation over several years. Too much root damage in a single year may be just as bad if not worse than damage caused by the roots themselves.