# Responding to Customer Concerns: Diagnoses of Ornamental Plant Injury

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Diagnosing plant injury can be a process of identifying what the problem is, and/**or** eliminating what the problem is not. **It is also a process of analyzing landscape risk factors.** You should tell the customer something that indicates you have a good understanding of what damages plants. Some people may think chlorotic plants got that way from herbicide damage; after all, herbicides are designed to damage plants. Some customers assume the landscape maintenance company did something wrong because normally plants "just grow". When you can not figure out what is wrong with a plant, you want to confidently inform the customer what is **not** wrong. There are only so many ways that plants get injured, and with experience you can quickly identify insect, disease and herbicide damage to the tops of plants. They usually have distinct signs, symptoms, and patterns of damage. There are two western web sites that can guide you through the diagnostic process, one from Oregon State and one from Arizona: http://www.orst.edu/dept/hort/dpd/, http://ag.arizona.edu/pubs/garden/mg/damage/index.html Even if you can not figure out what the problem is, these sites will help you generate an impressive list of what the problem is not and why.
http://www.agnr.umd.edu/users/hgic/diagn/home.html is a diagnostic web site from the University of Maryland and uses pictures to guide the diagnoses.

Once you think you know what the problem is, it can be verified by two University of California web sites that have good pictures. http://axp.ipm.ucdavis.edu/ is good for insects and diseases. This site also lists some very good books from the University of California. The other California site: http://wric.ucdavis.edu/information/herbicideinjury/herbicideinjury.html is good for herbicide damage. You can also verify the diagnoses by using the http://plantfacts.ohio-state.edu/ search engine to get fact sheets that are on the web.

A very important reference is the book, *Arboriculture - Integrated Management of Landscape Trees, Shrubs, and Vines, third edition,* by Richard W. Harris, James R. Clark and Nelda P. Matheny, 1999, Prentice Hall. In my opinion, if you don't read and understand this book you will not be very effective in diagnosing woody plant problems on commercial landscapes in California.

Once you have eliminated specific pests, except perhaps phytophthora, specific toxins and herbicides and freezing weather, you get to the topic of this paper and talk. On commercial landscapes the most common cause of poorly performing, and ultimately failing, plants is poor root growth.

The root problems are usually caused by some combination of some of these problems or risk factors:

- compacted/disturbed soil from construction – there are not enough free draining pores for air to get to the roots. Clay in the soil makes the problem worse

- root rot prone plants – usually any plant that needs good drainage, includes many drought tolerant plants.
- irrigation problems – it takes a long time to see the effects of too much water, you usually see the effects of too little water quickly. Overwatering is common.
    - poor coverage – this can lead to overwatering part of the landscape to avoid have another part dry out. At least parts of many landscapes get overwatered.
    - too many clocks to adjust for weather – this can lead to too much water during cool weeks to ensure that you apply enough water for hot weeks.
- turf competition – proper water for turf is usually too much water for woody plants, unless the excess water can easily drain away in sandy soils. Turf is very tolerant of overwatering. Fescues are also directly toxic to plants (allelopathy).
- planting too deep. Many people like the look of a plant "securely" in the ground.
- girdling roots – often no flair at base of part of trunk – happens with container stock
- salts from reclaimed water.

You can not always distinguish "the cause" from among these risk factors, although high enough levels of salt will give distinct symptoms of margin and tip burn, and salts in soil, water and tissue can be measured.

If you are examining plants that are growing slow, or are off color, you have to dig to examine the roots and root crown area. If the roots or root crown area is dead, the plant has failed and should be replaced. If the plant has been in the ground for six months and no roots have grown into the surrounding soil. the plant is failing and any risk factors should be reduced or eliminated. If you find girdling roots, the plant will likely fail some time in the future, and if the girdling is extensive, it is probably the cause of the symptoms. If you don't find obvious problems with the roots or crowns, try to reduce any of the above risk factors that are present. More time and effort can be put into watering so the surface few inches dry out before another cycle begins; turf can be removed from around plants; drainage can be improved or excess water intercepted by French drains; and soil can be removed from around crowns and from over-buried root systems.

Root problems often slowly degrade plant function over a period of years, and may not cause distinct symptoms. Remember that the above situations are risk factors, not necessarily distinct causes. The more risk factors there are, the greater the risk the plant will perform poorly. So most of the time you are dealing with probabilities of failure, e.g. I can tell you that these plants are not growing well, and some will fail, but this particular plant may or may not fail. Communicating this to a client who wants "the answer" can be a challenge. Customers want a solution and may want to know whose fault "it" is. In many cases, failing plants are an inevitable part of commercial developments, eliminating or greatly reducing the plant risk factors is far too

expensive or at odds with the design. Furthermore there are a number of concepts for dealing with failing plants that can be difficult for customers.

## Plants do not die like animals - they decline or fail

Plants don't move, don't breath, and do not have a brain. You may get concerned when an animal is not moving, and is not in a typical sleeping or resting position. You may prod the animal to get it to respond. If that gets no result and *rigor mortis* has not set in, you check for breathing. If the animal is not breathing you usually assume it is dead. Since people may be put on a respirator you may have to check to see if they have brain activity before assuming they are dead. Many people assume a plant is dead when the leaves or needles are all brown. Someone used to dealing with plants will often cut through the bark to see if the inner bark is white or yellow and moist. If the inner bark is brownish or is dried out, the plant, or that branch, is usually dead. On a landscape, the problem is that the plant stopped growing, months or years before it "died". A plant that is not growing should usually be replaced. Usually you want plants to get bigger and fill in the landscape. Even if you are happy with size of the plant, a plant that is not growing is usually (but not always) irreversibly proceeding to brown leaves or needles and dead wood. A plant that is not actively growing, is in fact actively "dying". This is why a better term may be failure of the plant, rather than death of the plant. Another term is decline. Decline is like death, in that the more the decline has progressed, the less likely that it can be reversed. For further discussion of decline see http://www.msue.msu.edu/msue/imp/moduf/07279524.html.

A plant may also grow slowly because of lack of fertility. Most landscapes get fertilized to some extent, and total lack of fertility is not usually problem in the west. The limiting fertilizer element is usually nitrogen, Most woody plants in California will respond to nitrogen fertilizer with increased growth, and a plant that does not respond to nitrogen fertilizer usually has one or more of the above risk factors. If a plant does suddenly wilt or turn brown it is usually an acute lack of water. This can be because the soil was allowed to dry out from an irrigation failure, or water was not getting to the tops because of root or vascular failure. The root or vascular failure was probably slow, fitting the decline concept, even though the water deficit was acute and suddenly expressed.

## Woody plant failure usually proceeds in specific order

Trunk caliper growth (cambium) is usually the first part of a landscape plant to stop growing. Trunks of trees that are declining or failing are usually thinner (less caliper) than actively growing trees. Pruning and other wounds do not callous over or seal. The risk of cankers and boring insects is higher. Woody plants store starches and other energy sources in woody tissue. Wounds that do not seal get infected which reduces energy storage volume. This is why leaving lower temporary scaffold branches on new trees reduces the risk of failure. See http://www2.champaign.isa-arbor.com/arbnews/apr01/feature2.html for more information on proper pruning. See http://www.chesco.com/~treeman/SHIGO/AUTO.html for pictures and

further description of the effect of wounds on energy storage in wood. It is relatively common to examine pruning cuts on landscape trees and find that on some trees they are healing and on some trees they are not. The tops may be green and leafy on all of them, and roots may have grown into the surrounding soil, but the plants that have pruning wounds that don't heal, are at much higher risk for failure. Reduce any risk factors you can.

Roots are usually the next part of a landscape plant to stop growing on a failing plant. Once the roots stop growing, woody plants rarely recover unless the root environment can be improved. A plant's main defense from root rot is outgrowing the fungi. When growth is too slow, the fungi win. At this point the green color of the plant may go off color (usually yellowish, but maybe reddish). Sometimes only some of the roots have stopped growing and only leaves or needles on the branches supported by the declining roots turn yellowish. It is relatively common to dig around the root ball of a tree or shrub that has been in the ground for six months and find no roots growing into the surrounding soil. The tops may be fine, but these are failing plants, reduce risk factors.

The production of new leaves is the third growth process to stop. By the time that you see branches that have no leaves or needles (dieback), the plant's trunk and roots have stopped growing from a few months to years ago. A plant with green leaves may be irreversibly failing. People may be reluctant to replace a plant with green leaves. However if you allow the customer to wait, they will loose growing time on the replacement plant. It is like compound interest, the earlier you start saving, the more money you will have: the sooner you replace a plant that is failing, the sooner you will have a large valuable plant.

## Potential Mismatch Between What Customer Wants and What Plants Need

When analyzing plant problems on commercial developments, keep in mind that the needs of the plants have to fit into other needs and priorities. Land is very expensive to develop. No revenue is being generated while an office or apartment complex is being developed. Typically money is borrowed for the construction. These loans can be expensive and are relatively short term. It is usually important to get the construction done quickly to minimize interest expenses. It is also important to get the building filled with paying tenants quickly so payments can be made on the loan. Money for items not important to tenants, like a high end irrigation system, may be hard to justify. Loans for developed property with paying tenants are much cheaper than construction loans.

Usually the soil on the whole property has to be graded and compacted to make a stable base for buildings, pavement and hardscape. This process destroys the soil structure and makes the soil less suitable for plant roots. Leaving areas undisturbed for plantings is usually not possible on sloping land, and even on flat land, working around the undisturbed areas would slow down the construction. Going back latter and excavating areas of the compacted soil for plantings is expensive and usually not practical because the buildings, pavement, and hardscape

present too many obstacles. Also the planting areas would have to filled with a planting mix that would be expensive to buy and again, difficult to put in place.

Land is usually very expensive, so space for plant material is often limited. This means surface areas close to where most roots grow is limited, and plants that have different needs are put close together, e.g. turf and woody ornamentals. Prospective tenants usually want to move into a development that looks finished and has a relatively mature looking landscape. This means planting at least some large trees. Large trees have a proportionally smaller root system, so any root system risk factors are proportionally higher. Many of the other plants are installed as relatively large container stock. Plants grown in containers have a higher risk of girdling roots, and every time the plant is moved up to a larger container, the risk increases. People tend to like a park or campus like atmosphere, which usually means turf. Turf is a risk factor for woody plants because of the frequent watering. A particular problem is narrow strips of turf, corners and isolated islands of grass that are difficult to water without wetting the adjacent landscape.

What all this means is that money has to be budgeted for plant changes, just like money has to be budgeted for broken windows, damaged carpets, leaking window seals, cracked pavement and other facts of building life. Part of the goal of diagnosing plant problems is too help the customer make the transition from new construction landscape to a more sustainable landscape, prioritize plant replacement, and help maintain a reasonable landscape budget.