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## TREE HEALTH FROM TOP TO BOTTOM<sup>1</sup>

by C.C. Powell

The primary objective of much of our work as tree care professionals is the maintenance of tree health. Those that successfully reach this objective do so by means of an understanding of the linkages of one problem with another, one environmental stress or change with another, one plant process with another. This is called holistic health management or tree health from top to bottom. This approach is not new. In fact, its roots are found in the actions of those experienced tree care professionals that employ a lot of common sense to guide them. Scientists and researchers have recently begun good work in this area — work that is often called integrated health management or environmental stress management. Let's discuss some of these holistic ideas and see how they fit together, in hopes that by doing so more of you will begin to make total tree care approaches work for you and your clients.

It is best to start (and hopefully end) with tree health. What do we really mean when we say tree health? What is a healthy plant? Is it the same as a plant in good health? Not necessarily! Good health involves a balance. If the total environmental elements that are influencing the tree are within reasonable ranges — both by themselves and in relation to each other, then the result is a tree that can balance its internal processes to satisfy its needs. Such a tree is in good health.

The basic environmental elements that promote plant health are not complicated. From a book on how to grow corn, I found this list of things that define a health-promoting environment. The list in-

cluded a friable soil, a proper balance of nutrients, sufficient balance of nutrients, enough root and crown space, ample water, optimum temperature and light, pure air, and freedom from pests and diseases. When one or more of these elements is out of range, the health balance of the tree is at risk.

Trees, and most other plants, have remarkable abilities to balance their internal processes and maintain health. After all, they cannot move to escape an inhospitable environmental stress like we, and most other animals, can! As plant health managers, we must simply help them to do their thing.

Stresses are the things that cause our most serious health imbalance problems! In many cases, we do not define stress very precisely when dealing with tree health. This does not make it less important as a concept however! Remember that our list of healthful environmental elements contains many things that occur in ranges. Either too much or too little of these sorts of things (i.e. temperature, light, water, etc.) can cause stress.

Good environmental awareness can help us to more easily recognize stresses. When confronted with an unhealthy tree, our first job should be to attempt to identify chronic stresses. I say this even though we might have already easily noted the presence of a particular acute stress, such as an infectious disease or insect pest. Put yourself in the place of the plant. Think like a plant! Total tree care demands this sort of attention to the total

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picture — to enable us to get a total and long lasting correction of the problem! We might want to investigate the soil water situation, light or temperature extremes, or the soil aeration and compaction conditions. Remember that stresses are apt to occur in combinations. They may be additive in their effect. For instance, soil dryness does not become stressful until temperatures climb. Such situations have often been called disease complexes.

Stresses can be of different types. I think it is important to separate them into two large categories at the beginning. These categories are acute stresses and chronic stresses. Acute stresses are those which occur suddenly and will cause damage very soon after they occur. Things like improper sprays, frost or freezes, injuries during shipment or transit and the like are examples of acute stresses. Chronic stresses, on the other hand, are things such as nutritional imbalances, too high a light intensity for an interior plant, improper pH of the soil leading to nutrient unavailability, etc. Chronic stresses take a while to work on a plant to make it diseased.

It is easier to deal with chronic stresses because we have some time to reverse the imbalance. We must learn to recognize signs of chronic stress early in the game so that the reversal can be made quickly. An acute stress, on the other hand, is something that has occurred in the past and has occurred suddenly. Therefore, we have not had much time or chance to do anything about it. About all we can do with acute stress situations is learn from our experience and make sure it is not repeated in the future.

As I have implied in the above paragraphs, chronic stresses that work on a plant over a period of time will eventually cause symptoms and sick plants. The time in which it takes the stress to work on a plant to make it sick is called a period of plant decline. There are all kinds or degrees of plant health, all the way from magnificently healthy to pathetically diseased. The longer a plant has to endure a stress, the more it slips along the continuum from health to disease. It is "declining." The key to plant health management is to recognize early on when decline is beginning. We must then take quick measures to reverse this decline and get the plants back toward the healthy

side of the continuum.

Disease is the term we use to refer to plants which are showing obvious symptoms of the unbalanced health condition. Sometimes these symptoms can occur from acute stresses such as pesticide burns. Symptoms caused by acute stresses have generally been called injuries by many in the past. Now there are some authors beginning to use the term disease even for this type of plant problem. In a sense, I guess this is correct, because it is really only a matter of time that makes it different from any other kind of plant symptom problem.

If a chronic stress is allowed to continue working on a plant for a time, it too will eventually get bad enough so that the plants will show some symptoms. If a pathogen is not involved, these situations are called "disorders" by many people. I prefer to use the term noninfectious disease to describe such health conditions.

Pathogenic organisms such as fungi or bacteria can also arrive on the scene. Very commonly, these organisms will attack and infect a plant that has previously been stressed and may already be showing symptoms of this noninfectious disease condition. When the pathogen enters the picture, we then add the health imbalance of infectious disease to that of the previously existing noninfectious disease. Actinopelte leaf spot of oak or Cytospora canker of spruce might be good examples.

Remember that the two types of disease imbalance are going on and are existing in the tree simultaneously. Another key point to remember is that management of stress can do a lot toward the management of infectious as well as noninfectious disease problems. Of course, this is not always true. There are some disease organisms that are so pathogenic that they will attack even vigorously growing and reasonably healthy plants. Fireblight of crabapple would be good example of this sort of disease.

Control or prevention tactics can be easily fit into this total tree care concept. These tactics fall into three integrated areas: plant selection tactics, cultural or care tactics, and pesticide use tactics.

Plant selection decisions have always been a difficult part of our business. We are now in an especially rapid period of dealing with "new" infor-

mation. New plants or cultivars are constantly being offered to us! Things to evaluate when considering the future healthfulness of a plant are: 1) its known susceptibilities to particular pests and diseases and 2) its known tolerance or ability to handle environmental imbalances! For instance, a new crabapple that is susceptible to scab would not be a wise choice. On the other hand, a crabapple with scab resistance but questionable tolerance of dry sites would be an equally bad choice!

Cultural tactics to modify environments are perhaps our most important ways to manage tree health. A good example, because it may well be the most common reason for poor urban tree health, is bad root-soil environments. Many soil environments are not able to support healthy roots, for many reasons such as compacted soils, poor aeration, nutrient or pH imbalances, etc.

The integrated cultural tactics we can employ are to improve the root-shoot ratio (usually done by pruning back shoots), undertake extensive irrigation and fertilization programs, and/or attempt to restructure the root environment. Restructuring the root environment has recently been emphasized by many throughout the country, especially where soils tend to be heavy and poorly drained — as in much of Ohio.

I have called such soil environmental improvement vertical mulching. In my opinion, vertical mulching is the most effective stress management tool we have! It has several objectives, thus is applicable in a variety of situations. Vertical mulching can improve aeration, improve drainage of excess water, improve penetration of water into dry soils, and provide places for roots to grow and proliferate.

Vertical mulching is relatively easy to carry out. We begin by drilling holes in the soil. The holes need to be in the area where the fibrous roots of the tree are located. The size, spacing, and depth

depend upon the situation, objectives, and condition of the tree. Fertilization can be, but probably should not be, combined with vertical mulching. I have never felt it wise to fertilize a sick tree. Fertilizer salts can further damage already weakened roots. If water shortage is part of the problem, fertilizer will only intensify such a stress.

Last in our areas of tree health control or prevention tactics are those involving the use of pesticides. Before I end, I want to leave you with a few thoughts about these sorts of tactics.

Remember that pesticides are only effective when pests or infectious diseases are truly the cause of the problem. In many cases, pests and diseases follow environmental stress — as secondary stresses. The pesticide will help, but is not the total answer. Also, remember that pesticides are only effective if several “rules” are followed. First, the correct material must be selected. This depends upon correct diagnosis and identification. Second, it must be applied at the right time of year and frequently enough to protect plant material adequately. Third, pesticides must be applied properly over plant surfaces. All of these things depend upon you making correct decisions based on correct knowledge. Too many people simply “spray and pray.” Failure is the usual result.

Thus we have “tree health from top to bottom.” Good plant health managers are — first and foremost — good environmentalists. They understand the holistic point of view. They understand that health management tactics involve several areas of thinking, planning and action. Finally, they are constantly in search of new knowledge to help them do their job more efficiently and effectively.

*Department of Plant Pathology  
Ohio State University  
Columbus, Ohio 43210*