How to Diagnose
Shade Tree Root Diseases

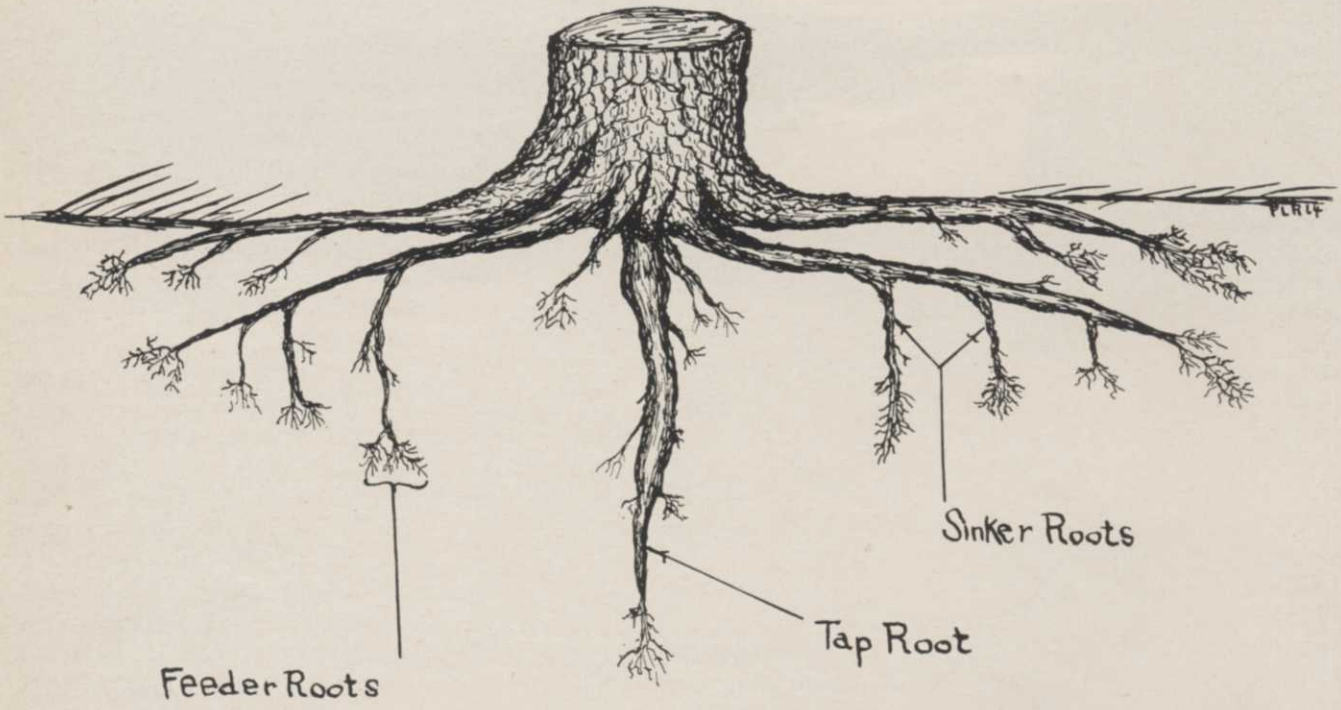

Diagram of typical pine roots. Much remains to be learned about diagnosing root diseases, author Rusden says, so tree specialists must exercise diligence in using all available data to help spot the trouble.

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DIAGNOSIS of tree diseases affecting the visible, above-ground parts of a shade tree is not easy. But it is a "pushover" compared with diagnosis of root troubles. A good diagnostician must know the normal tree and its requirements. He must identify the species correctly, recognize the growth zone to which it is adapted, evaluate the form, foliage density, size, and color. He should look for "normalcy" clues in the growth rate of twigs.

Quite a list of questions must be answered satisfactorily with regard to soil, site, exposure, drainage, temperature ranges, insolation, and general ecology of the typical "happy" tree. A probable condition of disease will be indicated when one or more signs point to abnormalities, no matter how slight.

Misleading symptoms must be ruled out. Dwarf varieties are not necessarily "sick." They are just small because of genetic factors. Variegated forms of ash or maple, for example, should not be suspected of pathological chlorosis. Some trees come into leaf late and/or shed foliage early because of genetic aberrations. Observations made in a single season may not reveal the basis for this kind of odd behavior.

Above-ground symptoms of trouble may be secondary. Primary causes may well be subterranean—out of sight. Out of mind, too, for the investigator who is untrained or simply drowsy!

When we would like, literally, to get to the root of the matter we may be stymied. The soil-penetrating, root-revealing X-ray machine has yet to be invented. In ignorance of what may lie below the soil, there is a temptation to speculate as to possibilities. Rachel Carson doled out *possibilities* with a free pen. Scientists, on the other hand, deal with *probabilities* based upon recurrence of carefully observed phenomena. It is *possible* that the tree on a dry site is drowning from a water pocket at its roots. It is *probable*, however, that it is suffering from drought since thousands of trees on really dry sites have been seen to be prime sufferers from drought.

Root Knowledge Scant

What do we know about the normal root system of a mature tree? Even professional botanists do not pretend to identify woody

plants from root specimens. In most instances, it is just too much of a chore to examine root systems through layers of mud, silt, clay, loam, gravel, and rocks. Many professional tree men spend their whole lives without ever having dissected out the entire root system of one mature tree. Our knowledge of roots, their functions and their ailments, is based on hundreds of bits and pieces of information acquired through the years. It is small wonder that our knowledge of the normal root system is sketchy. It follows that our store of root-disease know-how is relatively scanty. On the other hand, we do have a vast storehouse of knowledge of the complex soil fauna and flora, the thousands of microscopic and macroscopic animals and plants that spend their lives in the soil in intimate association with tree roots.

Roots grow in soil. Soil consists variously of inorganic and organic particles of all shapes and sizes from iron oxide molecules to boulders, intermingled with water, air, and odds and ends of gases. In general, tree roots do well in good soil and not so well in poor soil. This is not the place to discuss the chemico-physical qualities of soils in detail. Suffice it to say that faulty soils are the basis for many root diseases. Indeed, diseases in the form of physiological imbalance are much more common than infectious diseases due to specific organisms. Very small changes in temperature or moisture in roots can lead to trouble. The greater the relative change, the more obvious the source of such trouble becomes.

Tree roots must have *enough* soil in which to grow by normal cell proliferation. The root system of a tree is roughly proportional to the crown or system of branches. Confine the roots and you automatically reduce the size of the crown. A layer of clay hardpan or a rock ledge just below the upper soil "horizon" can have this root-reducing confining effect.

It's hard enough, author Rusden says, to diagnose tree diseases affecting the above-ground portions of a tree; but root diseases are even more perplexing. In this article, Bartlett's expert pathologist offers for treemen everywhere some inside tips on root care.

Roots of most trees need a granular soil in which the particles are relatively small. And a high proportion of the soil components must be nutritious — must consist of water-soluble minerals to yield the N, P, K, S, Cu, Fe, Mo, C, and other elements that are sent up in the sap stream to the photosynthesis factories in the foliage.

Insufficient or improper chemicals in the soil may cause the death of some roots. Water is needed to dissolve the chemicals if they are to be taken up by roots. Lack of water, i.e., drought, kills by desiccation. Excess water kills by drowning, a form of asphyxiation.

Dead Roots Invite Attack

Once dead, a group of roots are subject to attack by saprophytic bacteria and fungi. Some of these, once they are established, may become active parasites and go on to kill more roots. Large roots and even the trunk of the tree are attacked. The entire tree may be nearly dead before signs of trouble are visible in the crown.

Infection courts are often the result of mechanical damage. Windstorms can sway the crown enough to break roots. Excessive cultivation of flower beds near trees can break roots. Heavy machinery passing over the soil in which roots are growing not only compacts the soil unduly but actually fractures many roots. Digging away of soil in highway and building construction exposes thousands of roots to desiccation and infection. Bacteria and fungi are always

Bacterial crown galls, like the one shown here on the root of a willow tree, are typical results of the diseases Dr. Rusden discusses in this article.

This wood-rotting fungus, *Polyporus frondosus,* is one of many ailments tree service personnel must guard against. This growth is fruiting at the base of a large pin oak tree.

Nematodes, known scourges of lawns, also attack trees. The nodules shown here on roots of an oak tree are nematode-induced.

present in the soil ready to avail themselves of any breaks in the protective cortex of the roots. Once started, root rot is likely to continue.

Poisonous chemicals introduced into the soil are oftentimes directly harmful. Road salt (Na Cl or Ca Cl_2) may accumulate where drainage is poor. Roots are killed even though very slowly in most cases. Chemical waste from factories, natural or manufactured gas from leaking mains, and methane from rotting vegetation can kill roots.

Trees planted too far north (or south) of the zone to which the species is adapted will die. Trees improperly planted will often develop girdling roots that will strangle other roots and even cut off sap movement in the trunk. Planted too deep, roots will smother; too shallow, roots will freeze in winter or bake to death in summer.

Root Enemies Abound

A growing tree root not only meets mechanical and chemical barriers. It meets active enemies in the form of chewing rodents, digging dogs, grubbing humans, boring insects, cell-penetrating nematodes, noxious bacteria, rotting fungi, and occasional higher plant parasites such as *Monotropa*. Viruses, such as the

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Scholarship worth $400 was presented to Roy L. McClung, Jr. (right), senior agronomy major at Texas A&M University by Dr. Gene C. Nutter, past Executive Director of the Golf Course Superintendents of America. The GCSAA awards the scholarship to deserving students.

Need for Professional Turfmen Growing, Texas T-G Meet Hears

From 10,000 to 12,000 trained men will be needed to meet manpower requirements for the U.S. turfgrass industry in the next 10 years, Dr. Gene C. Nutter told the 19th annual Texas Turfgrass Conference at Texas A&M University, State College, Dec. 7-9.

Nutter said more and more young men in agricultural schools are taking interest in turf, but not nearly enough.

Precautions for using preemergence herbicides in turf came from L. L. Stitt of Velsicol Chemical Corp. in Chicago. Stitt recommended turf managers test each chemical on a small plot to see what it will do under local conditions, and keep a record of the tests.

About 200 persons attended the conference, which is jointly sponsored by the Texas Turfgrass Assn. and Texas A&M University.

Update on turfgrass research came from this pair of experts: Dr. Wayne Huffine (left) of Okla. State, and Velsicol's Lloyd L. Stitt.

Tree Root Diseases

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phloem necrosis virus, are found in roots.

Bacterial crown gall, more unsightly than destructive, attacks roots. The troublesome Verticillium wilt fungus enters through roots. The shoe string root rot from *Armillaria mellea* is a common disease more often suspected than found. So is the *Fomes annosus* root rot of evergreen trees.

Pines are subject to a root and butt rot caused by *Polyporus schweinitzii*. Species of *Xylaria, Daedalia, Daldinia* and *Phytophthora,* to name a few important genera, can kill roots and eventually entire trees.

The list of tree root diseases is long. The record of practicable control methods is sadly lacking.

The best that can be done to reduce the incidence of root diseases is to use concentrated common sense. Select the right tree for the site. Plant it carefully in well-drained soil (for most species). Provide adequate nutrients and water. Give it space to grow — in three dimensions. Use the available fungicides, nematocides, and insecticides where necessary.

Most of all—sponsor a program of tree root disease research in federal, state, and private institutions where the science of plant pathology is being pursued. Perhaps, before we expect it, a scientist will come up with a systemic root treatment that will assure healthy roots for all the shade trees of the future. Why not?

Georgia Weed Control Society Set for Macon Feb. 24-25

Recommendations and reports from participants in the 1964 Georgia Clean Acres Weed Control Program will be of singular interest to members of the Georgia Weed Control Society when they gather in Macon, Feb. 24-25, at the Dempsey Hotel.

The reports will reveal results of the society's initial statewide project, a broad educational program aimed at weed control primarily in agricultural production, and extended in modified form through extension organizations to include lawn, turf, industry, parks and highway weed control.

An equipment and products display by manufacturers is planned for this event. For details, write James F. Miller, Extension Agronomist—Weed Control, University of Georgia, Athens.

Meeting Dates

Michigan Association of Nurserymen, Annual Meeting, Pantlind Hotel, Grand Rapids, Feb. 9-11.

Aquatic Weed Control Society Annual Meeting, LaSalle Hotel, Chicago, Ill., Feb. 11-12.

National Arborists Association Winter Meeting, Guy Lombardo's Port-O-Call Inn, Tierra Verde, Florida, Feb. 14-16.

International Shade Tree Conference, Canadian Chapter, 16th Annual Meeting, Chateau Frontenac Hotel, Quebec City, Feb. 18-19.

International Shade Tree Conference, Southern Chapter, Meeting, Francis Scott Key Hotel, Frederick, Md., Feb. 21-23.

Southern Turf Grass Assn. Meeting, Peabody Hotel, Memphis, Tenn., Feb. 22-23.

Georgia Weed Control Society Meeting, Dempsey Motor Hotel, Macon, Feb. 24-25.

Midwest Regional Turf Foundation Meeting, Purdue University Memorial Center, Lafayette, Ind., March 1-3.

Wisconsin Park and Recreation Society, 34th Annual Meeting, Northland Hotel, Green Bay, March 10-12.

35th Annual Michigan Turfgrass Conference, Kellogg Center, Michigan State University, East Lansing, March 11-12.

Florida Turf-Grass Assn. Meeting, Sheraton Hotel and Plantation Field Laboratory, Ft. Lauderdale, May 6-7.

Florida Nurserymen and Growers Assn. Meeting, Sheraton Hotel, Ft. Lauderdale, May 13-15.

Alabama Nurseryman's Assn. Meeting, Admiral Semmes Hotel, Mobile, June 6-8.