

ACCURATE DIAGNOSIS OF PLANT PROBLEMS IS ESSENTIAL



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Dr. Roberts retired from Michigan State University in 2018 after committing four decades to advancing MSU's Land Grant Mission, originally signed into law by President Abraham Lincoln during the midst of the American Civil War. He has published hundreds of articles and has taught hundreds of lectures and workshops.

Dr. Roberts has researched many issues in Michigan's plant industry, including Oak Wilt, Dutch Elm Disease, Diplodia Tip Blight of Pines, along with a variety of cultural problems such as plant nutrition and herbicide toxicity. During his career, he has discovered a variety of new diseases and pests such as Phomopsis Canker of Spruce and the first bacterial wilt disease of turfgrasses in North America.

In the early 2000s, his research on Ash Decline in Southeast Michigan led to the discovery of the invasive Emerald Ash Borer in North America.

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PHOTO 1

The MICHIGAN Landscape™

Introduction:

We in the Plant Industry serve an important function for the public. Nurserypersons, landscape architects, arborists, landscapers, lawncare professionals, irrigation specialists, gardeners, and many others help to create wonderful environments for our clients, whether they be the public, a government facility, or a business. From ordered landscapes with multitudes of textures and colors (Photo 1) to the simple landscape design exhibiting the elegance of a nicely mowed lawn and resident trees (Photo 2), we have an important role in our communities. And just as there is a medical profession to address human health issues and a veterinary profession to attend to animal health, we have numerous plant doctors working within an extensive plant hospital network to deal with plant problems, right? No sir! Our plant hospitals are the "field", namely landscapes and nurseries. The contrast of the human/animal world vs. the plant world is rather stark don't you think? In reality, we in the plant industry are all plant doctors - every nurseryperson, every arborist, every landscaper, and every gardener.

I don't think anyone would dispute the notion that like the human health and veterinary professions, it is vital for us to accurately diagnose problems whenever and wherever our services are needed whether to resolve plant health matters or the basic maintenance inputs for optimum plant growth and survival. Yet, little attention and training is taught in the plant industry to teach us in university courses or at conferences to help us become better plant doctors. Apparently, it is assumed that diagnosis of plant diseases is simple and that we really don't need any special training. Nothing could be further from the truth. Even with the extensive training that Medical Professionals receive, they carry malpractice insurance because mistakes do occur.

My primary mission at the university for over 40 years was, and now into retirement is, to assist our industry in solving plant problems and offering reasonable solutions for their management. Following are some examples of real-life situations where accurate diagnosis could have a huge impact upon the property owners' financial wellbeing, their plants, and the environment.

PHOTO 2



Knowledge and Experience:

There are probably no better attributes for accurate diagnosis than having extensive knowledge and experience. The longer arborists, landscapers, nurserypersons, and scientists are on the job, the more expert we become. Many of us have extensive capabilities because of all of those years' devotion to our profession.

Herbicide or Oak Wilt? Taken in Western Michigan, Photo 3A shows an oak tree in the forefront and others in the background that appear to have died or are in the process of dying. Two ISA certified arborists independently identified the problem as Oak Wilt. A third ISA certified arborist asked for my assistance in diagnosing the problem because he believed the problem was not Oak Wilt but might be herbicide toxicity. Taken in Eastern Michigan, Photo 3B shows many declining Oak trees. The arborist who invited me to

this location also believed the problem was Oak Wilt. In both cases, the cause of tree decline and death was Imazapyr herbicide, which is found in many broad spectrum combination herbicide products on the market today. Perhaps most alarming, these products are available to homeowners who have little knowledge or training about herbicides. In both cases,

property owners would not admit to applying any herbicides (They or someone did!). Their insistent, non-admission of herbicide treatments may be what confused several professional arborists to shy away from an herbicide diagnosis to something more excusable, like Oak Wilt.

Over many decades, herbicide misapplications have challenged our

industry. Because of the diversity of plants we manage in nurseries and landscapes, it is arduous to utilize herbicides that will not affect non-target species. When diagnosing potential herbicide issues, it is always wise to look closely at other plants in the landscape that will also likely be affected by the herbicide if the issue is herbicide toxicity. Photo 3A Inset shows a shrub with stunted, gnarled growth beneath one of the afflicted oaks.

Why is an accurate diagnosis so important in these two situations? The implementation of Oak Wilt remediation techniques at either location would not only have been extremely costly but trees that might recover, trees not mortally affected, and many healthy trees would also have needed to be destroyed according to Oak Wilt remediation protocols, costing many \$1000s to \$10,000s in property value loss, tree removals, trenching, tree injections, etc.

Declining/Dead Scots Pines? Many conifers are in decline in many Michigan landscapes. Some of the exotic, introduced pines such as Austrian and Scots Pines tend to contract and develop more serious pests and disease problems than some of our native pines (examples: Eastern White Pine and Red Pine). During 2021, an epidemic of some malady affected many Scots Pines in some areas, and most of us did not take notice. Afflicted trees exhibited brown foliage (Photo 4A) and/or severe needle loss, resulting in some foliage-bare branches (Photo 4A Inset). The property owners of the Scots Pines that line the driveway into their horse farm (Photo 4A) would invest almost any amount of money to help these trees recover, if only they could find some somebody to accurately diagnose and treat the problem. Because many plant professionals dismiss Scots Pines as viable landscape plants, many trees have needlessly been destroyed because they were misdiagnosed as severely declined or dying. While Diplodia Tip Blight and Pine Wilt (nematode) can be brutal (even lethal) on Scots Pine, the primary problem I witnessed in 2021 in some of these regions was Brown Spot Needle Blight caused by *Mycosphaerella dearnessii*, which essentially caused a needle cast disease in epidemic proportions due to very conducive environmental conditions



during the summer months. Examining the trees very closely revealed green cambium tissues in the branches and buds (Photo 4A Inset). Hence, with the viable cambium, the trees have the potential to make a full recovery in 2022... especially with some inputs from plant healthcare providers. I think there is an assumption that because Scots Pine is not propagated to any appreciable extent in nurseries anymore, and hence not utilized in contemporary landscape designs, we should ignore this

species and its issues. Or perhaps we just don't know what is wrong with them. Many healthy/semi-healthy and valuable Scots Pines still reside in Michigan landscapes, and perhaps we need to *relearn* how to manage them when problems occur rather than write them off as passé (Photo 4B).

Large Cancerous Warts on Conifers?
Identifying the species of tree and the closely spaced galls, I could immediately

discern that the primary problem with this Scots Pine is Western Gall Rust (Photo 5, a fungal-induced gall) and not Eastern Gall Rust (due to my experience). With Eastern Gall Rust, which requires Oak as an alternate host, galls will be spaced much more distantly from each other because the spores must travel to the Oak and back to the Pine for completion of the disease cycle. The primary control for this disease is to prune out the galls. Because individual Scots Pine have differential susceptibility to this disease, pruning out the galls on highly susceptible specimens may not leave much of a tree.

Communication Skills:

I grew up in an era when Captain Kangaroo was a wildly popular morning program for kids across America. Among a variety of program characters such as Mr. Green Jeans, there was "Mr. Tree" who had to be awakened every morning with a song, "Good Morning Mr. Tree, we're very glad to see you. Wake up Mr. Tree..." (Photo 6). As youngsters, we



PHOTO 4A



PHOTO 4B



PHOTO 5



PHOTO 6

learned that trees could talk along with the financial and material benefits of believing in Santa Claus, the Tooth Fairy, and the Easter Bunny. As we got older, of course, we learned that trees could not talk, among other rude awakenings. Medical professionals have a distinct advantage with their patients because of obvious communication between Doctor and Patient. We as Plant Doctors are severely handicapped because it is difficult to communicate with our patients. Some people claim to talk to their plants, but I suspect there may be some sort of hallucinogenic drug involved. Because trees and other plants in the nursery and landscape are our patients, how can we communicate with them? Believe it or not, trees communicate with us in a variety of ways. One of the major communicative ways is that trees show us their symptoms when they are sick. If we can determine what ails them from their symptoms, then remediation becomes a whole lot easier.

Maple Cancer? Consider a common *Acer* (Maple) problem where communication and experience can play

important roles. Some of our clients ruminate incessantly about the imperfections they see on their trees, and they may wonder why we as professionals haven't fixed a problem that they are convinced could destroy their lovely tree (Photo 7, Warts on Silver Maple). Most of us can readily diagnose various galls on maple leaves and would easily identify this problem as bladder gall, caused by an Eriophyid mite (arthropod). Our dilemma now becomes trying to convince our clients that these mite galls pose no serious harm to the health of their tree, despite their objectionable appearance. In this case, the "Cure may be worse than the Disease".

Verticillium Wilt? Photo 8A shows another maple with apparent dieback. Tar Spot and leaf galls would not cause these dieback/decline symptoms. In our industry, this malady is commonly diagnosed as *Verticillium* Wilt. However, it may not be *Verticillium* Wilt if no telltale vascular discoloration is present (Photo 8A Inset). Other causes of dieback could be fungal root rot, girdling roots, trunk/stem cankers, etc. It may be difficult to diagnose some of

these issues without spending a considerable amount of time investigating the matter, and, perhaps, with an accompanying "Treeautopsy" or "Treeopsy". The reason many of us simplify the issue by calling this *Verticillium* Wilt is because it is a plausible diagnosis, and we may not want to take the time or have the time to perform a thorough diagnosis. However, if we don't perform a complete inspection and diagnosis, it is very likely that other trees in the landscape will be lost. This problem was caused by a multitude of contributing factors. Frequent lawn mower and weed trimmer injury to the lower trunk combined with daily irrigation provided the "perfect storm" for *Phytophthora* collar rot to develop and initiate irreversible decline (Photo 8B, note discolored infected tissue in stump).

Defective Junipers? Not only do we need to communicate with plants by examining their obvious signs of what ails them, but we also need to communicate effectively with their representatives, our clients. In Photo 9 for example, I was asked to identify the cause of the brown foliage/branches on these juniper shrubs. The property owners were exasperated and ready to yank out the junipers and start over with new plants because they believed they got defective plants from the nursery. I immediately diagnosed the undesirable condition as *Phomopsis* Blight, a fungal disease. Like many diseases, the critical ingredient in the development of *Phomopsis* Blight is moisture. So, I asked the clients of the arborist who brought me to the site if they use irrigation. They replied that their automatic irrigation distributes water for their lawn and landscape every night. Bingo! Reducing or redirecting that frequent watering plus application of a fungicide (thiophanate methyl) for a short time would likely help the plants recover in no time at all. After plant recovery, no additional fungicide treatments would be necessary provided the shrubs were not frequently wetted with water. Replacing the junipers would not have resolved the problem, and the problem did not originate from the nursery where the plants were purchased.



PHOTO 7

Becoming Inspector Clouseau:

For those in our industry who are too young to remember the Pink Panther movie series, Inspector Clouseau, initially played by Peter Sellers and subsequently by Steve Martin, was a bumbling police detective who managed to screw up the investigation of a crime innocently but hilariously (Photo 10). While we in the plant industry may not consider ourselves

bumbling idiots, important steps in diagnosing most plant problems include collecting as much pertinent information as possible and ferreting out as many clues as possible to assist us in our diagnosis. As we encountered in Photos 3A & 3B, the owners of both landscapes with suspected Oak Wilt would not admit to applying any herbicides, likely out of embarrassment. Yet I was 100% certain that herbicide and not Oak Wilt was the cause of the oak

decline and death. In addition to non-target impacts by the herbicide on other species of plants in the landscape (Oak Wilt doesn't affect other species), red oaks don't "half die" from the Oak Wilt. Some of the trees affected by the herbicide will likely recover; red oak trees would never recover from Oak Wilt.

White Pine Decline? In Photo 11A, an Eastern White Pine has turned brown and



appears dead. Small chips (like sawdust) rained down from the tree onto branch crotches (Photo 11A Inset) and the ground, indicating a “borer” was involved. Many diagnoses would stop there. But knowing that the borers, which produced hundreds of pencil-lead-sized holes in the trunk, are actually bark beetles which are secondary insects and not the primary cause of tree decline and death, may change the outcome of our diagnosis. Further investigation revealed sap secretions from a constricted lower trunk (Photo 11B). Excavations around the root collar area disclosed girdling roots and



PHOTO 11A

accompanying wire baskets that had been left on the tree when planted 20+ years previously. The wire baskets were constricting the roots and trunk and attracting the Pine Root Collar Weevil (PRCW), which was tunneling in the lower trunk and root collar area, preventing nutrients and water from being transported upward to the branches and foliage. Hence, the wilting of the tree. This tree represented the “Canary in the Coal Mine” for dozens of other white pine trees at this large condominium complex.

I recommended Imidacloprid drenches which might protect the other trees from PRCW and bark beetle attack for a sufficient time until supersonic air excavation could expose wire baskets and girdling roots for remediation of the problem on all other pines on the complex. My recommendations apparently worked because the landscaper claimed they lost no additional trees. This particular problem was quite complex and involved a diagnosis consisting of improper planting, two attacking insects, and girdling roots.

The Accuracy of Lab Analysis:

An option we can utilize to enhance our capabilities of an accurate diagnosis is to submit plant samples from our tree patient to a diagnostic lab. We as arborists/landscapers/nurserypersons are sometimes reluctant and consider lab analysis as a

last-ditch attempt because it is time-consuming, and some costs are usually involved. There are private commercial labs and university laboratories. Sometimes due to tree value or multiple trees affected, it might be advisable to submit samples to multiple labs. Lab personnel do the best they can with what they have to work with, but nevertheless, errors are made in the sampling and within the lab itself. The sample collected and submitted by the plant professional is extremely important for an accurate diagnosis. Today, lab tests are rather sophisticated; DNA and other complicated tests are readily utilized. Lab personnel cannot be in the field where a diagnosis is sometimes easier. While lab tests can help us immensely with a diagnosis, faulty lab analyses due to inadequate sample submission and/or errors within the lab itself may occur. It is important that we employ all of our capabilities to ensure that a lab test is not leading us in the wrong direction.

Faulty Sample Submission: A property owner wondered why leaves were dropping from her large 37", 100+ year-old tall oak in late July (Photo 12). She called an arborist who collected samples from the tree and submitted them for Oak Wilt testing at Michigan State University and the University of Minnesota. Both lab tests were negative for Oak Wilt despite the characteristic symptoms. A mistake was made in the sample collection. Although labs prefer one-inch diameter branch samples for Oak Wilt tests, this tree was so large that collecting a proper sample was near to impossible without bringing a climber or large lift truck to the property, incurring more expenses. So, the arborist collected samples from the bark of the lower trunk (Photo 12 Inset 1). Perhaps the arborist didn't realize that the Oak Wilt is caused by a vascular wilt fungus and not a bark inhabitant, the reason tests from both Universities came back negative. I sampled deeper into the vascular area and found gray spores of the Oak Wilt fungus, actually a “primordium” of the Oak Wilt fungus “pressure pad” (Photo 12 Inset 2 arrow). This sample tested positive for Oak Wilt, and we were able to justify proceeding with Oak Wilt management measures. Incidentally, the reason for



PHOTO 11B

infection of this large tree by the Oak Wilt fungus was that a power company contractor had pruned a branch from the tree in May without applying protectant sealant to the wound.

Oak Wilt False Alarm: Leaves began to drop from an oak tree in late June (Photo 13 arrow). The property owners called an Oak Wilt Qualified arborist who sent branch samples to a University Laboratory. Through PCR (DNA) analysis, the tree tested positive for Oak Wilt. The arborist requested assistance from me to help him decide how to remediate the site, which would include costly and highly disruptive trenching to sever root grafts and costly, long term prophylactic tree injections to protect healthy trees. By the time I arrived on the scene, the leaf drop had subsided. The only problem I could verify on the tree was minor herbicide (2,4-D) injury (Photo 13 Inset, note cupped, dark green leaves). I didn't think the tree had Oak Wilt for a variety of reasons, so I concluded that the tree did not have Oak Wilt despite the positive lab test. Another lab test (this time negative) confirmed my diagnosis that Oak Wilt was not the cause of leaf drop. Arborists are taught by some "Experts" that a positive lab test for Oak Wilt always confirms Oak Wilt. Not so. There are occasional false positive and false negative lab tests, and we need to be

cognizant of those possibilities and use all of our diagnostic tools and experience to arrive at a correct, accurate answer. In other words, question, question, question! The property owners were unbelievably elated with my diagnosis because it meant that \$1000s would not have to be spent, many healthy oaks would not need to be sacrificed, and 5-6' deep trenches to remediate Oak Wilt on their property would not have to be implemented. The tree is still doing fine two years later.

There are many variables in lab tests. A disease or pest might be detected but may not be the cause of the problem we are witnessing. We must always use our intellect and experience to ensure the best possible diagnosis.

Cantankerous Clients:

"The customer is always right" is a cliché we commonly hear. Arborists and landscapers frequently commiserate with me about clients who are never satisfied, no matter what we do and no matter what our diagnosis is when a problem occurs. Never mind the fact that homeowners themselves do things (such as apply herbicides or fertilizers, etc.) without our knowledge and that these inputs may compromise our efforts. And when we suspect something has been done, they may never own up to doing it. Sorry to say, and I'm trying not to be disrespectful,

but it might be better to pawn these clients off to some other arborist or landscaper so you can sleep well at night. With expectations that we be at their beckon call and that we stop by almost daily to check on their landscape, our efforts to help these recalcitrant folks means we probably are making only about \$2.00 per hour. The consumer who doesn't want to see any blemish whatsoever or any creepy crawly critter on their property is especially troublesome. *Plantus plastica* may be a better choice for some of these clients. *P. plastica* does not contract diseases or pests; they don't outgrow their space, and they rarely need watering or fertilization. Much of the time, the only maintenance requirement is to wash the dust from their leaves.

Discussion:

Accurate diagnosis of plant problems is tedious and difficult. We need to use all tools at our disposal; that may require resorting to lab analysis or seeking help from a variety of sources. Many arborists, landscapers, and nurserypersons have such extensive knowledge through years if not decades of experience that we can often benefit from helping each other.

Growing plants can be difficult and, regrettably, many people do not know much about trees, shrubs and other plants, the reason so many are killed under



PHOTO 12



PHOTO 13

auspicious circumstances. I'll close this article with Photo 14 and a quote from John Muir. In the background of Photo 14 is a 300+ year-old Bur Oak, which died after the grade was changed on three sides for the construction of an upscale outdoor mall. With the grade changes, water could not drain out of the area. The tree tried valiantly to survive over a period of several years but eventually died from root suffocation, fungal (*Phytophthora*) root rot, and Two-Lined Chestnut Borer attack. The individuals who were managing the landscape clearly did not understand the needs of this landmark tree. It is incumbent upon our industry to educate the public and to let people know when something is wrong.



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