A Solution To The Riddle- Post Oak Decline In The *Southern* Cross Timbers

by Pat Kelly

This publication is meant to address the specific issues of Post Oak Decline in the Cross Timbers District and as a supplement for the papers- "Feeding Post Oaks" by John Cooper and "A Solution For Post Oak Decline In Arlington Texas" by Dr. Don Smith

A Local History

The post oak tree is the most well adapted tree to the weather patterns and soils of the Cross Timbers District. It has been written by the early explorers of this region that the plants that were here when the explorers passed through were post oaks trees and prairie grass. Of all the trees that currently grow in the Cross Timbers District, native, pioneer species or transplanted, the post oak tree requires less care and is less disruptive to its surrounding environment. In this sense the post oak tree is the most sustainable and most suitable for this area.

Post Oak Tree Canopy and Root System

The more populous native oak trees of the Cross Timbers District; the post oak, black jack oak, and bur oak have developed characteristics that allow them to survive well in this environment. Their canopies and root systems are diffuse compared to other non-native oak trees or other completely different species. There are subtle differences to these three species of trees. The post oak tree and the black jack oak tree grow as far north as Connecticut. The canopies are generally diffuse and allows cooling winds and air to flow through their limbs. The bur oak, which grows as far north as southern Canada, and has some characteristics similar to other oak trees that grow in cooler northern climates but, has a tendency to have a thicker canopy once mature, than the post oak and black jack oak. The tree trunk and limbs on these native trees have developed thick bark for protection from heat, drought and fire. The root systems of these three tree species are comparatively diffuse to lessen the chance of one root tip competing with another root tip for water in the same area in a climate with predominantly dry soils. The roots are small in diameter and are efficient at bringing water to the tree in this warm climate when rain comes or irrigation water is available. After a dry spell when water does come it's a crucial period for the native oak tree in its native environment. Water has been known to travel over 90 feet through the root system of the native oak trees in a 24 hour period. This is compared to 60 feet of water travel by other tree species. It's the last one inch or so of the total root system that absorbs water. This part of the root is soft and porous. The other 95% of the root system has a cork like exterior to protect the root system from heat, fire and drought. The bur oak has a tendency to have a bit more dense root system, once the tree matures. Again a characteristic of oak trees native to cooler northern climate.

It is noticed that the root flare on a mature bur oak tree begins to turn and run laterally before it dives into the soil, compared to the other native oaks. The bur oak root system just off the root flare can be larger in diameter than the post oak and black jack oak trees. This is important when considering where to plant a bur oak in relation to foundations or other concrete structures. Tree roots that run along the surface of the ground or turf that have noticeable diameter is referred to as high surface root density. High surface root density roots make it difficult for turf grass to thrive in drought areas such as the southern Cross Timbers. Native oak trees have minimal high surface root density characteristics. The black jack oak is second in line with this characteristic. The post oak tree appears to be the least burdensome of all large trees growing in close proximity to concrete structures.

Post Oak Tree Savannah / Nature Areas in the Cross Timbers District

Post oak trees grow and do quite well on their own in nature areas provided their root system is not disturbed and the insulative barrier on the soil developed by the trees' canopy is left in place. It is known that mechanically disturbing the root system of a post oak is a sure way to contribute to its early demise. Once the root system has been cut or crushed it is a slow process for the remainder of the attached part of the root, with its small diameter and slow growth, to regrow the root hairs to absorb water before bacteria, fungus and rotting set in. The other way post oak tree roots are disturbed is from tree or shrub roots from more vigorously growing species within the post oak tree root system. This disturbance is quite prevalent in the Cross Timber District where plants compete for water. There is only so much water to go around. Yet the tree or shrub with the more aggressive root system within the post oak trees' root system that absorbs water needed by the post oak is not the whole picture of the problem. When post oak trees and other native trees don't get the water they need because trees and shrubs of a different species with their more aggressive root system are in the post oak trees root zone, the post oaks become starved of water and stressed.

It is relatively easy for non-native plants to germinate adjacent to the native oak tree. The leaf litter, known to stay in place unless mechanically disturbed, and the diffuse root system of the native oak trees create permeability in the soils within the canopy or drip zone. The heavy leaves in relation to their size, their natural curl, in combination with the absence of high surface root density characteristics that do not raise the level of the forest floor, allow leaf litter to more readily stay in place and build up over time for needed tree root insulation. Forest floor flora is aided by native compost leaf litter creating beneficial mold ground conditions. The sandy soils in the Cross Timbers District contain little organic material. The characteristics of the native post oak tree in developing heavy leaf litter that stays in place as it decomposes is of benefit to this region and the flora in it. This is a good characteristic for a tree in a hot dry climate; soil permeability and erosion control but, an issue for an area without periodic vegetation management if pioneer species seed germination is present.

Trees and shrubs not indigenous to the southern Cross Timbers have developed their root characteristics from different soils and cooler climates and have more vigorously growing and dense roots than the trees and shrubs indigenous to the southern Cross Timbers. The non-native plants, including the cedar elm tree, creates chronically dry soils in the southern Cross Timbers. Chronically dry soils can become hydrophobic or moisture-resistant. Attempting to hydrate soil in this condition is difficult as hydrophobic soils tend to channel moisture away through voids in the soil matrix and poor absorption results. This moisture is then lost to gravity and offers little real benefit to plants, resulting in drought and stress to the post oak trees. Put in more simple language- poor soils of the southern Cross Timbers with many years of leaf litter and organic material from the native oaks' mix with the poor soils, creating better soil and soil permeability. Water can then soak into these areas where the native oaks can utilize the water. By comparison, chronically dry soils created by aggressively growing roots from non-native trees and shrubs that don't leave much leaf litter in place create a soil surface that when water comes in contact with the dry surface the water runs across the soil surface instead of into the soil / organic material mix. Surface runoff in urban and nature areas means less water for the local watershed.

Aggressive root system plants growing adjacent to post oaks absorb water needed by the native oak tree. The native oak becomes stressed particularly at the location adjacent to the non-native plant. The native oak becomes susceptible to bacteria and fungus due to "drought conditions" on the side of the tree adjacent to the location of the non-native plant. These "spot locations" of hypoxylon canker start as a lightening up of the post oak tree bark on the truck of the tree adjacent to the invasive species plant. These invasive plants can be trees or shrubs. Unless the tree or shrub with the more aggressive root system is removed from the area where the post oak tree roots feed for water, the hypoxylon canker fungus grows worse and eventually kills the post oak tree through water starvation. The light colored patch will grow larger and in varying order the color will turn a bit yellow / tan. As vital cells of the tree succumb to the fungus the bark will separate from the tree. Later brown colored powdery spores are present eventually turning silvery-grey. Tree death is evident. This scenario is most prevalent in the Cross Timbers District where post oak trees in nature areas receive enough rain water to survive and thrive but, not enough water to survive the added hardship of the more aggressive root systems of pioneer species / invasive plants within their root zone. Although there are a number of different microbes listed that affect the native oak trees, they are not very prevalent in this area where post oak trees and other native oak trees live in the absence of the pioneer species trees and shrubs within their root zone. Hypoxylon canker fungus, generally only become prevalent around the native oak trees when a tree or shrub with a more vigorous root system is within the root zone of the native oak thus inhibiting the native oak from absorbing needed water. Trees suffering from drought are stressed and thus become susceptible to hypoxylon fungus and bacteria. Fallen trees or branches in areas where hypoxylon fungus is present should be

chipped or removed from the area of healthy trees to avoid contamination.

It is known that invasive species trees and shrubs have more allelopathic compounds than native species plants. Although this relationship between the native oak trees and the pioneer species plants within the native oak trees' root system is allelopathic like; it inhibits growth of the native oaks, it is not known what compounds may be inhibiting the native oak trees root system from thriving when pioneer species plants exist within the root system of the native oaks. It may be just water starvation. This is worth further study. For example, the Black Walnut tree that is prevalent in Georgia produces the allelopathic compound- juglone as a defense for the black walnut tree. Trees of other species do not thrive within the black walnut trees' root zone. In Post Oak Savannah areas where a significant area has been taken over by non-native trees and shrubs, these non-native trees and shrubs should be cut, chipped, and utilized for organic material needed for native grass areas and natural trails.

In observing a Post Oak Savannah for its well being during drought conditions it is necessary to notice if any of the native trees appear to be going dormant. If a number of trees across a broad area go dormant at one time, this can indicate the trees are simply going dormant. If a lesser or isolated amount of trees go dormant prior to the second group, this is usually an indication that the first group that went dormant is actually dying off, not simply going dormant. This applies even if the buds are still on the tree because the buds on native oak trees have exoskeleton characteristics and will remain on the tree until the dead branches begin to fall to the ground.

There are a number of municipal parkland areas in the Cross Timbers District where native prairie grass lands have been restored. Cross Timbers District municipal park nature area post oak Savannahs need occasional or periodic management as well especially during times of drought. Native trees in area Savannahs without irrigation that are stressed from drought need extra water. These conditions can be drought alone yet in many cases the native trees are dying because of pioneer species tree root encroachment. The following is a temporary approach to watering. Drill several small holes in the bottom of 5 gallon plastic buckets. Tape or cork the holes so the bucket will again hold water. Fill the buckets full of water and place at the perimeter of the tree canopy needing water. Unplug the holes of the buckets and let the slow draining water rehydrate the root area. In nature areas where there is an attempt to maintain the native oaks that suffered mechanical damage or pioneer species vegetation encroachment of the root system commercial fertilizer may be required to return the tree to health. 5lbs of 15-5-10 per 1000 sq. ft. at budbreak, in late March or early April is recommended. In cases of evidence of hypoxylon canker present in the immediate area potassium phosphite is recommended for the following reasons: antifungistatic properties, rapid uptake, root development, improved plant health, and increased production of natural

fungicides (phytoalexins) effectively providing organic disease control.
If there is publicly owned nature area property in a municipality in the Cross Timbers District Region the policy of that municipality should reflect at minimum removing the pioneer / invasive species plants in that nature area for the benefit of the native species plants. Restoring the presettlement, native species ratio should be the minimum conservation effort for Post Oak Savannahs. If there is a creek or stream within the nature area creek bank stabilization may need to be addressed to prevent erosion in the post oak Savannah / nature area. This should be the primary and ongoing exercise to maintain what few Post Oak Savannah / Nature Areas we have.

These Post Oak Savannahs are so rare and disappearing so fast a determined effort should be made to save them and return at least some of them to their pre-settlememt condition. It is worth learning the characteristics of the native oak due to the benefits they provide in a hot climate relative to other tree species in the area. With many cities in the Cross Timbers District receiving financial benefits from oil and gas royalties and lease payments this is an opportune time to address the needs of these few post oak Savannahs. Citizens in their respective cities should organize and inform their mayor and administrative staff of the need to establish a vegetation management program for their city where their nature areas have been overgrown with pioneer / invasive species trees and shrubs.

Trees utilized in the Cross Timbers District other than the native oak trees
There is not a need to go into every detail and characteristic of other trees growing or planted in this region. The main thing that is worth knowing is that except for the native oak tree and the pecan tree all other large tree species present problems. All trees other than oak and pecan are susceptible to these problems in varying intensity. Most have high surface root density and are therefore more difficult on turf grass, require more water, and more frequent pruning. Most of these trees are not prone to disease.
The cedar elm tree with high surface root density and large roots just below ground surface will heave and crack sidewalks and foundations. The smaller absorbing roots become very dense, absorb most of the available water in the area leaving little water for turf, native grasses, or other trees. They affect the health of area grasses and trees because the cedar elm tree is susceptible to Dutch elm disease (ulmus crassifolia). Elm leaf beetles are present on cedar elm trees. Other diseases associated with the cedar elm are- cotton or cushy scale, spider mites, powdery mildew, leaf galls, and aphids. Cedar elms' pollen is one of the fall allergens, since it is wind pollinated. It would be worthwhile to consider a tree with less disease susceptibility and allergy pollen characteristics in close proximity of downtown shopping areas, restaurants and schools. Cedar elms are more susceptible to mistletoe than the post oak tree. In pre-settlement times lightening strike fire kept the cedar elm population to a minimum in the southern Cross Timbers and therefore the fungi associated with the cedar elm tree was under control. Where there is a cedar elm tree eventually you will see characteristics of Dutch

elm disease especially on residential lots and commercially managed properties. There is more than one type of fungus associated with cedar elm trees. With high surface root density characteristics and if Dutch elm disease is present the vegetation including turf grasses are stressed. This scenario is repeated on many residential lawns throughout the Cross Timbers Region. In these situations turf grass can thin and die back resulting in the homeowners' desire to "treat" the problem with more fertilizer and chemicals that would otherwise be not needed if the Dutch elm disease fungus were not present. One disease stresses an organism creating the susceptibility to another disease. In this case it is because it allows the elm beetle to carry the fungi through the local area. In medical science fungus can be more difficult to detect. In cases similar to this "brown patch fungus" or "take all patch fungus" is present in the turf as well. These fungi negatively affect plant life and human kind as well. Fungi and pollen associated with the cedar elm tree have been shown to adversely affect the health of school aged children with hypersensitivity. There are a goodly number of school aged children these days with allergy related hypersensitivity.

Municipalities and school districts plant cedar elm trees in part because the tree is fast growing and can endure dry hot weather. A more thoughtful approach to planting trees and policy would be to omit the trees that are susceptible to insects, microbes, and especially fungi. Plant trees from an all around healthier or less susceptible list and plant them outside the potentially large root zone of the existing native oak trees.

Post Oak Trees in Yards

Post oak trees do well on residential or commercial property with turf grass. Because native oak trees have a diffuse root system and don't for the most part have high surface root density characteristics these trees relative to other species do not harm turf grass. Turf grass planted from seed, sod plugs or sod planted with space left between the sod grass pieces are easiest on the post oak tree roots. Planting turf grass in this manner allows the post oak tree roots time to adapt to change in the ground conditions. The soils underneath the canopy of native oaks typically have more organic material and allow turf grass roots and runners to grow and spread rapidly. Good quality fertilizer is recommended over fertilizer *with* herbicide because turf grass should spread rather well in these soils and choke out unwanted plants (weeds) in the turf. Native oaks don't tolerate herbicide well. Native oak trees are on the top of the list when thinking of water conservation. Post oak trees prefer to be watered infrequently because oxygen uptake is required while the root system is taking in water. Frequent watering saturates the soils and tree root system preventing the tree roots from getting the oxygen required. This infrequent watering technique can and does work well with turf grass well being. During drought turf grass can be lightly watered in between deep waterings to keep the turf from burning or becoming too dry. On occasion, and like any other tree species, oak tree roots can become compacted. A tree root aerator can be purchased by the homeowner and attached to the water hose to aerate the tree roots.

Native oak trees will self prune relative to other oak tree species provided trees and shrubs from other species are not in the root zone of the native oaks interfering with the trees water absorption needed for carbohydrates and moisture to self prune.
If a tree limb does rot and fall away it's best to clean cut the damaged area from the tree. To remove the branch make the cut parallel to the main branch. Avoid leaving knobs sticking out as they are susceptible to decay and insects. Seal the wound with Treekote, non-phytotoxic brush on wound dressing or plastic roofing cement. A tree knob where a limb has rotted and fallen away, unless the wound is sealed over and healthy looking, has a tendency to flow sap year around, will never heal and attract sap feeding insects. This is noticed by a copper color on the bark just below the wound for a distance down the tree trunk. This is especially the case if trees and shrubs with aggressive root systems are within the root zone of the post oak tree. The interior canopy of a native oak tree as a general rule does not require periodic pruning. Lower limbs are sometimes removed to allow foot traffic close to the tree. This can not be said for oak trees of other species. The native oak trees have a tree limb direction conscientiousness that the prevalent pioneer species tree group does not. Many of the non-native trees grow into other trees, or other structures, creating tree damage and unsightliness.

Native oak trees do well in ice storms relative to other trees because their canopy is diffuse allowing snow and ice to travel through the canopy to the turf. Wind flows through a diffuse canopy therefore the tree is less prone to be blown over by wind. Because of this there is less pruning required from tree limb damage after a snow, ice or wind storm.

Native oak trees are a dry, slow growing tree. When a limb is pruned from a native oak the carbohydrate liquid at the wound will dry out. A crack or split in the wound will occur before the wound is healed over. Because of this cracking the wound should be sealed with plastic roofing cement to insure bacteria, fungus, insects and animals don't create heart rot or a larger wound or hole in the tree. Tree pruning cuts have healed well with no added protection. There are enough examples of pruned cuts on native oaks that have not healed well to justify a thick coating of pruning cement. Plastic roofing cement has not been shown to be harmful to native oak trees. The healthy cells in post oak trees seal themselves off from material used to seal the wound.

The native planted black jack oak tree appears to be the most susceptible to mistletoe, hypoxylon canker, and ants of the three native oak trees mentioned. Drought conditions exacerbate the susceptibility. This is noticed even though in nature areas black jack oak trees are out numbered by post oak trees by 20 to 1. If a tree has been infected with mistletoe, the mistletoe should be removed at a minimum of every dormant season. Mistletoe has been known to extract water from tree limbs at 5 time the rate of normal tree processes. A good rule to go by when planting a large growing tree of another

species on a residential lot is to plant the tree outside the potential root growth zone of the native oak to ensure its long term health.

Post Oak Trees in Urban and Downtown Areas

Historically post oak trees have been one of the most difficult trees to transplant. In recent times horticulturist and college professor Dr. Carl Whitcomb of Oklahoma has developed the Air Pruned Container that allows rapid mast growth. This is also called the RootMaker system. This approach to growing trees allows the creation of many more small feeder roots than normally would develop if the seedling were grown in a conventional plastic container. This air pruned container system has a 90% or better success rate of tree transplantation and the trees grow much faster because of the development of many more feeder roots on the root ball from just after germination. The trees grow faster still even after they have been transplanted to their permanent location. Tree protectors and the *stake and tube watering system* also allow for faster growth because of the increase in the plants photosynthetic and transpiration rates. The tube allows for more frequent watering and enables the tree steward to "push the growth" of the tree. Trees grown in air pruned containers and later transplanted can utilize the extra feeding water because of the additional feeder roots formed by the air pruned container root growth system. The additional root development from the rapid mast growth system provides a stronger tree to insure the tree stands straight once the stake and tube system has been removed from the young tree.

Native oak trees are pleasing, budget conscious and safe to have along downtown urban areas. The mayor, his staff and the administration of area municipal parks and recreation departments, in the Cross Timbers District, should see for themselves the success of the air pruned container approach to rapid and healthy growth of post oak trees and implement a similar tree program in their cities. The *benefit cost ratio* for a successfully planted, esthetically pleasing, low maintenance species native oak tree will benefit the areas city budgets. The native oak trees are a long lasting tree. Their root system will continue to grow in relation to the size of the tree canopy. Keeping this in mind, there will be a need for a thoughtful esthetically pleasing flush with the sidewalk tree grate or tree medallion system. Sidewalk tree medallions can be designed to be varied and interesting.

Native oak trees, especially the post oak, can live a long time. Some of the older post oak trees are 400+ years old. Recent improvements in the root growing process and policy revisions will ensure the post oak has a place in nature areas and modern urban society. Of all the large growing trees in the Cross Timbers District the post oak tree is the least obtrusive and most sustainable.

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