THE CITRUS PAPERS

by

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SAMPLE PAGE ONLY

NOMINAL ROLL

2nd Class

INTRODUCTION

The following is a series of brief articles that appeared in VO Outlines between January and March of 2010. Because of the extremely dry summer of 2009, a number of the citrus trees in the park (and for that matter, throughout the valley) suffered varying degrees of distress. Initially, we thought the distress was caused strictly by the harsh summer conditions. However, after conducting an extensive study we gradually came to realize that water is not the only maintenance variable that affects the life and condition of a citrus tree. These articles are a compilation of what we learned, and we hope by sharing them with you, you will pick up some tips and information that will help you enjoy healthy and productive trees.

Citrus vs. Water
Myth vs. Fact

"Water, water everywhere and not a drop to drink.
Water, water everywhere and all the boards did shrink"
With apologies to Samuel Coleridge

This has been a tough year for water in these parts. As of 12/31/09 we received 3.2" for the entire year—43% of the normal of 7.5"/yr. Not much, even by Arizona's diminished standards. To put this into perspective, even native cactus like the Saguaro and the Strawberry Hedgehog require 8"-12"/yr. for health and sustainability. Citrus, by comparison, require close to 60"/yr. to remain healthy, productive, and disease-free.

So, with these figures in front of us, how come Arizona is the third biggest supplier of citrus in the nation, behind California and Florida, and marginally ahead of Texas?
The answer is simple: irrigation. For over two centuries, since the introduction of citrus in Arizona by the early Spanish settlers and Franciscan missionaries, citrus trees have been nurtured by the waters of the Gila, the Salt, the Verde, and the Colorado rivers, together with the once unlimited Maricopa Aquifer. These resources have now become diminished by population growth, urban sprawl, and the effects of a persistent fourteen year drought. These factors have both increased the cost of water and reduced the quality of the water due to increased alkalinity from the lack of dilution by adequate rainwater.

The effects of this at Venture Out are both noticeable and measureable. There are over 2000 citrus trees in the park, and about 75% of them are in less than prime condition—in spite of having received more water this past year than in any previous year. 208 trees have now been evaluated (roughly 10%) and the following comments are based on that evaluation. Heat stress, caused by an exceptionally hot and dry summer, has made the citrus trees susceptible to a variety of problems including insects and disease. Trees are also being damaged by uninformed growing practices such as: inadequate water basins, poor understanding of how and when to fertilize, bad pruning practices, and chemical damage from inadvertent 2-4-d overspray.

Over the next few weeks, this column will continue with a series of "tips" on how to keep your citrus trees happy and healthy. No, you don't have to brush their teeth every night, or teach your trees to floss, but there are a number of things that are easy to do that will help give your trees a fighting chance. In the meantime, do this immediately: TURN OFF ALL THE DRIP IRRIGATORS UNDER ALL YOUR TREES (this is easy, most irrigation heads are like bottle caps- just twist them shut) and do not turn them on again until new growth appears on the branch tips! Reason? When the nighttime temperatures are in the 40's and low 50's, citrus roots are incapable of absorbing water. By watering them this time of year, all you do is create an environment for root rot. Next week we'll talk about watering basins and how you can triple your tree's chance for success and productivity.

Citrus vs. Water
The Issue with Basins

Last week's column mentioned in passing that, among other things, many of our Park's citrus trees are having problems because of watering basins that are too small. If the basin is too small for the size of the tree, the tree can absorb only a small percentage of the irrigation water provided. Here's why:

If you consider both the above ground and below ground parts of a citrus tree, the tree is shaped like an hourglass. If the canopy of the tree is eight feet in diameter, the roots will extend to the same diameter and beyond. Furthermore, most of the "feeder roots" (the small hair-like roots whose job it is to absorb most of the water and fertilizer) are located under the edge of the canopy. If the watering basin under this same eight foot tree is only three feet in diameter, and the area outside the basin is covered with any combination of black plastic and gravel, concrete, brick, or pavers, the tree will absorb insufficient water and fertilizer no mater how much of both are provided. Water and fertilizer applied within an undersized basin tends to soak down rather than out, and the feeder roots receive only a small percentage of even abundant applications. Additionally, water will collect under the trunk and if drainage is poor (as is typical of our local soil), soil-born diseases and root-rot can occur and huge amounts of water are wasted.

Fortunately, correcting an undersized basin is not horribly difficult. Simply scribe a line around the edge of the canopy and remove all non-porous materials that might be on top of the soil (black plastic, concrete, pavers, etc) from within the scribe line. Then loosen the newly exposed soil to a depth of four inches. Finally, cover the loosened soil with either gravel or organic mulch, making sure that no mulch material touches the trunk. Your tree will now be capable of absorbing the water and fertilizer it receives. How much water and fertilizer and when it should be applied will be the subject of next week's column.

Citrus
Fertilizer: The Continuing Dialogue

NOW IS THE TIME TO FERTILIZE CITRUS TREES!!!!! I hope that is a clear statement and that there is no misunderstanding. Now means now!

Having made that statement with such forcefulness, let's take a look at why it was made in the first place.

Citrus trees need a lot of fertilizer to be healthy, productive, disease free, and drought resistant. Nitrogen is the nutrient of choice for citrus trees and, in Florida, Texas, and California, it is the only nutrient that should be supplied to citrus on a regular basis. This is because the other nutrients required by the tree are present in the soils of those States in sufficient quantities for healthy growth. Unfortunately, in Arizona these "other nutrients" are locked up in our notoriously alkaline soil and thus unavailable to the trees. To be healthy, our trees in the park need additions of both nitrogen and the so-called trace nutrients. And they need these nutrients in the right quantities and at the right time of the year to be effective.

Mature citrus trees, those more than five years old, require between one and two pounds of *actual nitrogen* per year along with the necessary trace nutrients. The actual nitrogen contained within a fertilizer can be computed by multiplying the percentage of nitrogen, as listed on the label, by the weight of the bag. For example, a 20-pound bag of ammonium sulfate, which is 21% nitrogen, contains 4.2 pounds of actual nitrogen. Or, 5 pounds of ammonium sulfate contains about 1 pound of actual nitrogen. Immature trees (under five years old) require 1/8 pound of actual nitrogen in their first year, ¼ pound in their second year, and between ¾ and 1 pound in their third and fourth year.

The timing of fertilizer application is important. The most important time to apply fertilizer is just prior to bloom, which is normally January or February. You can apply the entire allotment then, as do the commercial growers, but most home growers and growers with trees in confined spaces (like we have in Venture Out) prefer to divide the annual allotment into three applications. For park owners, a simple way to think of it is to apply 25% when you arrive in the fall, 50% in January or February, and the final 25% when you leave in the spring. If this sounds too complicated, here's a simpler method that seems to work for most residents: Buy the citrus fertilizer spikes available at Home Depot, Lowe's, A&P Nursery, or other local nurseries and use them fall, winter, and spring. These will provide both the necessary nitrogen as well as the necessary trace nutrients. The number of spikes per application will vary according to the diameter of the trunk, but there is a chart on the package that will tell you how many to use for your tree. Don't worry about the tree variety. All types of citrus have the same nutrient requirements.

Positioning (where you put the fertilizer) is just as important as the timing. DO NOT PUT ANY FERTILIZER WITHIN A FOOT OF THE TRUNK. Fertilizer is most effective when placed under the drip-line of the tree canopy. If you have an undersized watering basin this is obviously a problem. Get a copy of last week's article on basin enlargement for a rationale and instructions for enlarging basins. If you decide to use spikes, it is especially important that they be placed in the drip-line, or their effectiveness will be severely limited.

5 to 10 pounds/yr.

Citrus
The Issue of Water

If you think about it at all, the chemical compound we call water is pretty weird stuff. Consisting of only two atoms of hydrogen and a single atom of oxygen, it has both extraordinary and enigmatic properties. It can exist as a solid, a liquid, and at least two different gaseous forms, and it can easily kill you in any of its manifestations. It has the power to carve mountain ranges, decimate cities, and destroy life. Yet without it there would be no life. Our bodies are 97% water. In warm climates, lack of water can kill a human being in less than a day—and too much water can kill almost instantly.

Citrus trees, too, have a similarly tenuous relationship with water. They need about 60" of it per year to be healthy and productive. Too much water at the wrong time of year can seriously damage or even kill a citrus. Yet citrus, unlike humans, have a remarkable mechanism that allows them to preserve water in times of extreme drought. The surface of each leaf is covered with thousands of microscopic pores that absorb the carbon dioxide used for photosynthesis (the production of the sugars that sustain the tree), and to release the by-products of photosynthesis, namely oxygen and water. Normally, these pores remain open. In times of extreme drought the pores close during the heat of the day allowing the tree to conserve its available water. In this manner a mature (over 5 years old) tree can withstand lack of water for up to 4 months and sometimes longer. The canopy of the tree will look pretty bad when this happens and fruit development could be affected, but the tree will not only survive, it will return to normal in the following season, if the rains come. In fact, in the arid southwest, temperatures become so warm that most trees usually wilt or look off color during the hottest part of a midsummer day.

The above scenario is what occurred to <u>some</u> of the trees here at Venture out last summer. Very little rain fell (3.26 inches for the entire year!). Without dilution from rainwater our irrigation water became more alkaline than usual, and pressure and valve issues were being addressed as the new water separation system was installed. Trees with direct western and southern exposure, those with undersized watering basins, and those that were under-fertilized the previous winter fared the worst. Trees located in more protected positions and with adequate watering basins fared better. Some have even produced bumper crops.

Here in Mesa, citrus trees should be watered during the entire growing season February through October. Water is not required in November, December, or January except in situations of extreme and prolonged lack of rain. The irrigation system in the park is set up to accommodate these water requirements. Normally, Venture Out waters once a week, but in extremely hot or dry weather that watering increases to twice a week. The fan sprinkler emitters, that have replaced most of the drip emitters on citrus trees in the park, are capable of providing over 160 gallons per month for a single tree. This was done last summer during most of July, August, and September. To put this in perspective, commercial citrus growers in the area were only using 30 gallons per month during this same period. Why the extreme difference? Simple. It all has to do with the watering basin. Commercial growers have set up their watering basins properly for flood irrigation, and every drop of the water applied to the tree gets to the tree. In the park we have an extraordinary number of undersized basins, concrete and pavers covering most of our surfaces, and a huge amount of reflected heat. A delivery of 160 gallons per month per tree can yield as little as 10 gallons per month per tree depending on the size of the basin and the location of the tree.

All of us would like to see a wonderful crop of fruit next winter, and we can have that if we take three simple steps: Enlarge the watering basin, fertilize now, and pray for rain! Next week we'll talk about pruning.

Arsenic and Old Lace
(Weed control in the Desert)

Spring has sprung at Venture Out. Desert Bluebells, Arroyo Lupine, and Mexican Gold Poppies are blooming and, at night, the air is filled with the heady smell of citrus blossoms. Inexorably, our minds and hearts seem drawn to remembrances of young love, gentle springs gone by, and reflections on the eternal vernal question: "How do I kill the *blank *blank weeds this year?"

Here in the low desert, seed germination is stimulated by rain. The rains we had recently, not only stimulated the appearance of the aforementioned desert wildflowers, they produced a minor outcropping of broadleaf weeds. The summer of 2008 was blessed with occasionally heavy rainfall and produced a commensurately large crop of weeds—as many of you well remember! Controlling the '08 crop was difficult and, in some cases, expensive, but we learned a few lessons and collectively braced ourselves for Weed War II in 2009.

That war never happened. The summer of 2009 produced very little rain and most of the weed seeds decided to remain dormant for at least another year. At the same time, residents were learning about various poisons and pre-emergents that soundly whacked any adventurous young weeds who decided to leave the safety of their dormancy to lay out in the sun. Most of us are not chemists or agronomists and, unfortunately, some of the poisons we elected to use had some long-range negative consequences. These consequences will be addressed below, but first let's take a look at what we <u>can</u> do to prevent a summer weed takeover, and how we can do that without jeopardizing our landscape plants and trees or, for that matter, our own health.

First, take care of your own body. Every single weed control chemical on the market is a poison. If your poison of choice is a powder or in granular form, put on long pants, a long-sleeved shirt, gloves and a dust mask. If you decide to spray, add a hat and safety glasses and seriously consider substituting a vapor barrier mask for the dust mask.

Pre-emergents (chemicals that prevent seeds from germinating) work very well if applied according to the directions on the package. Pre-emergents are available as a liquid however, powders are easier to find and more commonly used. Recommended brands are PREEM and Eco Smart Weed Stopper II. If you prefer to use a spray, the three safest are Roundup (all formulations), Ortho Groundclear, Ortho Total Kill Weed and Grass Killer and Spectracide Weed and Grass Killer. There are, of course, numerous other brands and products available, but please be careful what you buy. There are some real bad actors lurking on the friendly shelves of Lowes and Home Depot. Whatever, you buy, read the directions carefully and don't apply any weed killer beneath the canopy of a tree.

Remember those "negative consequences" from the Weed War of 2008? The weeds were so bad that year that we threw a whole laboratory of products at the problem, and some of those products, regrettably, contained 2-4-d. 2-4-d, while indeed a very effective weed killer, has some positively hideous side effects. Like arsenic, it can be applied as an amine salt, or it can be applied as a more powerful ester. In humans, it is known to cause blindness, ALS, Non-Hodgekins Lymphoma, and male reproductive disorders including erectile dysfunction. It is banned in most countries in the world, but not in the US. The other day I found over 10 products at both Lowes and Home Depot that contain 2-4-d. Another one of the side effects is that both citrus and oleanders are damaged or killed by 2-4-d. Overspray from 2008 damaged a number of oleanders and almost 10% of our 2000 park citrus trees. Some of the younger trees actually died. Caveat emptor (buyer beware). Always read the list of ingredients, and if it contains 2-4-d, please put it back.

The Dark Side of the Orange
Pestilence, Disease, and Death

If you have been following this series on the care and feeding of citrus trees here at Venture Out, it has probably occurred to you that properly sized watering basins and adequate fertilization are the kindest things you can do for your trees. If this has not occurred to you and if these issues (at a minimum) have not been addressed you will, most likely, have to deal with some other issues which are considerably less pleasant than simply enlarging a water basin and fertilizing regularly. Adequately watered and fertilized trees are generally healthier and stronger than their minimally cared for counterparts, and are absolutely more resistant to visits from pestilence (insect attacks), disease, and the third horseman of the citrus apocalypse, death. Like humans, insects, bacteria and viruses are opportunistic feeders and breeders. Tender food is more desirable and easier to eat than tough food. Weak trees have weak cell structure and are more tender and tastier than strong trees—at least as far as bugs, bacteria and viruses are concerned.

Having said this, it should be pointed out that most citrus are surprisingly resistant to bugs and diseases. Newer trees (those under six years old) have benefitted from new grafting techniques and genetic engineering and are even more resistant than older trees. Nevertheless, there are some locally persistent pests and maladies you should know about, and in most cases there are easy, safe and effective counter measures.

The most common insect attackers are white flies, thrip, leaf miners, and aphids. Scale, which is a huge problem in California, does not enjoy our warm summer breezes. White flies are easily controlled with yellow "sticky traps" which can be hung like tree ornaments in an afflicted tree. Most local nurseries carry them. The minor leaf curl that occurs on many park trees is usually caused by thrip, a small (almost microscopic) bug. Thrip damage is usually only cosmetic and spraying for thrip is a tricky business and not recommended unless the infestation involves at least half the leaves. Leaf miners are little tiny wormy things that chew their way through the interior of leaves. They are not terribly common, but if you see evidence of "tunneling", simply pick off the violated leaf and dispose of it. Aphids, usually the Brown Citrus Aphids, are not common, but if you notice lots of ants on a tree and sticky leaves on new growth, you've got 'em. Fortunately, aphids attract predatory insects. Lacewings, Ladybugs, certain wasps and pirate beetles feast on aphids and can usually make short work of even major infestations. This is one of the reasons pesticides are not generally recommended for aphids, or for that matter, other insect pests as well. When you spray to kill an insect pest, you also kill the natural predators of that pest. Predator insects could easily be feeding on aphids or thrip on as many as thirty different trees. So if you kill them while they are on your tree, you may well be messing up the control mechanism for a whole neighborhood.

There are not many bacterial infestations that afflict our local trees. There is, however, a citrus virus that has already caused considerable damage at Venture Out. Citrus Tristeza Virus (CTV) is the Bubonic Plague and Darth Vader of the citrus world, and will be the subject of next week's column.

The Dark Side of the Orange (continued)
Death and Destruction

If you have a citrus tree, I hope you're saving this stuff. This weekly information is intended to help you to have healthy and productive trees. If your tree is neither healthy nor productive, please read the last six weeks offerings. If you think you have a problem with your tree(s) that has not been covered, call the office. They will pass the information to me and I would be delighted to come and take a look.

This week's treatise is an extension of last week's discussion of biological problems that affect citrus trees here in the park. The big one, as promised, is CTV, Citrus Tristeza Virus. CTV is a virus that kills citrus trees, and like other viruses in the human world (like HIV/Aids), it is both mercurial and fatal. Mercurial means that the virus can take different forms. In the 1920's CTV wiped out the citrus business in Africa. In the 1930's CTV destroyed the largest citrus business in the world in Brazil. In the 1950's, 60's and 70's, CTV seriously damaged the citrus industry in California, our nation's largest citrus producer. So much so that Walt Disney was able to buy a huge tract of land in Orange County at bargain prices to establish Disneyland.

Here in the park the virus is found, mostly, in older grapefruit trees, although other varieties of citrus can also be infected. Primary symptoms of the local virus strain are splaying bark that imitates sunburn, and big globs of amber colored sap that appear along the limbs or in limb crotches. If your tree exhibits these symptoms and if the rind of some of the fruit is bumpy and irregular, your tree may have CTV. Diagnosis is easier than the cure. There is no cure. In both Spanish and Portuguese, tristeza means "sadness". Once a tree is infected, it can die within a single season or it can linger on for over five years, becoming progressively sicker with each passing year. Furthermore (and this is the really bad part), an infected tree can pass its hideous infirmity to other nearby citrus trees. The transmission vector (that's bio-geek talk for a germ carrier) is the common brown citrus aphid. While not common in this part of Arizona, these aphids do appear from time to time and can easily pass the disease to large populations of trees.

There are, however, a couple of rays of sunshine penetrating this dark picture. About 20 years ago nurserymen figured out that by simply grafting new trees to a virus resistant root-stock they would end up with virus resistant trees. This means that most of the younger trees in the park are safe and only mature trees over 20 years old are susceptible. And the other bit of happiness is that Southern California and the area around Yuma Arizona destroy infected trees as soon as they are diagnosed, thereby reducing the impact of aphids. Infected and sick trees in Venture Out have very little opportunity to spread their disease.

On a happier note, Nancy and I will be conducting a seminar on growing plants in the desert on Friday March 19th at 1:30pm in the Auxiliary Ballroom. We'll have lots of pictures and info on a variety of native plants that are colorful, attractive, and water-wise, as well as tips on weed control and how to best prepare plants to survive the summer.

Citrus: Questions and Answers

For the last seven weeks we have been talking about growing and nurturing citrus trees here in the lower Sonoran Desert. Sometimes, and in some situations, this can be a difficult task. Erratic rainfall, blistering summer and fall temperatures, poor soils, alkaline irrigation water, and rare citrus diseases are just a few of the challenges facing us. Yet most of you have risen to the occasion and have taken the right steps to mitigate these issues. You have dutifully expanded the water basins under many trees. You have fertilized, you have pruned... and you have asked lots and lots of questions. As they say in Australia, "Good on ya!"

As for the questions, here are a few of the most frequently asked, together with the most commonly presented answers:

Q: "Why are the outer leaves curly?"
A: If only a few leaves are affected, it is most likely to be a small (almost microscopic) bug called Thrip. Thrip causes cosmetic damage to some of the new growth and chews brown tracks on the surface of some of the fruit. The damage is cosmetic only and will not hurt the tree or spoil the taste of the fruit. However, if the leaf curl is on half or more of the new leaves, it is likely you are dealing with the last stages of 2-4-d damage from two years ago. If your tree has made it this far, it will survive.

Q: "I just fertilized my citrus a month or so ago. Do I need to fertilize again before I leave?"
A: Probably. Mature citrus trees, those older than five years, require 1-2 pounds of *actual nitrogen* per year. The actual nitrogen contained within a fertilizer can be computed by multiplying the percentage of nitrogen in the fertilizer (as listed on the label) by the weight of the bag. For example, a 20 pound bag of ammonium sulphate, which is 20% nitrogen, contains 4 pounds of actual nitrogen. Thus ½ a bag per year per tree is about right, applied around the edge of the tree canopy and not next to the trunk. Once you have calculated your annual fertilizer requirement, the best thing to do is apply 25% of the total just before you leave for the summer, 25% when you get back, and the remaining 50% in January. If multiplication and long division are not your long suits, use the calculator hiding in your cell phone.

Q: "Last summer my tree didn't get enough water. Will it get enough this summer?"
A: Yes, depending on the size of the basin beneath the canopy and the condition of the drip/fan emitters. Sufficient water will be delivered to each citrus tree. But if there is black plastic, concrete, or pavers under the canopy of the tree, it will only be able to absorb a small portion of the water delivered to it. Also, if you have older emitters, soak them overnight in vinegar before you leave. Our irrigation water is very alkaline and older emitters have a tendency to plug up with salt.

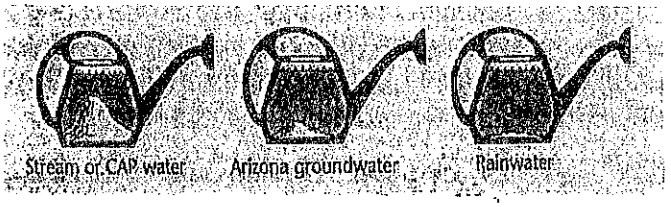
Q: "What do I do with all this fruit?"
A: Uh, let's see now; have you talked to the equipment manager at the lawn bowling club? Actually, disposal of excess produce can be a real problem. I once made the mistake of planting four zucchini plants, and my neighbors and friends would hide in their back rooms and pretend they weren't home if they saw me coming. If you are leaving town, you really need to strip the remaining fruit off your trees. If that turns out to be a bunch of fruit and giving it away to your rapidly disappearing friends gets to be a problem, you might consider donating your citrus to local soup kitchens and food banks. United Food Bank at Javelina and Mesa Blvd in Mesa would welcome even small donations. The Genesis Project at Desert Chapel United Methodist Church in AJ, south of University at Palo Verde, currently feeds 300 people a day during the week and really could use fresh citrus.

The Salty Citrus Situation

Many residents returned to the park last fall and were alarmed to find that LOTS of the leaves on their citrus trees were yellowed and burned on their tips and edges. Most residents reacted with what seemed to be a logical explanation: "My tree(s) did not receive enough water last summer". After checking with both VO Administration and the City of Mesa, I was surprised to learn that last summer the park delivered nearly twice the volume of irrigation water that we did in the previous year. So what happened, and why did we see so much leaf burn?

The symptoms many of us noticed at the end of last summer are known in botanical circles as "salt burn". They are caused, not by water deficiency, but by a combination of insufficient natural rain and too much irrigation water. Let me explain.

Much of Arizona's surface and groundwater carries high amounts of salt. These are not just your typical table salts (NaCl). They include carbonates, sulfates, and chlorides of Calcium (Ca), Magnesium (Mg), and Sodium (Na). This is why most of us drink bottled water or use the reverse osmosis machines scattered around the park. As irrigation water evaporates from your soil, salts are left behind. Low rainfall (like we had last summer), Low humidity (like we had last summer), high temperatures (like we had last summer), and the presence of high amounts of clay in the soil (which we have all the time), and the delivery of extra irrigation water (ie. extra salt), created a perfect storm for salt buildup.



When citrus trees rely entirely on irrigation water (very salty), which is undiluted by rainwater (not so salty), salt concentration in the soil increases as water evaporates. Reduced growth rate, yellowing and marginal leaf burn can result, sometimes killing the tree. Citrus trees are particularly vulnerable because they originated in the acidic costal soils of South China and their genetic structure is not properly adapted to deal with salt.

So what should we do? Fortunately, we got a break, and right now there's not much we have to do. The break, of course is the unusual abundance of natural rainwater we received this winter. The soil is now completely saturated and the offending salts have literally been "flushed" to below the root levels of citrus. The current prognosis for the summer monsoon rains is also good. If that, indeed, turns out to be the case, there will be very little problem with salt burn this year. If however the monsoon turns out to be another "non-soon" and salt burn again affects the citrus trees, our Administration and Maintenance Dept. will explore ways to mitigate the problem. In the meantime, pray for rain.

Citrus Review
(Just the Important Stuff)

For the past ten weeks we have been discussing citrus trees and how to keep them happy, healthy, and producing lots of fruit. The bottom line is this: when trees are under stress they become unhappy, unhealthy, and unproductive. Stressed trees are susceptible to insect attack, bacterial infection, and viruses, or they can evidence their unhappiness by turning yellow, dropping leaves, or producing sour and scrawny fruit—or no fruit. So what do you do with a petulant, unhappy and stressed out tree? You can't exactly give it Prozac or teach it to practice contemplative prayer, or send it to "group". There are, however, some things you can do for your tree that are likely to keep it from becoming stressed in the first place, and if you've been following this column you already know what those things are. In case you were absent on the days the lesson plan covered all this the first time, and you're worried about the final exam, a quick crib sheet is provided herewith.

The major causes citrus tree stress within the confines of Venture Out are not enough water, too much water, not enough fertilizer, sunburned bark, and poor pruning practices:

Lack of water usually occurs when a watering basin is too small for a tree. Remember, in this dry climate, the basin should be the same diameter as the canopy of the tree. Black plastic, hidden under the gravel or pavers extending under the canopy, is the other water thief that prevents irrigation water from reaching the feeder roots. Most of the feeder roots of a tree are under the edge of the canopy, and if the basin is too small or there is plastic under the canopy and the feeder roots are covered, water and fertilizer end up too close to the trunk where they cannot be accessed by the feeder roots. Got it?

Too much water, while rare, happens when trees end up being planted in a patch of very heavy soil (lots of clay) in a shady location. Overly wet soil over a period of time leads to various infestations and diseases including, but not limited to, aphids and Texas root rot. Preventing these things from happening is the reason the park doesn't turn on the irrigation system when the soil is already saturated by rain. Even the commercial growers do not irrigate in January and February because citrus roots are dormant then and are incapable of absorbing water.

Citrus trees need a lot of fertilizer, especially nitrogen. Commercial growers apply a year's supply of fertilizer in January. Here in the park we find that the best method is to first determine the annual requirement for a tree (there are simple formulae on the package of your favorite brand), and then to apply 25% of that requirement when you get here in the fall, 50% in January, and 25% when you leave in the spring. Be sure to apply the fertilizer under the outer half of the canopy as close to the drip line as possible. If you apply it around the trunk of a mature tree, it will have the same effect as dumping it in the street.

Sunburned bark usually occurs on trees that are planted in full sun locations and have been pruned like shade trees. The best stress reliever is to wrap exposed trunk sections with tree wrap. Painting the trunk with white latex doesn't provide sufficient protection from Arizona's intense summer sun.

The "pruning problem" is less a problem of methodology, than it is one of timing. Citrus trees can be pruned in a truly astounding array of forms without damaging or stressing the tree. However, if you whack on them at the wrong time of the year, your tree can be totally stressed. Other than minor cosmetic control, all major pruning should be done in late January or February before the blossoms and new growth appear. Fall pruning leaves the tree susceptible to winter cold damage and late spring pruning increases the possibility of sun and heat damage.

So there you have it; the five step citrus de-stress program. If you faithfully follow these steps your the tree is still stressed out, think about taking the Prozac yourself.