



THE UNIVERSITY OF ARIZONA

Cooperative Extension



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### **DEALING WITH SOIL COMPACTION**

If you are having problems getting irrigation water to sink into the ground, soil compaction could be the problem.

There are many reasons why water will not sink into the soil but compaction ranks right up at the top of the list. Because it is so common, and because it can absolutely affect the health of plants, it is important to know how to recognize it and how to fix it.

Soil compaction is not really a new issue for us because it is so common. Most of us can relate to physical soil compaction because sometime in the past we have tried to dig a hole for a new tree or shrub only to find that it is nearly impossible to drive the shovel blade into the ground. Many would blame it on caliche, but many times, it is really just hard, compacted soil.

Physical soil compaction usually can be fixed easily and simply by following a few basic steps. Let's take a look at what physical compaction is, how it occurs, why it is a major challenge for plants growing in desert soils, and what can be done about it.

Just to be clear, caliche and alkali soils are topics separate and apart from physical compaction. They can cause compacted soils, yes, but they are completely different. We are speaking today of only simple, everyday, run-of-the-mill physical compaction. It occurs when individual soil particles are jammed down tight together in a formation that slows water penetration and hinders the movement of air in and out of the soil. It also makes it hard for plant roots to push down into, and through, soil layers. Think about the soil underneath a playground swing or a base path in a softball field and you will be able to visualize what it looks like on the surface. Compaction layers can also occur down in the ground hidden underneath the surface of the soil.

Physical compaction can result from a number of different pressures, but the three most common causes are foot or tire traffic, gravity, and water flow. Each, in their own way, can cause the soil particles to collapse down tight against another and slow down or prevent the flow of water and air into the soil.

Recall that soil particles are nothing more than little rocks eroded down to a size that allows it to be called soil. These tiny bits and pieces of larger rocks simply lay against one another in the soil. Physical compaction results when there is nothing to cushion and separate the soil particles, such as compost or some other type of organic matter, and the individual pieces become mashed down tight together.

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## SOIL COMPACTION ... CONTINUED FROM PAGE 1

Foot or tire traffic can compact just about any soil. An unpaved, dirt road, for example, is compacted down tight so that it will provide good support and traction for any vehicle driving along its surface. In some places, foot trails can still be seen today many years after the last set of feet passed along the route. The same goes for wagon train wheel ruts that still persist today along the old California and Oregon trails. Repeated traffic can compact soils.

Gravity can also lead to soil compaction as it pulls down smaller particles down through the soil profile, especially in a soil that has little organic matter. The smaller particles tend to accumulate when they come into contact with some kind of barrier. Barriers can come in many forms but a clay layer, for example will slow not only water but filter out any particles suspended in the water. These layers of collected particles can become quite compacted over time. Organic matter in the soil tends to help keep channels open for better drainage.

The movement of water can also cause compaction problems. Not only will the weight of the water pressing down on soil particles tend to compact soils but it will also wash soil particles down until those smaller particles come to rest somewhere in the soil profile. This downward movement can eventually result in a constricted soil layer.

The quickest and easiest way to test for physical soil compaction is to dig a hole. Using a pick and shovel, excavate out a shallow hole, twelve to twenty inches deep and about one foot wide where you suspect there might be a problem, or where you are thinking about planting a tree or shrub. Then, fill it full of water.

Once the water is in the hole, keep track of the time it takes for the water to disappear into the ground. Most soils should drain within thirty minutes to two hours, but some soils with higher levels of clay might take longer. If there is any hint of drainage problems, it is important, for the good of the plants, to fix it.

A physical compaction layer most easily can be resolved by tilling the soil. In general, this often entails drilling holes, digging with a shovel, or running a mechanical tiller. When, for example, we are working up a vegetable or flower garden bed, we like to till up the soil with a shovel or mechanical tiller to loosen any compacted soil in the root zone. A few weeks ago, we discussed the process of double digging which is perfect to resolve compaction in super hardened soils.

Likewise, in a perennial lawn or around trees, I prefer to drill holes and backfill them with sand. The sand helps keep the holes from collapsing in on themselves, because, when that happens, the soil can become compacted once again. The holes themselves help loosen the soil and allow greater water and air penetration into the soil.

Many home gardeners like to use water pressure to drill those holes for them. Some will purchase a root feeder and attach it to a hose. The water squirting out from the end of the feeder will drill through most compacted layers quickly and easily. It is a simple matter afterwards to dump sand down the holes. The root feeder is sold online for about \$30.

For those who prefer to use something a little less expensive, jury rig a three- to four-foot piece of PVC or galvanized pipe to the end of a garden hose. It serves the same purpose. Another approach is to attach a one-half inch augur bit to a portable drill. Whichever method is selected, the object is to drill as many holes into the ground that there is time and energy. Don't forget to backfill with sand or you may have to repeat the treatment later on.

If you have a plant that has lost a number of leaves and looks sickly, you may want to check for physical soil compaction.

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## THE CHINESE ELM TREE

The desert-adapted Chinese elm tree has its good points and its bad points, but, in some situations, it might be a good choice for a medium to large yard where shade is important.

The Chinese elm tree was a popular landscape tree here in the desert Southwest for many years. Recently, however, it has fallen somewhat out of favor because of its need for water, lots of water. Still, many appreciate it for its shade.

Because of water bills, drought, and other outside pressures, as tree connoisseurs we have trended towards purchasing low water use trees and shrubs. Where we used to choose mulberry, ash, cottonwood, and the Chinese elm for their shade and beauty, we now purchase Chilean mesquite, Desert Museum palo verde, and the native ironwood. They cost about the same in the nursery but the low water use plants tend to pay for themselves in water savings each year. Nevertheless, we do still find the old stand-by trees in the ground and for sale here and there.

Let's make sure that we do not confuse the Chinese elm with the Siberian elm. Both trees can be found in the literature, online and elsewhere. In fact, Jones and Sacamano in their excellent reference book, "Landscape Plants for Dry Regions," does list the Siberian elm as acceptable for Arizona but they make clear that it is right only for the higher elevations. The Siberian elm is not appropriate for our desert areas because it will not survive our heat. It also tends to spread quickly, we call it invasive, and that can be a problem also. For these reasons, it is not recommended that you consider a Siberian elm for the desert areas of Pinal County.

The Chinese elm, on the other hand, is well adapted for the Sonoran Desert. It does require quite a bit of water, so don't even begin to think of putting it on the same drip system line as a mesquite or saguaro. It just won't work. In practice, the Chinese elm requires about the same amount of water as a citrus tree so, once established, it would need a good, deep irrigation every seven to ten days depending upon the texture of the soil and the heat. Temperatures hovering near 120°F may require an irrigation every three to five days. With that major downside out of the way, let's talk about the good points of the elm.

The name of the Chinese elm, like that of the Siberian elm, is a reflection of its native homeland. Native to China, Korea, and Japan, it has the capacity to survive in a wide range of environments, including our low deserts. It can keep its leaves during the winter or lose them, depending upon the low temperatures of the season and its own genetics, of which apparently there is a great diversity within the species. It is not unheard of here locally to see an elm tree with some or most of its leaves throughout the winter months.

The reason for the diverse behavior usually boils down to the variety selected at planting. Some forms tend to be deciduous, that is they lose their leaves during cold weather, and some that keep them. When purchasing an elm tree, or propagating your own, you may want to keep an eye out for this type of behavior.



Chinese Elm Tree serrated leaves-  
wikipedia

Most of the elm trees that I have seen in Pinal County reach somewhere between thirty and forty feet tall but some say that they could reach as high as fifty feet or more. Most elms tend to have a spreading growth habit with long, arching, and sometimes even weeping branches and twigs. With a good canopy of leaves, the elm provides excellent shade during the day.

The leaves themselves tend to be somewhere between three-quarters of an inch to over two inches long, depending again on the genetics. Most varieties that I have seen planted in yards are about one-inch long. The edges of the leaves are serrated with evenly-toothed edges to the leaves. The leaves tend to be rough to the touch with the veins of the leaves somewhat exposed.

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The tree has a light grey-colored bark that can become heavily seamed as it matures. The grey color offsets well the dark green color of the leaves for a striking contrast. The color and texture of the bark and leaves, coupled with the shade that it provides, lead many people to consider planting this tree.

Another feature of this tree that some find appealing is its relatively rapid growth rate. When we need shade, we need it now. This tree is one that within just a few years can begin to provide that shade. For that reason, it is marketed as a fast growing tree.

What kind of problems can we expect from this tree? Well, as in most trees, there are a few. First, and foremost, the tree is very susceptible to cotton root rot, or what some people know as “Texas root rot.” This is a nasty, soil-borne plant disease that quickly kills susceptible plants. If you know that you have cotton root rot fungi in your soil, that is, if you have had this disease kill other plants in your yard, do not plant this tree.

There are a few insects that like the Chinese elm, but they do not really cause major problems. At most there is a hole here and there in the leaf. Most people just ignore them.

At planting, it is important to give the Chinese elm a good head start by placing it in a well-drained soil that does not stay wet for long periods of time. It prefers to not have its feet wet all of the time. The soil should also be free of caliche, high salt contamination, and hard pan problems.

Make sure that the planting hole is no deeper than the depth of the container it comes in and that the soil extending out laterally from the trunk of the tree is loose enough to accept new root growth. The tree needs to have a large and expansive root system to provide the water and nutrients needed for proper growth and development. A strong, deep root system will also anchor the tree solidly in the ground. We have seen some blow over in storms recently because they were not solidly anchored in the soil.

As the young tree begins to grow, make sure to train its branches correctly. If some branches become overlong, it is okay to trim them back slightly. If the canopy becomes thick enough to cause wind resistance during storms, some thinning might be necessary. However, resist the urge to trim out larger branches if possible because the pruning wounds can be slow to heal and they will leave the tree open to infection by airborne diseases, such as slime flux and heart rot.

In the first year or so, let the new growth or small branches that might sprout along the trunk of the tree remain until the tree trunk can stand up without the use of a stake. When the trunk becomes strong enough to keep the tree erect, then those small limbs and sprouts can be trimmed or rubbed off to give the tree a well-kept look.

The tree will need regular fertilizer applications through the year, I would say similar to citrus, to keep it growing healthy and strong. A nitrogen-based fertilizer should be sufficient to keep it happy.

The Chinese elm makes a pretty good patio tree, or a specimen plant wherever shade might be needed in the yard. Since it does not have thorns, it can be planted close in to any public area without fear of the “pointy touch” that so many of our own desert trees provide. If you are looking for shade in our hot desert, and do not mind the extra water that it will take, you might want to give the Chinese elm a careful look.



Chinese Elm tree. Wikipedia

Trade names used in this publication are for identification only and do not imply endorsement of products named or criticism of similar products not mentioned.

## VIVIPARY

If you have ever cut open a grapefruit or shelled a pecan nut and found the seed inside already starting to grow, you have experienced up front and personal the biological phenomenon called “vivipary.”

Vivipary is defined simply as the premature germination of a seed while it is still located in its original protective fruit or shell. Sometimes it is called pre-germination, and sometimes we just use the scientific name, but almost always it means trouble.

To understand why this is so, we need to review a few basic rules of botany governing seed germination. First, what is a seed? A seed is nothing more than a baby plant and a little bit of food tucked into some type of protective covering. For some plants, that protective structure may be a fleshy fruit, like an apple, or an orange. For other plants, it might be a hard shell, such as pecan, pistachio, and sunflower. There are other mechanisms, of course, but all in all the bottom line is quite clear. The goal is to produce seeds that will grow into new plants.

Second, seed germination begins when the governing environmental conditions are right. There are a whole host of factors that govern seed germination, but the two most important seem to be the presence of moisture and temperatures warm enough to sustain the newly developing plant as it begins its life cycle. Generally, temperatures greater than 60° to 70°F are required for seed germination in most plants. In Southern Arizona, we see temperatures warm enough for good seed germination in the summer and early fall periods. We certainly know about those warm temperatures, don't we?

Third, a key requirement for seed germination is water, either in the liquid form, or in its evaporated form. Water vapor is one term that we use to describe moisture in the air. Another one is humidity.

During the month of June and into early July, our relative humidity readings may be quite low, perhaps lower than 10 percent. That changes dramatically when the rains of July, August, and September kick in. During that period, humidity levels of 50 percent or more on any given day are common. Inside a fleshy fruit, like an apricot, apple, or orange, the seed may be swimming in watery juice. In situations where the seed may be in a hollow pocket inside the fruit, humidity levels could be as high as 100 percent. In both situations, there is plenty of moisture to trigger germination.

Fourth, once germination begins, it cannot be stopped. It is simply a point of no return for all seeds that start down that road. They either have to survive to become established plants, or the seedling dies.

Finally, as the developing seedling rapidly uses up stored energy, the freshness, flavor, and nutritious status of the nut, and sometimes the fruit, begins to decline. That decline speeds up as the growth process kicks into high gear. Affected seeds and fruits may take on a bitter or bland taste and become in many ways not worth eating. For this reason, vivipary can spell trouble for those trying to grow food for the table.

Since it is generally warm temperatures and the presence of water, either in the liquid or gaseous phases, that mostly triggers the growth of a seed, it is easy to see why the arrival of these favorable conditions can lead to pregermination, especially when the seed is in a vulnerable stage of growth.

While seeds from many different plants can germinate prematurely, let's focus on three examples that we commonly see here in Pinal County. While describing them, let's also mention what we can do to minimize problems in our own gardens.

The first example is the pecan, a common landscape tree in Pinal County. Unfortunately, some varieties are quite prone to pre-germination. 'Western Schley' and 'Wichita' are good examples.

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Some years ago, we did a quick and easy study of pregermination frequency in pecan varieties. We randomly pulled nuts from trees and counted the number showing pregermination. In that particular year, Western and Wichita of all other varieties had the highest pregermination rates.

We need to say here that pecan pregermination problems may not happen every year. The pecan seed has to be at the right stage of development, almost mature, and conditions have to be right for the problem to strike. A late, cool spring, for example, may delay nut maturity and susceptibility until after the monsoon's high humidity levels fade away. Without the humidity, the late developing nut will not be encouraged to germinate. The problem is that late springs with cool temperatures have been few and far between recently.

With that said, and based upon vivipary issues alone, you would think that we would want to select other varieties that are less affected, like 'Cheyenne' or 'Pawnee,' but there are other factors to consider. With pecan, we have to keep pollination in mind.

Because the male flowers on a pecan tree may not be ready to shed pollen at the same time that the female flowers are ready to receive, or vice versa, the normal solution is to plant two trees, one where the female flower is ready first and one where the male flowers shed pollen first. In that way, we can ensure a good harvest on both trees. However, many people do not have room in their yards for two large trees. The only solution is to select and plant the one variety that has some overlap between male and female flower maturity, Western Schley, and just deal with the pregermination problems.

In years with early springs and humid monsoons, our best recourse for vivipary may simply be to harvest the nuts early and dry them quickly indoors. The only other alternative is to plant one variety in one yard and have a neighbor plant a pollinating variety in theirs. Both trees would provide nuts and a smaller yard is not cluttered up with two big trees. Someday, perhaps, they will come up with a variety that has good pollination overlap and is not affected by vivipary. We can only hope.

The second example is the grapefruit. Unlike oranges which do not remain long on the tree, grapefruit can hang in there for some time and still maintain freshness, flavor, and texture. Still, all good things do come to an end and, towards the end of the season, particularly during the warm summer months, the fruit may begin to dry out and the seeds may begin to germinate. When this happens, the taste of the fruit goes downhill quickly. The secret is to keep a close eye on your grapefruit and finish your harvest if signs of aging start to show up.

The final example is tomatoes. Now, we know that tomato flowers usually stop setting fruit once 90-degree temperatures set in. Because of this, we usually do not see vivipary too often here in the desert. Still, some varieties may be producing well into the warm and humid months. When this happens, we pick the fruit as early as we can and then try to select a different variety for the next season.

There are examples of vivipary in other plants also. Watermelon, cantaloupe, and sweet corn have been known to germinate seeds while still inside the fruit or husk. The best answer to prevent vivipary is to select recommended varieties, and to harvest at peak freshness.

While not all that common, vivipary can have significant effects on the quality of food products. Once it starts, it is next to impossible to stop and the best recourse is simply to throw the affected fruit or nut into the trash and try again next year.

## DESERT WILLOW

Do you need a drought-tolerate, medium-sized tree that provides good color? Consider the desert willow.

The desert willow, *Chilopsis linearis*, and its near relative, *Chitalpa tashkinensis*, are two desert-hardy plants that display showy flowers, which, when the tree is in full bloom, can be spectacular. Managed correctly, both make great landscape plants that offer many benefits.

Chief among their horticultural attributes are their colorful flowers. These blossoms are a study of light and dark with hues of white, pink, purple, and lavender all possible in a single flower. The various colors are all jumbled together in the flower to create a striking and attractive display. The trees seem to flower most profusely when they receive adequate water.

Another benefit is the size and structure of the plant. In the wild, the size of the desert willow varies greatly, usually dependent upon how much water it receives annually. However, most sources would say that a desert willow receiving sufficient water in a landscape could range in size from six to thirty feet tall and almost as wide. Desert willow trees planted in yards will generally max out around fifteen to twenty feet tall which makes them just about perfect for smaller yards. Its filtered shade allows for growing other landscape plants underneath the canopy for a look that more naturally approaches what we would expect to see in a plant community out in the native desert along a wash.

Other benefits include its tolerance of heat and cold, the nectar found in its flowers that attracts many different types of birds, especially hummingbirds, and other animals. When we think about our tough growing environment, its relative unconcern for full sun, reflected heat, and times of low humidity in the air become very important. It is just hardy to desert conditions all the way around. Since it has no thorns, we can live up close and personal with this plant without fear of prickles or stabs as we brush by. Its lack of thorns makes it perfect for a yard where outdoor activities are the norm.

It receives its willow name, I guess, from the shape of its leaves, which are thin and long. Regular willows have leaves that are similarly shaped. If you are familiar with the weeping willow or one or more of its relatives, you will recognize the description.

However, it is important to know that the desert willow is not a true willow. For evidence, just think of the flowers. A true willow has small fuzzy flowers, kind of like a blonde caterpillar, which show up mainly in the spring. The desert willow sports those large, colorful flowers mentioned above which can show up just about anytime during the year. Desert willows require much less water than the true willows and requires much less pruning and other care.

Let's visit now briefly about the closely related chitalpa tree. The chitalpa name may be a new one for some, but it fits into this discussion because it is a genetic cross between the desert willow and the catalpa, a tree widely grown in yards in the eastern part of the United States. Both parent trees are closely related in the same plant family, which is why the biological cross could happen in the first place.



Desert Willow-Arizona State University

The catalpa tree, not the chitalpa, has broad leaves, showy flowers like its desert relative, and is found east of the Mississippi River in the wild because it prefers a more humid and damp climate. It has been tested here in the west, but keeping it happy can be a stretch. For this reason alone, we do not see the catalpa tree here locally.

As a hybrid cross, the chitalpa retains characteristics of both parents and the result is a tree that is desert-friendly with a flower display that is similar to both of its parents. The chitalpa and the desert willow both grow to about the same size in height and width. That is good because they will both fit into the same

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kinds of horticultural niches in the landscape. The leaves are about one inch in width, which is wider than those of the desert willow, but more narrow than the catalpa. The wider leaves of the chitalpa provide a more dense shade than the desert willow, as long as the tree has a full canopy of leaves. There is that water requirement again. The Desert Winds school on the corner of McMurray Street and Casa Grande Avenue have several planted on the property and all are in bloom at this time.

Because the chitalpa tree requires more water to maintain a thick canopy of leaves, it cannot be truly classified as low water use so we do not see it regularly planted in our drought-prone deserts. For that reason, and because it is more commonly available for sale in our area, the desert willow usually gets the nod when it comes time to select a color specimen plant for local landscapes. The chitalpa is a good plant for the desert otherwise, but the water demand makes it a little more expensive than the desert willow to maintain.

Both the desert willow and the chitalpa trees tend to grow multiple trunks. They can be trained to one single trunk, but it can be a challenging task because of the multiple trunk tendency is a normal growth characteristic and it keeps trying to do so. It will too, if we are not diligent. If a single trunk is desired, it will be important to shade the bottom part of the trunk with some kind of covering that prevents the entry of light. Any new growth along the base of the existing trunk must be kept pruned off until the correct form of the tree is established.

Because the flowers tend to pool nectar at the base of the deep funnel flower, the tree is a must for those who desire to attract hummers to their yard. They are absolutely attracted to the plant when it is in bloom, which is most of the year. Flowers begin to spring into action in May and continue until October.

Sphinx moth adults are also attracted to the flowers for a sip of energy-rich nectar. Other birds, like the verdin, and some insects, like the carpet bee, do not have mouthparts sufficiently long to stretch inside the flower for nectar, so they tend to just peck a hole along the base of the flowers to access food. It can be fun to search for those little telltale holes along the outside of the flowers where this kind of feeding has taken place. If you enjoy watching birds and other animals, the desert willow and its near relative are good trees to consider.

Desert willow trees are commonly selected by those desiring to cut back on their water bill but still enjoy season-long color. An added benefit are the birds and insects that are attracted to the flowers and the nectar that they contain. On a quiet day, and with a pair of binoculars handy, I can envision the satisfaction that would come from just sitting back and enjoying the show.

If you have questions about this newsletter, have any plant related problems, or wish to have a publication sent to you, please call (520) 836-5221 x204 or (520) 374-6263 and leave a message. If you have a plant problem and are able to email a picture, please send a picture with any information you can provide about the plant, and your contact information to our diagnostic team at [macmastergardener@gmail.com](mailto:macmastergardener@gmail.com) and a Master Gardener will contact you.

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### **Successful Desert Gardening Series**

This will be a practical, in-depth view of the principles required to grow healthy outdoor plants in the desert southwest. Get answers to your gardening questions. The cost of the class is \$10 per person, paid by cash, check or money order. (Sorry, cannot accept credit cards). Space is limited, so please RSVP to save a seat by contacting either BJ Seemuth at (520) 431-6167 [bjseem@cox.net](mailto:bjseem@cox.net) or Theresa Ellsworth at (520) 836-5221 x202 [tellswor@cals.arizona.edu](mailto:tellswor@cals.arizona.edu)

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