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TRANSPLANTING SAGUAROS
by Jim Elliott

This subject is the source of more myths and misinformation than the Dutchman's gold. Unfortunately, once bad information is printed it takes on a life of its own and is referenced over and over again. Most authors have very little experience with the subjects they write about, but are very good at searching the "literature" for references. Thus the same weary, inaccurate sources are used.

My experience has been gained over the past seventeen years as co-owner and operator of Arizona Cactus Sales, Inc. During that time I have relocated thousands of saguaros from seedlings to mature specimens. Some have died, most have lived. In an average year we are successful more than 95% of the time and in good weather we may go months without losing a saguaro. This success rate contrasts sharply with published statements by 'experts' who twist the facts to fit their personal agenda. I have read stories where an 'expert' has stated that less than five (5) per cent of saguaros survive transplanting for as long as five years! I guess he has never driven through Sun City, Sun Lakes, Sunland Village, or hundreds of other neighborhoods in the Valley where there are thousands of healthy saguaros. Using his ratio there would have to be 19 dead plants for every one left standing. Yards having four specimen plants would thus have had 80 to start with! Some expert.

The success rate of saguaro transplants is inversely related to the size of the plant. The smaller (younger) plants have a much greater chance of survival. In fact, it is almost impossible to kill a saguaro that is two feet or shorter. By contrast, the very large saguaros of twenty-five feet and taller rarely survive. These giants do not re-establish due to a combination of problems: their own weight often causes tissues to be crushed allowing rot to begin, they have to be planted so deeply that new roots do not reach the surface, and the trauma of transplanting may accelerate conditions within the plant that would have killed it eventually without the move.

If a saguaro of reasonable size (less than 20' tall) is relocated, the primary factors in determining its success are how it is handled, an appropriate planting site, and the correct watering regimen. There are situations where a saguaro is the worst possible plant to use as its special adaptive features are ignored. Unfortunately the current trend to build very large homes on very small lots is a classic scenario for failure for reasons that will become clear.

PROPER HANDLING.

This consists of two parts: protect the saguaro from damage and protect yourself from the saguaro. For saguaros shorter than eight feet tall this can be a do-it-yourself project if you have several strong willing friends to help you. Be realistic about your abilities as a healthy saguaro can weigh as much as 100 pounds per foot of height. Most of

the smaller plants are much lighter of course, but once you have dug the plant out of the ground your options are very limited.

For exceptionally fat saguaros and any saguaro over ten feet tall I would heartily recommend calling a professional nurseryman. Be prepared to pay anywhere from \$10 to \$15 per foot to relocate saguaros without arms (called "spears") and from \$200 to \$400 for armed plants (1994 rates).

If the saguaro you are moving goes from one property to another you also have to call the Arizona Department of Agriculture (255-4933) to obtain a trip permit. Moving a native plant without a permit may result in a fine or confiscation of the plant.

Before you begin to dig the sauaro have your tools and packing material together. You will need a good shovel, a saw to trim the roots, a couple of ropes about 10-12 feet long and several layers of carpet or foam rubber to pad the plant. Given the nature of most of Arizona's soils you may need a pick or digging bar (we use an electric demolition hammer!).

Wrap the packing material around the saguaro while it is still upright. Remember that you will want to re-orient the saguaro in the new location to minimize sunburn problems so mark the north side of the plant or the packing so you can get it right. Normally the plant will be set somewhat deeper in the ground when replanted so leave the packing away from the bottom foot to foot and one half. Tie the packing to the saguaro with your ropes so that you have equal lengths of rope to each side of the knot. These rope ends are your handles to lower, carry, and raise your plant as very few of us are macho enough to just put a bear-hug on the saguaro and carry it off.

I recommend digging about a foot away from the base of the plant and be careful not to cut into the body. You will normally find at least three major roots that radiate from the saguaro just a few inches under the surface. These hold the plant up as the term "taproot" for saguaros is misleading. Even a twenty foot specimen rarely has a taproot more than three feet deep. Once you have dug down about 12" to 18" you are deep enough to cut the roots. I prefer to use a bow saw as the blades are easily replaced. The combination of soil, rocks, and roots will ruin a blade very quickly. Remove or carefully pad any sharp rocks or debris where you are going to lower the plant so you don't puncture the saguaro. Gently lower the saguaro to the ground and stub back the roots to about 4" for laterals. Shorten the taproot to a diameter of about 3" to 4" so it will have the strength to support the plant. New roots begin in the fleshy ring around the woody core of the roots so it is essential that your cuts be clean and square. I have read experts advise to save all of the taproot--balderdash! Standing a heavy plant on such flimsy roots would be comparable to a human standing on his fingertips for an eternity. The tissues will inevitably be crushed which creates the perfect place for rot to begin. Cut them as outlined above. In Arizona's hot dry climate the cuts normally dry within hours so normally no special treatment is necessary.

If it is cold and wet and you can't wait for better weather, you can disinfect the cuts with a 10% bleach solution and use soil sulphur to speed the drying.

Carrying the padded saguaro is relatively easy as you have the rope ends as handles. If you place it on a vehicle be sure to tie it down. Remember also that a horizontal saguaro is very vulnerable to sunburn so don't leave it exposed. Even a few minutes can cause sunburn during the hottest days of summer so cover your plant.

THE PLANTING SITE.

To determine an appropriate planting site you should take into consideration at least the following: drainage of the soils, overhead obstructions, safety, future access if removal becomes necessary, and satisfying visual design.

Saguaros are very efficient at obtaining and storing water. They can not stand being wet. This presents your first major problem in choosing the right location for the plant. Eliminate those areas that are low or can not drain. Always remember that your saguaro's roots are from 12" to 30" below the surface so merely moving the plant a few inches up a slope may still leave their root area in the retention basin. You have to study the drainage patterns off your house to see where the water will go. Planting directly in front of a downspout or valley of the roof could be a disaster. Conversely, planting directly in front of the apex of a gabled roof may be genius as all runoff is directed away from the saguaro. Every situation is different and most are not perfect, but search out the highest and driest location and you are on the right track. Do not plant in areas that are surrounded by concrete or behind a low wall that will trap water.

Check your chosen spot(s) for overhead obstructions. Will the saguaro grow into the eave of your house? Don't laugh, I have been called out many times to remove a plant that is jammed under a roof overhang. I guess the urge to be cute overpowered any other thought processes when these locations were selected.

Safety is yet another concern. It comes in two sizes, yours and the plants. For your safety avoid putting a saguaro close to walkways and high traffic areas. For the plants safety don't locate it where vehicles are likely to hit it such as immediately alongside a driveway.

Future access is seldom considered when planting a saguaro. This lack of planning can be expensive when you have a mature specimen that may weigh thousands of pounds with no access for heavy equipment. Try to find a place that can always be reached by a truck and you will not have to face the extra expense of hand labor to remove it.

DIGGING THE HOLE

Before you dig, call the utilities free Blue Stake service (263-1100). Omitting this step and cutting a telephone cable or an electric line can sure ruin your day.

Add a few inches to the widest dimension of the roots

to get a reasonable width for the hole. Obviously, the depth will vary with the overall size of the plant so I will give you some basic depths we use:

Original standing height	Depth of hole
1'-2'	6"-8"
3'-4'	10"-12"
6'	15"
8'	18"
12'	24"
15'-20'	30"-32"

I try to make the walls of the hole as vertical as possible to minimize the amount of soil disturbed. Your biggest immediate danger with saguaros is that they will fall over shortly after transplant. Stand the saguaro up and have your friends hold it while you backfill. Put in a few inches of soil, tamp it down firmly. Continue this process until the hole is full. We also leave a tapered mound (cone) of soil around the base of the saguaro to divert rainwater away from the soft disturbed soils that hold the saguaro up. This cone will gradually erode but by that time the soil has stabilized and the plant is secure.

Don't take shortcuts and don't think if a little is good, a lot is better. Put in the effort to get the proper depth, because if you plant shallow the plant will fall. If we recommend 30" deep, don't think 36" or 48" is better--the plants new roots will return to within a few inches of the surface before spreading sideways to form new laterals. If you have buried them too deeply this may never occur.

Several sources of gardening information right now are claiming that saguaros must be planted at their "original depth" to survive. They recommend these shallow plantings with a series of braces held together by cables, etc. The braces will rot away long before the plant can grow strong enough laterals to hold itself up if planted this shallow. You only have to realize that a 12' saguaro may be sixty to one hundred years old to see that your braces must last quite a long time. If you follow the procedures outlined in this article you will be planting from 2" to 15" deeper than "original depth". The plant will live very well without the ugly braces.

Another 'expert' requirement is some form of soil amendment. Whenever you change the composition of the soil in such a relatively small area you create an uneven water absorption. Inevitably one side or the other will hold the water better. That can have two effects; either the planting hole will stay wet (disaster) or the surrounding area will wick the water away which is also bad for the plant. Our success rates have been achieved by simply replanting in the native soils.

WATERING REQUIREMENTS

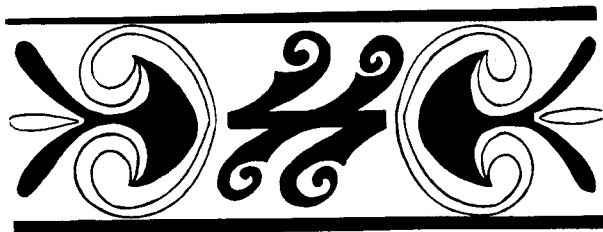
Plant the saguaro dry. That does not mean just a little water--it means none. Saguaros have a very high

water content that is locked up in their tissues. This allows them to survive for extended periods without adding water. The stress of transplanting occasionally causes some rotting in the root area. If the plant and soils are dry, the saguaro's evolved defenses halt the problem and the plant lives.

This dry regimen should be followed through the first six months or more to give the plant its best chance of survival. If your saguaro is very dehydrated after this period of time, you can remove the cone of soil around the base and dig a shallow watering well right at the plant. The well should hold no more than two or three gallons for a large plant and somewhat less for a plant shorter than eight feet tall. Give the saguaro about five gallons of water once a week to help build it back up. This watering should not be started in winter--wait until temperatures get back to the 90s.

If your saguaro has not dehydrated badly and the color looks good, I would never water it---ever. Saguaros in urban settings have so much more water than in the desert that they average over one foot per year in growth. When you get a half inch of rain on your roof, the flow into your yard may be several inches. Add this runoff to the supplemental watering for your other plants and there is an abundance of water for the saguaro. You will be better served to have a healthy plant that grows slower and does not become a bloated monster. Thankfully the use of black plastic under gravel toppings is declining as we have found plastic causes many problems for saguaros. The plastic makes a nearly perfect vapor barrier so when the soil becomes wet it may take months to dry out. This constant wetness encourages the growth of organisms that cause rot. If you have plastic under your toppings, it is a good idea to remove it at least six to eight feet in all directions from the saguaro so it has a chance to dry out.

After reading this article you may determine that your location just isn't right for a saguaro. Saguaros have evolved as a species dependent on quick-draining soils with intermittent rainfall and fairly well spaced vegetation. If you can not provide a site that fairly well meets those criterion, you may need to select other desert plants that handle water better.



ON THE DRY SIDE

by Timothy Chapman

Oh, man. August has got to be the worst. The humidity, the brutal heat that seems like it will never let up, the heavy clouds that dance teasingly on the horizon and then evaporate. True, we've forgotten about the taxes we had to pay last April, and the commercial stranglehold of "the Holidays" hasn't started sneaking up on us yet. But August is physically daunting. And what's worse, I probably lose more plants in August than in any other month. I'm always tempted to grow plants that I have no business growing without a cooled greenhouse, and my succulents and I suffer the consequences.

Nonetheless, some of my little pals remain stalwart and true, suffering triple-digit temperatures with a determination that I truly admire. My Anacampseros, for instance, have withstood heat, shifts in humidity, and my how-the-hell-should-I-know watering style. One of my favorites is, naturally, A. alstonii, with its pale, delicately scaled stems and handsome flat-topped caudex.

Anacampseros is a genus which taxonomists have placed in the Portulacaceae, or purslane family, along with Talinum, Portulaca, Lewisia, and others. They are all considered to be leaf-succulents and their flowers are radially symmetrical (actinomorphic). And the purslanes are considered to be somewhat closely related to cacti and mesembs -- huh? Well, its true, and you can't tell by just staring at them real hard. The factor that links these seemingly disparate groups, along with certain embryological evidence, is the presence of a purple pigment known as betacyanin. I guess biochemistry is thicker than water.

All of the species in Anacampseros, with the exception of one little goof-ball hanging out in Australia, are African. Jacobsen, ever the trouble-maker, divides the genus into four sections, two of which are puny and are getting swept under the rug at present for brevity's sake. The other two sections are Telephiastrum and Avonia, and look very different from one another because of the kinds of stipules they have and the size of the leaves. Now stipules are little growths that sit at either side of a leaf's petiole. When present in non-succulent plants they look like little green, I don't know, things. But species in the section Telephiastrum have turned their

stipules into little hairs sprouting out from near the leaf base. And in Avonia, which is where we find Anacampseros alstonii, the stipules have been modified into white, translucent, overlapping scales which protect the tiny leaves beneath. Pretty neat.

My little A. alstonii seems to be basically winter-dormant; when the dozens of little stems look all lifeless and bland, I give very little water. But in the spring and summer I water once a week, sometimes more. To reduce the likelihood of overwatering I have given it a very porous potting mixture. The plant produced pale purple flowers in June (some specimens produce white blossoms), and I was kind of annoyed when they wouldn't open until I found out that that's often the norm. Finally, Anacampseros species are frost-tender, so don't leave them in the freezer.

Yeah, August can be pretty rotten. And it's not just the heat. Some of my new-age friends say that because of the annual meteor showers that pelt the earth around this time of year, everyone's vibes get pretty whacky. So don't take it personally if you've had a rough time of it recently. Hold on just a little longer. September will herald calmer souls and, just maybe, our first day under a hundred degrees. Hang in there.



SO MUCH FOR PEAT MOSS & WATERING.

When they say peat moss holds water they are not kidding!

Once it is wet, peat moss (non-specific type) holds 6 - 15 times its weight in water; sphagnum moss up to 15 - 30 times its weight, and they hold tightly.

Water molecules adhere to the surface of ALL soil particles and co-here to each other, surrounding each particle with a microscopic film of water. Surface tension binds the water to the soil particles. When the moisture level gets very low plant roots cannot overcome the tension to get water. The soil won't let go of it when the film of water reaches a certain "thinness."

When the water reaches this level of high tension, the plant is dry and thirsty even though the soil may feel wet (non-succulents may wilt) especially in soils of high peat moss content.

Conversely, when it gets thoroughly dry through evaporation, peat moss sheds water and resists re-wetting. Water runs through without adhering, causing tension in the waterer.

(From MID-IOWA C & S SOCIETY NEWSLETTER 1987.)



21. OPHTHALMOPHYLLUM:

Also BERRISFORDIA.

Highly succulent plants somewhat resembling LITHOPS on the one hand and CONOPHYTUMS on the other. I have 5 species and 3 duplicates. Flowers start appearing in September and bloom through October. Most are white, some diurnal, others nocturnal. New leaves appear in March. My favorite plant is O. rufescens with its red windowed leaves and fragrant white nocturnal flowers. This plant of two heads has won 4 blue ribbons and 1 red. Use clay pots, porous soil and only water when blooming or showing new growth.

22. PLEIOSPILOS:

Blooms August to December. Hardy to 14 degrees Fah. Of easy culture. P. nelii blooms in March and is only hardy to 28 degrees F. Medium soil, clay or plastic pots and lots of water when flowering or showing new leaves.

23. VANHEERDIA:

Very succulent plants of diversified leaf forms. I have two species in my collection. One, V. divergens looks like a fat CHEIRIDOPSIS, while V. primosii looks like a windowed leaf LITHOPS. Use plastic pots with porous soil and water only when flowering or showing new leaves. New leaves appear in March while flowers appear in May. V. divergens is hardy to 14 degrees Fah.

in my collection that I have personally watched over a period of years. I hope these notes will be of some use in the growing of these wonderful plants. Lots of T.L.C. is needed but is well worth it. After all we talk to our plants and the molecules of heme (hemoglobin) and chlorophyl differ only slightly in their configuration, one having iron, the other having magnesium.

I would like to end this article with a quote that covers my feelings about these beautiful mimicry plants. It expresses my feelings about raising them and enjoying their diversity.

PSALM 96:12 - "Let the field be joyful and all that is therein; then shall all the trees of the wood rejoice."

This article by JAMES A. ROBBINS first appeared in the NEWSLETTER OF TUCSON CACTUS AND BOTANICAL SOCIETY, Volume XI, No. 2, 1976.



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The following article was submitted to BETWEEN THE SPINES, Central Kansas Cactus and Succulent Society Newsletter, and taken from FLORISTS REVIEW, June 30, 1983. It is a small sample of the large amount of plant experimentation and research constantly being conducted.

Courtesy of Elaine Taylor-Steichman

A NEW TECHNIQUE FOR GRAFTING CACTI

"Medical discovery helps cacti 'stick' together"

(by N. Zeislin and A. Keren, associates with the department of Ornamental Horticulture of the Hebrew University of Jerusalem.)

Grafting is common in the propagation of cacti. This technique is used for a variety of purposes, such as accelerating growth of slow-growing plants, preserving species that do not grow well on their own roots and preserving abnormal forms that are not capable of independent development, such as red cacti without chlorophyll or monstrous cristate forms.

There are several methods of cactus grafting available. All require a good fit of scion and root-stock, along with materials to ensure good contact between them, such as strings, rubber bands, clips, or thorns. And, of course, skillful handling is vital. As a result, it is difficult to graft cacti soon after germination of the root stock and scion species because of the small size of the seedlings.

Several years ago a medical publication about using an adhesive instead of strings for tissue contact in human surgery stimulated the idea of using the same technique in cactus grafting. Subsequently, many types of adhesives based on various chemical components were examined. Most of the glues were unsuccessful, including the very expensive medical one which was donated by an Israeli hospital.

Finally, after three years of effort, an adhesive based on cyanoacrylate as an active ingredient was found to be successful.

Many cactus cultivars and species were grafted by gluing at various stages of stock and scion development, including very small seedlings. Species not previously used as root-stock were tested and found to be very suitable for this purpose. Grafts of a red-colored variety of *Gymnocalycium michanovichii* and various cristates were examined.

Of all the experimental grafts, more than 80% were successful. The glue graftings worked even in winter, unlike conventional methods, which often are successful only during spring and summer.

Improvement of the method by addition of growth substances to stimulate the development of connective tissues to the adhesive, and the use of this grafting technique in various woody species, are now under investigation.

