



COLLEGE OF AGRICULTURE AND LIFE SCIENCES

COOPERATIVE EXTENSION Pinal County



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U of A Cooperative Extension, Pinal County 820 E. Cottonwood Lane, Bldg. C., Casa Grande, AZ 85122 (520) 836-5221 http://extension.arizona.edu/pinal

ROCK GARDENS

If you are looking for a type of garden that doesn't take much time, is stingy on water, and still has a nice desert feel, you might want to consider a desert rock garden.

While rocks of various colors and textures are the stand-out features of a rock garden, a selection of plants will add diversity and interest to the garden. I often hear a common complaint: "Everything that I plant ends up dying." Because of this they finally give up gardening for good and never experience the joys that come from successful, attractive gardens. One solution is to select hardy, low water use plants that look good and don't take a lot of time or effort to maintain. A rock garden with the right mix of plants might be the best way to find success.

So, just what is a rock garden? A rock garden is uses natural or native stone carefully arranged to give the same look as a natural outcropping of rock and planted with an arrangement of locally adapted, low growing plants that give the feeling of a natural ecosystem. Here in the low deserts, it makes sense that a rock garden would mimic the ecosystem of the desert around us, but, if one really wanted to create, say, an alpine environment, that could also conceivably be done. It all boils down to they type of rocks and the type of plants desired.

To achieve the desired outcome, good planning is absolutely necessary. Just plopping down some rocks and throwing in a few plants will not provide the desired atmosphere, but a well designed and installed landscape can give decades of worry-free outdoor living.

A good landscape architect or landscape designer can be a valuable asset during the planning phase. Rocks of any size will be quite heavy, often requiring specialized equipment to safely move them into position. A well designed landscape really is an art form and to get just the right "feel," you might need a little help.

Rock gardens fit well into nooks and crannies of any landscape, or they can be the focal point of an entire area. Rock gardens work especially well in helping to landscape and stabilize sloping banks or hill sides.

In order to give the desired effect, a well designed rock garden needs the variety that comes from a blend of rocks, ground covers and desert-adapted plants. Hills and water drainage channels should work together with rocks and plants to mimic the desert in every way. Do not short yourself on the plan because it can save a lot of work, expense and frustration later on.

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To begin a rock garden, carefully evaluate the site in mind and decide what rocks and plants can stay, and what needs to go. Then clear the area of unwanted plants and debris.

Any soil improvements that need to be made should be made at this time. When the area will be devoted mostly to rock, drastic changes are not necessary; but any plant, desert-adapted or not, must have good drainage to prevent future plant health problems. At the very least, drill drainage chimneys through compaction or caliche layers so that water, and air, can move easily through the soil.

It is important to add any contours or other features to the rock garden before any decorative rocks are installed. Any mounds, depressions or artificial drainage channels that may be needed or desired should be built first and given time to settle so that when the heavy rocks are added, no displacement or settling of the stones will occur.

Contours and other features can provide variety and interest to a desert rock garden. You may want to collect rainwater from the roof or a paved area and send it to a tree or other plant, for example. Water and rock are natural components, and some of the most memorable scenes in nature result from a view combining these elements. This feeling can be captured even on a small scale.

If a truly natural appearing rock garden is desired, the rocks must look like they were positioned by nature. When moving rocks from one location to another, it is best to do it skillfully so that the rocks look like a natural formation. Do not place a rock with the side that was previously buried in the soil facing up or outward, for example. Broken, unweathered edges likewise should be hidden from view.

Another hint is to group similar rocks together. Sedimentary rocks and volcanic rocks should be separated because they do not often appear together in nature. If the rock has strata, lines, all of the pieces should be placed with the strata lines in one direction.

If you have a choice of the type of rock to use, select a porous sandstone rather than a hard and non-porous granite or schist. The softer rock will weather much faster and give a more natural appearance to the garden. Be careful of newly quarried rock. These might have sharp edges or signs of drilling which would be unnatural in a native landscape.

When designing and installing a rock garden, do not forget to consider the need for accessibility to each plant in the garden. Small pathways or stepping stones will help one reach the plants in order to groom it or treat it for problems. Safety is also important. You will want to be able to maneuver among the plants without tripping over rocks.

When selecting plants for use in a rock garden, consider first the native, desert-adapted, long-living trees and shrubs common to our area. It will not take many, because the desert does not naturally support a lot of plants in a given area, but the selection should blend in with the environment. Plants also help to shade the rocks and reduce solar heat gain that can heat up the local environment. Consider saguaro cacti, agaves, Chilean mesquites or palo verde trees and arrange your selections into a natural-appearing display. If a smaller tree is required to fit the space, you might want to think about the sweet acacia or one of its relatives. In any event, arrange the larger plants to the rear of the display so that they do not hide the rock features. Smaller plants can be placed to the front.

For additional ideas on how to design, create, and care for a rock garden, do an online search to find a wealth of ideas and photos of what others have done.

A rock garden, properly designed and assembled, is an effective water conservation tool and can give a pleasing, natural feeling to any landscape.

## FERTILIZER BASICS

All plants need an ample supply of nutrients in order to look their best.

In the wild, native plant systems, proper nutrition for each plant must come from the environment in which those plants are growing. Some of the nutrients will come from the air. Others will come from the soil, and still others come from other source. In most situations, the sources are sufficient for the plants that grow in that location. Otherwise, the plants would most likely die and something else more competitive would take its place.

In artificial systems of our gardens and landscapes, nutrients can be used an a rapid rate, perhaps more than the native system can resupply. In those cases, it is necessary to help by adding nutrients to the soil through applications of a nutrient-bearing source. We generally call these outside sources of nutrients a fertilizer.

Not all essential nutrients need to be resupplied. Of the sixteen elements essential to plant growth, three are provided free of charge from the air surrounding the plants. These are carbon, hydrogen, and oxygen. Nitrogen, phosphorus, and potassium, are used in fairly large amounts by plants and because of this are often called primary nutrients. Secondary nutrients that are required less frequently than the primary nutrients but more than the micronutrients include calcium, magnesium, and sulfur. The rest are used in fairly small amounts and are called micronutrients. These include zinc, iron, manganese, copper, boron, molybdenum, and chlorine. When the natural environment is deficient in any nutrient, they can easily be added with the proper application of fertilizers.

Fertilizer formulations package and hold essential elements in a way that makes it easy to determine how much to apply for proper plant nutrition. They also simplify the process of properly applying nutrients to the plant's environment.

Fertilizers can be formulated into either dry or liquid fertilizers. The majority of fertilizers sold are dry, either as a powder or as granules. Some formulations compress granules into stakes which then can be easily driven into the ground with a hammer. These dry particles dissolve when they contact water and, separating out into their basic elements, become available to the plant roots for absorption. The process of becoming available can be very short, making the nutrients available almost immediately, or it take as long as two weeks or more depending upon the weather and chemistry. Nitrogen, for example, may take two weeks to be transformed by microorganisms from the ammonium form into nitrate, the plant world's cake and ice cream.

Liquid fertilizers are less common, and sometimes more expensive; yet they play a valuable role when used correctly. They are easy to use, especially on container plants. There is little risk of burning tender roots as long as the directions on the label are properly followed during the dilution stage. The nutrients are also immediately available. Liquids are less practical for large-scale use because they usually cost more and often must be used more frequently than the dry formulations. Liquid formulations are most often used for container plants with relatively small, confined root systems; and for foliar feeding.

Foliar fertilizers are applied directly to the leaves of plants through which the nutrients are directly absorbed. Many liquid or water-soluble fertilizers include instructions on using the product for foliar feeding. Actively growing plants seem to show the best response to this method of application but the effect is usually short lived. While the plant responds quickly to nutrients absorbed through the leaves, it generally is only a short term solution. It is often best to use foliar feeding as a quick solution followed by the more long lasting benefits of soil applied fertilizers. Make sure the concentration of foliar fertilizers applied is not stronger than what the label recommends as burning of leaf tissue can occur. Temperatures over 85 degrees Fahrenheit also facilitate damage to the leaf tissue.

Fertilizers are formulated according to the number of essential elements included in the bag or container. The label will always identify the chemical makeup of the formulation. The three numbers on the front of the bag tell the percentage of nitrogen, phosphorus, and potassium in that order. A bag of 10-10-10, for example, will contain 10

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percent nitrogen, 10 percent phosphorus, and 10 percent potassium or pot ash. If there is a fourth number, it will be for one of the other nutrients that has been added to the formulation. In our area, that often is iron.

A complete fertilizer will contain all three of the primary nutrients: nitrogen, phosphorus, and potassium. On the container or bag there will be a number higher than zero in each of three locations. The first number is always for nitrogen, the second for phosphorus, and the third for potassium. An incomplete fertilizer will contain only two of the three nutrients and a simple fertilizer will contain only one nutrient, such as ammonium sulfate, 21-0-0.

In Southern Arizona, nitrogen will almost always be lacking in soils and most fertilizers will include this element. Most local soils, however, generally contain sufficient phosphorus and potassium and additions of these elements may be unnecessary. Occasionally, it may be necessary to add phosphorus, perhaps every third or fourth year. A common incomplete fertilizer is ammonium phosphate, 16-20-0. Rare is the situation where potassium, the third number, is needed in Arizona soils. For this reason, complete fertilizers are not often recommended for plants growing in native soils.

Urea is a nitrogen fertilizer which requires extra care. It is 46 percent nitrogen with no phosphorus and no potassium. With more than double the amount of nitrogen found in ammonium sulfate, it can easily burn roots of plants when applied at the normal rate of ammonium sulfate, a common mistake.

There are fertilizers with many different nutrient ratios on the market. It is important to remember two principles when selecting a fertilizer ratio. First, the higher the number in the analysis, the stronger or more concentrated is the fertilizer. Second, the higher the concentration, the less should be applied at one time. Most recommendations for fertilizer applications to landscape and garden plants indicate that at least three applications per year should be made, never just one. This is for both plant safety, and to minimize the loss of fertilizers below the root zone through leaching.

Slow-release or controlled-release fertilizers are balls of beadlike granules of complete fertilizer coated with resin, sulfur or some other permeable substance. When the granules are moistened, as during a normal irrigation, some of the fertilizer diffuses through its coating into the surrounding soil. Every time water is applied, this is repeated until the fertilizer is used up. Some products are effective for four months; others for up to eight months or longer.

Finally, all fertilizers, for best results, should be incorporated into the soil by digging or raking the pellets so that they are covered. The only exception to this rule are the nitrogen-only fertilizers which can be carried into the soil with the irrigation water.

Different plants require different amounts of fertilizer. For fertilizer recommendations for specific plants, consult a good plant nutrition reference or contact the local Cooperative Extension office to speak with one of our Master Gardener volunteers.

Understanding how to select the right fertilizer for the specific task at hand can save time and money as well as prevent unnecessary injury to the plant. It can also help a plant enthusiast be gentle to the environment by eliminating the addition of unneeded fertilizers.

## MYCORRHIZAL FUNGI

Even though the word “fungus” often sends shivers up and down the spines of dedicated gardeners, it is important to remember that one class of fungi are “good guys,” the mycorrhizal fungi.

Fungi are a type of plant, a very basic type of plant, that sometimes are microscopic and cannot be seen without magnification, and sometimes form parts and pieces that are large and showy. Some are parasitic and harmful to plants because they cause diseases, but some, like the mycorrhiza are highly beneficial.

The mycorrhizae, that is the plural form of the word, are fungi that form mostly beneficial relationships with the roots of plants. Some have been found to be somewhat pathogenic but almost all, perhaps 90 percent or more, are extremely helpful to the host plant.

These beneficial fungi can be of assistance because they intertwine with and enter into the root tissue. By so doing they become part of the root system itself and make the uptake of water and nutrients more efficient. Some just attach to the cell walls of the root from the outside while some actually penetrate into the individual cells of the roots themselves. Far from being harmful, they actually assist the plant in various ways, and the plants help them. We call it a symbiotic relationship because the two mutually benefit each other.

Symbiotic relationships are actually quite common in nature. Take, for example, the relationship that exists between the *Rhizobium* bacteria and the roots of legume plants. The relationship is beneficial because the bacteria are given energy by the plant and in exchange the bacteria give essential nitrogen to the plant. That is how come desert legume plants like the mesquite and the palo verde can thrive in a low nitrogen soil without fertilizer applications. Mycorrhizal fungi similarly help their host plant in several ways.

First, mycorrhizal fungi help plants by making it easier for the plant to access nutrients from the soil. Because the fungi are attached to the roots themselves, the surface area of the combined fungi and the roots is larger than just the roots alone. For this reason, there is more opportunity to absorb and transfer the essential nutrients that come from the soil to the plant. Plants attached to mycorrhizal fungi have greater access to larger amounts of nutrients than plants that are dependent upon their system of roots alone.

A greater surface area, and thus a greater exposure to soil nutrients, is not the only benefit. Mycorrhizal fungi tend to be much smaller than the individual roots of plants and can squeeze into tight places where roots may not be able to penetrate. In this way they have access to available nutrients that the roots alone cannot reach. Some fungi also have the ability to change the chemistry of the soil and make it easier to extract nutrients from the soil particles. These physical and chemical abilities can be greatly beneficial to the plants, especially those growing in less than desirable soils, such as highly alkaline, compacted, or nutrient depleted soils. This is an accurate description of some of our Arizona soils.

Research studies have also found that mycorrhizal fungi help plants survive diseases, salinity problems, drought, and other adverse conditions. While the mechanisms are complex and highly variable, the bottom line is that if we want to have healthy plants that do well in our desert soils, it is important to create conditions in the soil that encourage the development of these fungi and enhance their relationships with the plants in our gardens and landscapes. How do we do that?

My colleague, Jeff Schalau, who works as an Extension agent up in Yavapai County, wrote a column on the mycorrhizal fungi in November of 2012. In his report, he quoted the work of a Washington State University researcher who found that the best way to encourage these beneficial relationships between plants and fungi is to work hard to increase the health of the native soils. Here is a direct quote from that column:

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“Washington State University Extension Horticulture Specialist, Linda Chalker-Scott, has conducted extensive literature reviews on the use of mycorrhizal inoculants in gardens and landscapes. Given current research results, she has identified two themes: 1) healthy soils naturally contain indigenous mycorrhizae and adding packaged mycorrhizae to such soils is a waste of money and resources; and 2) where soils are impaired to the point where indigenous mycorrhizal species can't survive, mycorrhizal amendments alone won't improve the situation.

“Dr. Chalker-Scott further concludes that beneficial microbes are important components of garden and landscape soils, and the best way to cultivate their presence is through thoughtful, sustainable horticultural practices. Sustainable practices include appropriate plant selection, appropriate use of organic mulches, adequate and timely irrigation, and minimizing fertilizer applications (especially phosphorus).”

The bottom line is what I have been saying in this space for years. The best thing that a gardener can do to have healthy plants is to build up and maintain the natural organic matter levels in the soils because the organic matter levels in soils have a huge impact on mycorrhizal fungi. Typically our desert soils are very low in organic matter. The leaves of the native trees and shrubs are basically quite small and there is relatively little rainfall through the year to maintain good composting conditions both on the surface of the soil and more importantly down in the soil itself. The microorganisms that decompose organic matter are generally highly active in the warm soils of our climate and what little bit of organic matter there is quickly disappears from the plant root environment.

Regular additions of compost, decomposed manures, leaf mulch, and even finely chipped woody stems and trunk refuse with a little nitrogen added to help in the decomposition can greatly help the overall health of the soil. Organic mulch worked into the soil helps encourage mycorrhizal fungi and their relationships with our plants.

Personally, I like to work in lots of organic matter down as deep into the soil as I can get it. Then I build up my garden beds, plant my garden, and then lay a deep level of organic mulch over the surface of the soil to help minimize evaporation and cool the soil around the roots. At the end of the garden season, I throw on some more compost, till that and whatever plant materials remain from the past season and start again. In this manner, I can maintain a consistent level of soil organic matter level in garden soils.

Around trees, vines, and shrubs, I like to keep a layer of mulch on the surface of the soil which slowly decomposes over time. I don't dig it in because I do not want to damage the roots of the plants near the surface of the soil. The organic mulch on the surface, however, will gradually break down and leach into the soil to the benefit of the root system of these perennial plants.

Mycorrhizal fungi can bring definite benefits to the plants in our gardens and landscapes, especially to those that are not really native to our desert. By enhancing the health of our soils, we can help encourage these wonderful allies.

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## GARDEN TOMATO TASKS

Are you one who likes to eat your own vine ripe tomatoes? Here are a few tips to help you along the way.

With the recent warm temperatures, tomato plants should be growing quickly and starting to set fruit. Some who may have planted early and provided frost protection may already have vines that are flowering. Others, who planted just a few weeks ago may be seeing vines that are just starting to show new growth. If you are about to plant now, you will want to push them pretty hard to help them get their jobs done before the heat arrives.

No matter in what growth stage your particular plants are found, now is a good time to provide them with a little nitrogen fertilizer. A moderate feeding now will give them a lift and help the plant focus more energy into producing fruit. Nitrogen is one of the elements that serve as building blocks for vine and fruit growth and development. A shortage at this time could stunt the plant and seriously reduce fruit set and development.

Another task is to evaluate the irrigation system and schedule. Tomatoes do not do well when they are short of water. Remember that with these warmer temperatures, all plants will be using more water to help cool themselves and to move nutrients around to where they are needed. On the dry side, tomatoes, or any plant, cannot perform these essential functions. In tomatoes, poor fruit production is the usual outcome. Consider putting in a drip irrigation system with a timer so that water will not ever be a limiting condition.

This is also the time of year when you may find a large caterpillar with a predominant horn on its hind end feeding on the vines and fruit. The tomato hornworm can reach four inches long and almost as big around as a finger. The large size of this animal makes it bulky enough to consume entire leaves and small stems. In addition, it is a sure bet that no one wants to find a worm chewing on that nicest tomato in the patch.

Tomato hornworms can be hard to find in the garden. They are dark green in color, which matches the color of the foliage of the vines, and they have silver to white lines arranged diagonally along their bodies which gives them a bit of camouflage to hide them from their enemies. Sometimes it is easier to look for their large, black droppings that may be on the ground or settled onto leaves. If you see the droppings, look around closely because they will be there, somewhere.

The best way to get rid of hornworms is to simply pick them off by hand or to snip them with shears. It is quick and easy to do. When they are small, *Bacillus thuringiensis* may also give some relief. If they have been a particular problem in the garden, rototilling after harvest will get rid of resting pupae which have burrowed into the soil to wait out cold or hot temperatures.

Aphids can also be a problem in tomatoes. Aphids are soft-bodied insects that remove valuable juices and nutrients through sucking mouthparts. Since almost every aphid at this time of year is a female, and because aphids give birth to live young, populations can explode quickly. The problem is further enhanced because female aphids do not need to mate to produce young. One aphid today can mean thousands tomorrow, their reproduction is that rapid.

Check regularly for aphid populations in the garden. Especially look on the underside of leaves because they prefer the bottom surfaces. It protects them from the environment and enemies. However, they will also be found on the upper sides, so check both sides.

Predator insects like lady beetles and lacewing larvae will clean up an aphid infestation quickly but sometimes considerable damage can occur before the problem can be completely resolved. Help the natural predators along by washing the plants off early in the morning with a strong stream of water from the hose. Once the aphids are off the plant, it is difficult for them to return. It may take several treatments at regular intervals to keep the aphids washed off. Remember, they reproduce quickly.

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Another pest that is often prevalent but easy to miss is the tomato russet mite. This mite is not easily seen without magnification. In fact, it is hard for me to see with a ten power hand lens even when I know what I am looking for. They are best seen under a good microscope such as the one that I have in my office. If you think you might have mite problems, bring in a leaf sample and either I or one of our trained volunteers will help you look.

Tomato russet mites are rose-colored, conical-shaped mites with eight legs. They are good at crawling around and finding fresh feeding sites. When their populations explode, they can suck the life right out of a leaf and eventually the plant. The most common symptom of russet mites are leaves that turn yellow, wilt and then turn tan as they die. Some have described the condition as a plant that is “melting.”

Okay, I know that this is not really all that descriptive, but it is the best that I can do in this space. For more information, and photos, take a look at the University of California, Davis integrated pest management website. Just type in tomato russet mite into your browser and you will find a wealth of information on this pest. I like the UC Davis site best. Insecticidal soaps are your best bet for controlling these pests. It is not perfect, but it is the best that we have, in my opinion.

Sometimes tomatoes in local gardens grow beautiful, full vines but do not set fruit until fall. Even then, fruit set will be sparse. A common observation is to see the plant put out lots of flowers but shortly after see the flower abort or drop off the plant before setting fruit. This particular problem may be a result of that particular variety’s sensitivity to desert conditions. If this problem happens to you, consider planting another variety next season.

Finally, protect tomato fruit from sunburn. The harsh sun can quickly burn tender fruit and leave them with yellow or brown spots in the fruit. Place a good nursery shade cloth, or even a layer of burlap, on a frame above the tomato vines. The shade will allow sufficient sunlight into the canopy of leaves to produce the energy necessary for plant growth while screening out the harshest rays.

Tomatoes are a great garden treat at any time of the year. The marvelous taste of fresh garden-ripe tomatoes can finish off that tossed salad or fresh-grilled hamburger. With a little planning and good care, tomatoes can be a great addition to any garden.

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.

This newsletter is available to view on our website at: <http://extension.arizona.edu/pinal>



Richard D. Gibson

Extension Agent, Agriculture

RDG/te/sh/aw

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Have a sick plant or just questions about caring for your plants?



Visit our Plant Diagnosis Clinic held every third Thursday of month from 9:00 to noon at the U of A Cooperative Extension 820 E. Cottonwood Lane, Bldg. C Casa Grande, AZ 85122



Or you may call the Maricopa Agricultural Center at (520) 374-6263 to speak to a Master Gardener.

If you are able to email a picture, please send it with any information you can provide about the plant, and your contact information to the diagnostic team at [macmastergardener@gmail.com](mailto:macmastergardener@gmail.com) and a Master Gardener will contact you.

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