COLLEGE OF AGRICULTURE AND LIFE SCIENCES
COOPERATIVE EXTENSION
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## Garden & Landscape Newsletter

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## WEEDY FIRE HAZARDS

Winter rains bring life to the desert. If we look, we see the effects all around us. The desert plants that just a few months ago looked like they were on the edge of death's door now are in full leaf and looking happy. Some are in full flower. Other signs include the many wildflowers that we have enjoyed throughout the county and the wildlife populations that have rebounded this past year.

The downside of the rains, of course, are the weeds that eventually dry up and leave behind a significant risk of fire. This is especially true of the annual plants, those that germinate, grow, flower, seed and die in one growing season. Perennial plants live for more than one year and can also be a hazard. However, because they retain some moisture even when they are dormant, they do not cause near the problem of the annuals. When these short-lived plants finish their life cycle and die, they completely dry out. This makes them a tremendous fire hazard.

Why are there so many of them? Most weedy plants have the ability to survive under a variety of conditions. These plants typically produce many, many seeds each season. The more seeds they produce, the better chance the species will survive from year to year. With all of these seeds, it is little wonder that a little bit of rain will cause a huge problem.

If we are going to reduce the seed in our soils, there are three things we must do. First, we just simply need to be aware if there are weedy plants growing around our homes. Second, we need a plan of control through which we can keep ahead of the problem. Third, we must execute our plan in a timely manner.

The first step is to find out if weeds have been or will be a problem in the yard or alley. It is essential that all of the grounds be inspected regularly. If the yard is large, it may be important to write down the location of the problem areas so that they are not forgotten.

Check the alley behind the home. Look behind outbuildings, along fence lines and in hidden service areas. Check behind hedges, retaining walls and in nooks and crannies. Weeds can grow just about anywhere. If we not check these hidden areas, we may miss a critical population. If the missed weeds produce seeds that are spread by the wind, our yards can be reinfested without us ever knowing.

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Right now is the time to cut down, rake up, and discard the dried up, withered remains of the winter plants. This will reduce the immediate threat of fire, but it will do nothing to prevent new plants from growing, once the rains come again. For this reason, it is a good idea to make sure that our plan of action includes the steps that we will take to control them once they once again begin to grow. There are several hints to pass along.

First, and foremost, resolve never to let a weed go to seed. One of the easiest ways to prevent future weed problems is to cut down these weedy plants before they shed their seeds. If you can prevent them from producing seed, and stay diligent in the project from year to year, there will be fewer and fewer weeds each year to contend with. If we delay or forget, we just add to the problem.

Second, next November, just before the winter rains come again, lay down a pre-emergent weed killer such as oryzalin or trifluralin. Both of these are common names for products sold at your favorite garden center. Just ask for a pre-emergent and the attendants should be able to help you. Be sure to follow exactly the label directions, all of them, to make sure you get good control. An effective plan will often require a combination of mechanical control, such as cutting or pulling, and the use of herbicides.

Third, if you prefer not to use a herbicide for weed control, a plan will need to take this into consideration. For other alternatives to work properly, however, it is important to know the weeds. Do not worry too much about plant names. Instead, focus on their growth habits. Are they tall and rangy? If so they will probably burn easily when dry. Focus on these first. Do they have a deep taproot, or are they shallow rooted. Are they a grassy weed or a broadleaf? This information will determine the best way to control the weeds, and in some cases the tool that you will use.

Plants with a deep tap root often will regrow from buds in the crown, the place on the stem located closest to the ground, so just cutting them once during a season may not be enough. Little mallow, London rocket, and the sowthistle are all excellent examples of big, rangy winter annuals that can regrow from the crowns. They can also quickly become major fire hazards when they dry out so we need to keep them at bay. Plants with shallower root systems like shepherds purse and the grassy weeds, can also regrow from the crown, but are less of a problem because they usually are easily removed with a quick swipe of a hoe or other sharp blade.

The fastest and easiest way to make quick headway against a large weed population is the standard lawn mower. Another tool useful for quick cleanup is the string trimmer but be sure that you protect the trunks of any trees and shrubs from injury. The high velocity string can rip and shred tender bark tissue. In tight, hard to reach spots, it may be necessary to use a standard garden hoe, a push-pull hoe, or a sharp linoleum knife.

Once you have the standing weeds knocked down and removed, the fire hazard is pretty much eliminated. However, we cannot rest on our laurels. There is the summer rainy season to think about and the winter rains next fall will follow soon after. You need a plan of attack that fits your needs and desires. It also needs to work around the clock and across the calendar. Now is a good time to start building that plan.

## PHOTOSYNTHESIS

Let's take a moment to consider photosynthesis, the simple but critical process that captures sunlight.

Most people are familiar with the chemical reaction that uses energy from the sun to transform carbon dioxide from the air and water from the roots into plant foods. If we are going to keep our favorite plants healthy and strong, we should also know how to look at those same plants with a careful eye to judge just how well they are carrying out this essential function. “Wait, Rick, what did you just say?” I am saying that all of us that care for plants, no matter whether we are doing it for fun or for a living, need to make sure that our plants are carrying out photosynthesis at peak efficiency. How do we do that?

First off, let’s reacquaint ourselves with the parts of the plant and some of the chemistry that is involved. We should also look at the most common obstacles to good energy production and how to recognize them. We will finish up by suggesting a few things that we can do to minimize damage to the energy factories that are so important to plant health.

All living things are composed of tiny structures called cells. They have a wall around them that separates them from their neighbors. Most have a nucleus that contains the genetic makeup that determines plant characteristics and functions, including photosynthesis. Inside the cells are structures that are even more tiny. These are the chloroplasts that contain chlorophyll, the workhorse of photosynthesis. Chlorophyll reflects green-colored light which gives those plant tissues where photosynthesis occurs their typical color. Generally, chlorophyll and chloroplasts are found in the leaves, but some plants like the palo verde have chlorophyll in their green bark.

The primary purpose of chlorophyll is to absorb energy radiated by the sun. As this energy flows through space, it ultimately strikes the leaf and excites the chlorophyll molecule. This extra energy is transported from one chemical reaction to another inside the plant until it is embedded in energy-rich products.

The first reaction in the chain of events is the splitting of water into its component parts, that is, hydrogen and oxygen. Oxygen is a waste product and is shunted out of the plant through tiny holes in the bottom of the leaf, called stomata. Of course, we all know that it is the oxygen in the atmosphere that allow all animals, including you and I, to breathe fresh air. The hydrogen from the water, together with carbon atoms from carbon dioxide, form energy-rich chemicals called simple sugars.

Most plants, governed by their genetics, form three-carbon sugars. Other plants form four-carbon sugars and still others have a completely different photosynthetic process called the Crassulacean Acid Metabolism. Both of these latter alternatives give plants the ability to grow in adverse conditions or climates. Cacti are examples of CAM plants and many of our weedy plants that grow without much rainfall or other water are examples of four-carbon plants. I do not want to get bogged down into too much detail here, but it is important to know that there is a lot of diversity among plants. In most cases, it is this diversity, some of it in the realm of energy production, that give plants a leg up in the face of adversity.

It is important to always remember that the overall success and health of a plant is dependent upon its ability to perform photosynthesis often and well. Any stress or other constraint that limits a plant’s ability to conduct photosynthesis can have a negative effect on the well-being of the plant. The symptoms of low energy can be varied and often confused with other problems but by carefully reflecting upon the condition of the plant, it is often possible to figure out what to do.

Unfortunately, there are many ways that plants run into problems. For example, a plant with a high light requirement, such as most of our dominant landscape and garden plants, that is either planted or germinates under the canopy of an existing tree or shrub can become “shaded out.” Plants short of light often become weak and

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spindly. We also run into this problem when we take an indoor plant with a high light requirement and put it in a location where it receives insufficient light.

Pests can have a huge impact. Insects that feed on leaves, particularly sucking mouthpart insects like aphids and whiteflies, can be a problem. Not only do they steal energy, but they also reduce the amount of chlorophyll present in a leaf. Loss of chlorophyll can limit a plant's ability to create new energy. The feeding of mammals, large and small, can also have significant impact on energy conversion. Other constraints such as dust on the leaves, shortages of key nutrients, salt damage, over enthusiastic pruning, and some plant diseases can also have negative impacts on plants.

One of the easiest problems to diagnose, if not to treat, is when a plant loses all or most of its leaves due to lack of water, cold weather, animal feeding, or poor soil conditions. Without leaves, it will not take long before a plant begins run short of food. The solution is to figure out how to get those leaves to grow back as soon as possible.

Conditions where the essential raw materials for photosynthesis are in short supply can also have negative effects on energy production. One of these is water. Even if we are irrigating correctly, there may be other challenges. For example, if there is damage to the water conducting structures within the plant, water may still be in short supply up in the leaves. The bacterial disease crown gall and the fungal disease Verticillium are common culprits in inefficient water transfer within susceptible plants.

Nitrogen, zinc, and magnesium are nutrients essential either to the creation of chlorophyll or are utilized in the processes associated with photosynthesis. If one or more of these are lacking, trouble can arise so attention to proper plant nutrition is essential.

Allowing dust to remain on the surfaces of leaves, particularly after our heavy dust storms, can shade light and slow photosynthesis. It is a good idea to regularly wash off the leaves of both indoor and outdoor plants so that light can penetrate the leaves.

There are many other factors that can affect photosynthesis, of course, too many to mention here. For this reason, I believe it important to always have in the back of our minds when we are considering the overall condition of a plant the possibility that any factor might negatively affect photosynthesis. It never hurts to at least think about it.

All in all, I suspect that there is no chemical reaction more essential to the survival of all life than the simple transition of carbon dioxide into chemical energy. Because healthy plants require an abundance of energy to carry out their critical life processes, we must ensure that the plants under our care are able to perform this function at peak efficiency.

## Cell Respiration

When is the last time that you took cell respiration into account when you set your irrigation timer, spread on some fertilizer, or pruned your tree?

I can hear in my mind a wide range of likely responses to that question. They range from "Say what again?" to a vigorous "Who cares!" I would submit that we all need to care because it is this series of internal chemical reactions that take the energy captured from the sun and turn it into a form of energy that drives each and every life process within the plant. Without cell respiration, the plant dies. It is as simple as that.

I have to approach this topic carefully because as soon as I start mentioning the key biochemical steps in cell respiration, such as glycolysis, the citric acid cycle, and oxidative phosphorylation; I may lose your focus really quick. Yet, it is these key steps that get the job done. Let's see if we can work our way through the various processes and then visit about how we can protect them.

We all know that it is the energy of the sun, captured by photosynthesis, that provides all of the power to operate the various life functions of living organisms, both plant and animal. Photosynthesis turns the radiant energy of the sun into chemical energy in the form of simple sugars. It is cell respiration that begins the process of putting this captured energy to work.

After photosynthesis is complete, the plant moves the newly manufactured chemical energy around and stores it for eventual use in cells throughout the plant. It is important to remember that cell respiration can occur in any cell, not just in the leaves. Because sugars are stored throughout the plant, there tends to develop a balance of energy between the top of the plant and the bottom of the plant. This is a good thing because a plant out of balance energy wise is going to be a plant that does not do well. It is often slow growing, stunted, discolored, and unproductive.

As a rule, energy is just as important for annual plants as it is for perennial plants. Annuals are those that germinate, do their thing, and die within one year. As such, they use energy like there is no tomorrow. That is truly the case because, for them, there really is no tomorrow. For plants that live for more than one year, it is essential for good health that they store a supply of energy that is well balanced between the parts of the plant that are above ground and the roots.

What happens to the sugars in the cells? Well, that is where it all gets really interesting. It is important to understand that there are several chemical forms of these sugars but the end product of photosynthesis is most commonly a three-carbon sugar called glucose. The first step in the use of the energy is to break down this glucose into more simpler forms. This is called "glycolysis" by biological chemists.

Other major steps in the process include the citric acid cycle and a system called oxidative phosphorylation. The bottom line to know is that energy is released during each of these steps and that this energy is used by the plant to drive its many functions. The formation of beautiful flowers on a rose bush comes after the expense of energy. Good production of tasty oranges, apples, or apricots on healthy trees requires the use of energy. Lush and plump lettuce leaves for our salad come after an expenditure of energy. If we want our plants to look good and produce at their peak efficiency, there has to be sufficient energy in the plant to drive all of the processes. Again, this energy comes from cell respiration.

The final piece of information needed to understand the importance of respiration in cells, is the relationship between the adenosine-phosphate molecules. When sugar is split and the process of energy extraction is underway, the energy is stored in these molecules. Without boring you with details, it is important to know that there are two main players in this game. These are adenosine diphosphate and adenosine triphosphate, or ADP and ATP for short.

In the diphosphate form, there are two phosphorus atoms attached to the adenosine molecule and in the triphosphate

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## CELL RESPIRATION - CONTINUED FROM PAGE 5

form there are three. When energy is released during the cell respiration process, ADP accepts energy and attaches a free phosphorus atom to form ATP. When energy is needed for some reaction or another, the plant splits off the extra phosphorus from ATP and puts to work the energy that is given off. This transition between ADP and ATP happens all the time back and forth in healthy plants.

Since energy is constantly expended inside the plant, there must be a continuous supply of energy coming into the plant to keep it healthy. Without constant photosynthesis and respiration, the plant will soon run out of energy and begin the slow, and sometimes not so slow, decent towards death.

What is the final payoff in this extraction of energy? Quite impressive, actually. It takes two ATP molecules to start cell respiration but the entire process produces up to 34 ATP. The net total yield then is either 30 or 32 ATP, depending upon the process. Don't we wish all of our investments would yield that kind of return?

Understanding these processes helps us realize just how important the combination of photosynthesis and cell respiration is to our garden and landscape plants. A healthy, green, and vibrant plant is a smoothly working factory that churns out energy at impressive rates. Recognizing this, it is easy to see the importance of giving plants the right care.

Water comes to mind first. A plant must have water to transport the energy from place to place in the plant. It also uses water to keep the individual cells plump and full; this is essential for peak efficiency. It is also water that moves essential nutrients, plant hormones, and other raw materials that are used in the manufacturing processes. Correct irrigation and plant hydration go a long ways in helping plants create, store, and use energy.

Proper nutrition is also important. We have already seen how important phosphorus is to the energy equation. In addition to this critical element, a proper balance of nitrogen, potassium, and all of the other essential nutrients within the plant is required. Attention to soil fertility will pay dividends.

Finally, pest control will also support good energy production. Insects and vertebrate pests can greatly affect the amount of energy in the plant. Frequent and uncontrolled feeding removes not only the structures required for energy production but also the basic materials needed. This is particularly true of those insects with sucking mouthparts like aphids and whiteflies, but the feeding of chewing insects can also have an impact. Those who constantly see feeding damage from ground squirrels, rabbits, and other vertebrate animals on their plants will also see the importance of this discussion.

All in all, proper plant care will work wonders in maximizing cell respiration and the resulting extraction of energy within our garden and landscape plants. The ultimate result will be spectacular looking and productive plants.

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## Attracting Pollinators to the Garden

Pollinator insects and other animals play a key role in the successful production of fruits and vegetables. Sometimes the choices that we make, what we ourselves choose to do in our own gardens, can influence the impact of pollinators in either a positive way or a negative way.

In the plant world, the distribution of pollen is a critical step in the life cycle of most plants. Produced in the anthers, the male portion of the flower, pollen has to successfully make the journey to the stigma of the female part of the plant as the first step in the pollination process. Sometimes wind can carry the pollen to the right location, but sometimes the pollen needs a little help from insects or small mammals. Animals that help in the pollination process are called pollinators.

This outside assistance by another living thing is absolutely critical to the long term viability of many plant species. Without this help, the plant would not be able to reproduce as efficiently as needed. For some plants, they would not be able to reproduce at all.

Because pollination is so important, as gardeners we should be really focused on making sure that our most susceptible plants have the assistance they need. Some plants are more at risk than others. Pecans are completely wind pollinated so those who grow and harvest pecans do not need to worry about pollinators to get a good nut crop. However, for those growing cantaloupes or watermelon, the help of pollinators is absolutely critical. "Why is that," you ask?

Squashes and melons all have two different sets of flowers. In one location are the male flowers, they usually are quite showy and colorful to attract pollinators. The insects, usually some type of bee, crawls into the flower to harvest nectar. In the process, they pick up pollen on their feet and on the tiny hairs on their body. Then, crawling around, they brush up against the female flowers, which are located on another part of the plant, and fertilize the flower. Wind is of no use in these types of plants. It has to be done by a pollinator.

Another example is the saguaro and bats. At night, the flowers of the saguaro cactus are pollinated by the lesser long-nosed bat and the Mexican long-tongued bat. However, the cactus leaves nothing to chance. Pollination can also take place during the daytime with the assistance of bees and birds, such as the white-winged dove.

Some plants, like citrus, can benefit from both wind and pollinator-assisted movement of pollen. Some wind pollination does indeed occur within flowers of the citrus tree, and many other types of plants for sure, but the fruit tree always seems to produce more fruit when pollen from other flowers happens to fertilize a given flower. If you have watched a citrus tree during flowering in the spring, you may have been impressed with the impressive level of bee activity, sometimes so much so that the humming of these insects becomes almost like a symphony. The tree does much better for their attention.

Still other plants require pollen from a similar species but perhaps a different variety for best results. In the desert, apples are a good example. The 'Anna' apple fruits better when it is pollinated with pollen from another variety, like 'Golden Dorsett." How does the pollen get from the Dorsett to the Anna? You guessed it, with the help of pollinators.

These are just a few examples. We could visit for quite a while about additional plants that are equally dependent upon pollinators. The point is, plants need them, and we do too. "So, how do we encourage pollinator activity in our gardens and landscapes?" That is a good question.

Pollinators are attracted to plants because they know that they can find what they are looking for, generally food or protection. If we want to attract them to our gardens and landscapes, we need to provide one or the other of these two basic needs.

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## POLLINATORS . . . CONTINUED FROM PAGE 7


Mexican honeysuckle (University of Arizona)

Mexican honeysuckle, *Justica spicigera*, is a good example. Bees are attracted to the plant, as are hummingbirds. As these pollinators travel from plant to plant going about their business, they do the plant a great favor by moving pollen from one location to another. One key then is to select plants that attract pollinators and place them strategically in places where the animals can find them.


Fairy duster (Univ of Arizona)

Other plants that attract hummingbirds include fairy duster, *Callindra eriophylla*, rose globe mallow, *Spheraloea ambigua*, the chaste tree, *Vitex agnus-castus*, spotted manfreda, *Manfreda maculosa*, herba de venado, *Porophyllum gracile*. Flitting from flower to flower, you can just imagine how important these birds are for pollination, particularly for plants that have long, tubular-shaped flowers, like *Penstemon* and the ocotillo, that shield the critical flower parts from the wind.


Desert willow (AZ State University)

Plants that attract bees and other insect pollinators include most any plant with a showy flower. Some of those would include the many species of cacti, fairy duster, primrose, *Oenothera macrocarpa*, yarrow, *Yarrow millefolium*, Parish's goldeneye, *Viguiera parishii*, desert willow, *Chilopsis linearis*, and many others. If anyone would like to see these plants up close and personal, and many others, you will find them in the Pollinator Garden at the Pima County Cooperative Extension office in Tucson. Managed by the Master Gardeners, it is always a place I like to visit. The Pima office can be found at 4210 N. Campbell Avenue, Tucson, 85719.

Once pollinators are attracted to a garden or a landscape, it is important to make sure that they are not harmed or discouraged in any way. It is absolutely essential to not spray any insecticide or other material that might harm bee, wasp, or beetle pollinators during the flowering period. Some may be anxious to spray "something" to minimize thrips damage to citrus leaves never considering the bees working the flowers may be at risk. This of course, would be a classic example because few if any insecticides will solve a thrips problem in citrus but most insecticides will expose the pollinators to great risk.

There are many, many examples of these kinds of situations. In fact the labels of most insecticides will include a clause about not applying the material on plants at times when pollinators are active. It is extremely important that those warnings on the product label be heeded in order to protect the pollinators. The warnings are there for a purpose.

Pollinators are absolutely essential to the long term productivity of many of our garden and landscape plants. As we come to understand the importance of pollinators in our gardens and landscapes, we will also come to understand the importance of both attracting them and protecting them.

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 and a Master Gardener will contact you.

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