



The Virtual Gardener —Autumn Leaves

Did you know that those of us who live in Sierra Vista or are within view of Miller Peak have a visual seasonal barometer to tell us when spring and fall are arriving? The “barometer” is a stand of quaking aspen trees high up on the north slope of Miller Peak. The splash of bright, virgin green in the spring tells us that warm weather is not far away, and the flash of brilliant yellow in the early fall signals that cooler weather is on the way.

Quaking aspens, *Populus tremuloides*, are named for the shimmering aspect of their leaves in even the slightest breeze. This is caused by the unique airfoil shape of the stems of the leaves (petioles) which cause the leaves to oscillate in the wind. Another distinguishing characteristic of the aspens is the brilliant yellow color of their leaves in the fall. And that brings us to the topic for this article. Why do leaves change color in the fall?

Scientists have understood for a long time the reasons why leaves change their colors to yellow and orange in the fall. The pigment that causes the leaves to appear yellow is the same pigment that gives egg yolks their color, xanthophyll. The orange color comes from a pigment,

appropriately known as carotene, which gives carrots their color. These pigments are present in the leaves all summer long and assist in extracting the maximum energy from sunlight, but their colors are masked by the green pigment of chlorophyll. Think of chlorophyll as green paint on a brown or yellow surface.

Chlorophyll is the component that allows plants to convert sunlight into the energy used to drive the chemical reactions they need to grow. During the summer, chlorophyll continually deteriorates and needs to be constantly replaced, in effect “repainting” leaves with green pigment over and over again. But in the fall, as plants prepare to rest for the winter, chlorophyll production slows and finally stops. As the green “paint” disappears, the yellow and orange shades underneath become visible.

The red and purple colors are caused by other pigments called anthocyanins which, unlike the yellow and orange pigments, are not present all summer long but are synthesized in the leaves during the fall. The function of anthocyanins is controversial.

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According to the traditional view, anthocyanins are created from sugars that are trapped in the leaves during the fall. Throughout the warm summer months, the sugars move throughout the plant to provide the energy for growth. When nighttime temperatures drop in the fall, cells in an area called the abscission layer develop at the base of the leaves cutting off circulation to the leaves. Sugars still being produced in the leaves at this time accumulate there and chemically change into anthocyanins, giving the leaves their red and purple colors, or so the story goes.

Some scientists postulate that the anthocyanins are a form of sunscreen for the plant. Others believe they play a role in protecting the leaves from insects. According to yet another theory the anthocyanins are produced to protect the photosynthetic cells as the chlorophyll begins to break down in the cooler weather, thus prolonging their production of sugars and coloring the leaves. These explanations are great as far as they go, but other still puzzling questions remain. Why are the colors more spectacular in some years than in others? And why are the fall colors in some areas more brilliant than in other areas?

According to the [US National Arboretum](#), weather conditions throughout the growing season and especially the fall influence the nature of the fall colors. The amount of sunlight and temperatures during the period when the abscission layer is forming at the base of the leaf petiole control the rate at which chlorophyll is destroyed. Cooler nighttime temperatures combined with abundant sunlight during the days promote the production of anthocyanins. The Arboretum webpage sums up

the topic by stating, “a growing season with ample moisture that is followed by a rather dry, cool, sunny autumn that is marked by warm days and cool but frostless nights provides the best weather conditions for development of the brightest fall colors.”

But what about the second question? Why are some areas especially noted for producing brilliant fall colors? Obviously the types and relative proportions of the different types of trees in an area is the most important variable, but even areas with similar types of trees may differ. Why?

Two scientists at the University of North Carolina-Charlotte, Emily Habink and Martha Eppes, suggested the answer in a [presentation](#) to the Geological Society of America. Their explanation nicely dovetails with the sunscreen theory and provides a clue as to why some areas perennially have more brilliant fall colors than others. The authors of the presentation observed that nutrient-poor soils—especially soils low in nitrogen—cause trees to produce more anthocyanins and therefore display more brilliant colors. Thus the production of anthocyanins would appear to be a survival mechanism designed to extract the maximum nutrition from poor soils as the temperatures drop and the trees prepare for the cold winter ahead.

If you would like to learn more about autumn leaves, check out the links in the paragraphs above or, for a more technical discussion, visit [On the Hidden Colors in Leaves: What are the Functions of Those Yellow and Orange Pigments We See in the Fall?](#) from Appalachian State University.

Until next time, happy surfing!

Gary Gruenhagen, Master Gardener
virtualgardener@cox.net



I Give Up! The Sun Has Won!

I was sitting on my porch a couple of weeks ago, gazing out at my fall garden when I suddenly came to a profound conclusion. I have fought the sun for 5 summers now, and every summer I have lost the fight. When I first envisioned my patio and gardens, I saw a lovely profusion of colorful flowers blooming in the bright sun under the cobalt blue Arizona sky. So I bought annuals to fill my pots, vincas, and petunias, and allium to trail over the edges. And then I watered, and watered, and watered some more. I bought a water harvesting tank, and I installed drip irrigation, and I watered some more. My flowers shriveled up and died. Oh, some years, during a really wet monsoon, they did pretty well, but mostly they died.

So I'm looking at my fall garden now. The horrible, unending heat of summer has slacked off and the puny leftover flowers will probably last until Thanksgiving if I'm lucky. But you know what looks good? The cactus and the succulents and the agaves and yucca and salvia all look great. They looked great all summer and they'll look great all winter. I officially give up! I can have my little patch of flowers and bulbs under the dappled shade of the mesquite tree. But I am planting sturdy natives in the bright, hot sun under that cobalt blue sky, and if I have to clip the pointy tips off the agave so I don't spear myself when I walk by, well I think that's a small price to pay. I am going native and I'm not looking back. So take THAT, you Arizona sun! I give up! You win.

Kris Williams, RPh, Master Gardener

Discovery Gardens Grand Opening — It Happened!

The weather was gorgeous. The people were wonderful—a classic, friendly, warm Sierra Vista crowd. More than 200 folks arrived at the Grand Opening of the Discovery Gardens at UA Sierra Vista on October 14 to help celebrate the presentation of Sierra Vista's first community educational demonstration garden.

After 2 years of planning, building, planting, installing structures, fertilizing, mulching, clipping, deadheading, and planting some more, we finally brought the Discovery Gardens to enough maturity to offer them to the public!

The gates opened at 10:00 AM. The Sierra Vista Chamber of Commerce Ambassadors were there to perform their classic, celebratory Ribbon Cutting ceremony for us, followed by a grateful, heart-felt speech by Mayor Rick Mueller about the Discovery Gardens and about the history of the Cochise County Master Gardener involvement in our community over the past three decades.

Mike Boardman, President of the UA South Foundation, then followed with a talk to welcome the Gardens' opening, and about the Foundation's plans to support and be involved with the Discovery Gardens. The Foundation plans to provide a new wrought iron fence around the Gardens' borders.

Many of our Master Gardeners were on hand to help with the day's festivities which included live music, rock painting, gold panning, seed planting, and food! Cal Kelley kept the hot dogs cooking for everyone on our new outdoor kitchen grill in the Discovery Pavilion. All the activities kept rolling with the help of Mas-

ter Gardeners Linda Lawson, Sheila DeVoe Heidman, Gigi Haynes, Ed Faux, Mark Woods, Jody Sharp Webb, Scott Culp, Elizabeth Riordon, JoAnne Ehasz, Kris Williams, Nadine Parkhurst, and Evie Van de Bogart.

We even had some fabulous members of the Sierra Vista Area Gardeners Club come help us! Carol Sulzbach, Jane Hartling, and Kunie Kummer spent the entire day at the Discovery Gardens, working like engines! Mark Apel from Cooperative Extension gave his Saturday morning to run the seed planting table. We are hugely grateful to everybody for the multitude of help.

There is another special handful of Master Gardeners who have come to the Discovery Gardens on a regular basis for our weekly Wednesday work days. They have helped plant, clean, install, and build the Discovery Gardens all along the way. A warm thank you to Mark Grams, Gisa Krueger, BJ Searcy, Jody Sharp Webb, Ed Faux, Sheila DeVoe Heidman, Jolene McGowen, Mark Woods, and Linda Lawson for being there week after week, giving their time and talents.

Most importantly, we are grateful to all the folks who came to the Discovery Gardens on October 14 to help celebrate the Grand Opening. It seems the word "grateful" has been used frequently here, but that's what we are. Grateful for all the help. And grateful for the wonderful opportunity to have been able to create and develop the Discovery Gardens for our community. Please come visit the Gardens. Visit often for interest, inspiration, or simply a quiet stroll.

*Jan Groth, Master Gardener
Program Coordinator*

Cuttings 'N' Clippings

✿ For CCMGA information contact Valerie at:

valeriedavidson@email.arizona.edu
or the Cochise County Master Gardeners web site at:

<http://cals.arizona.edu/cochise/mg/>

✿ Water Wise will sponsor a free Septic Care Workshop on **Saturday, November 4, 9:00 AM—Noon**. Come and learn how to take good care of your septic system. Location is the University of Arizona Sierra Vista. For information contact: 458-8278, Ext. 2141 or

valeriedavidson@email.arizona.edu

Check out the Water Wise web site for their 2017 schedule at:

<http://waterwise.arizona.edu/>

✿ Remember **every Wednesday, 10:00 AM—1:00 PM** plant clinic and seed library in the UA Sierra Vista Discovery Gardens Pavilion. Everyone welcome!

✿ AZ Native Plant Society Meeting, **Friday, November 17, 5:00 PM**, Cochise County Community Development Office, 4001 E. Foothills Drive, (Corner of Highway 92 and E. Foothill Drive) Sierra Vista.

Speaker and Topic: Ron Coleman Native Orchid Botanist. *The Cypripedium (Lady Slipper) Orchids of North America*. Ron's presentation,



Pink Lady Slipper

illustrated with his beautiful photographs, will provide a succinct summary of all the *Cypripedium*

orchid species occurring in the United States and Canada. For more information, follow AZ Native Plant Society on their web site:

<http://www.aznps.com/chapters/cochise/cochise.htm>

Organic Farming—Part III

In 2008 ([March](#) and [April](#)), I wrote two articles in this newsletter about the history of organic farming in the U. S. and the state of organic farming in Arizona². In this article, I'd like to update you on the evolution of aspects of the National Organic Program since 2008, and tell you about organic farming in the United States and Arizona in 2016. But just by way of review, the federal government says that:

The National Organic Program (NOP), part of USDA's Agricultural Marketing Service (AMS), has regulatory oversight responsibilities over the USDA organic standards and the accreditation of organic certifying agents. The NOP also has authority to take appropriate legal action to enforce the organic standards and thus protect the integrity of the USDA organic standards, from farm to market, around the world.³

One of the criticisms of the NOP was that so much of it was based on trust. Organic inspectors are usually at a farm only once a year to do an annual inspection required by federal rules. Inspectors dutifully report what organic producers say about how they farm. In the past, organic inspectors did not ask for forensic tests of organic products or inputs unless there was unmistakable evidence of an effort to trick the inspector. In short, almost no forensic investigations occurred. It was easy to hide cheating.

This very issue was the subject, among other things, of a 2010 U.S. Department of Agriculture Office of Inspector General Investigation (OIG) of the NOP. The OIG stated in the executive summary of the investigation report:

. . . [We] believe that NOP officials need to . . . improve program administration and strengthen . . . management controls to ensure more effective enforcement of program requirements when serious violations, including operations that market product[s] as organic while under suspension [!], are found. In addition, they need to strengthen their oversight of certifying agents and organic operations to ensure that organic products are consistently and uniformly meeting NOP standards

We found that NOP officials need to improve their enforcement of program regulations and their resolution of complaints, as noted in our prior report. NOP officials did not have adequate procedures or a system for tracking the receipt, review, and disposition of complaints and any subsequent enforcement actions⁴.

The investigators further said that although the Organic Food Production Act of 1990 requires certifying agents to conduct periodic testing of organic products, NOP officials did not incorporate testing provisions of the law into NOP regulations. None of the four certifying agents that the investigators visited were conducting



periodic residue testing of the nearly 5,000 operations for which they were responsible⁵.

The inspectors made several recommendations in their report. Among these were that NOP officials develop and implement procedures for monitoring organic operations' compliance with enforcement actions once the new procedures were issued⁶. They also recommended that the NOP regulations clarify the authority of the NOP director to issue civil penalties⁷. Fraudsters were selling products labeled organic without any consequence. This is what made so many skeptical of the logo that announced "USDA certified organic."

Now, as a result of the OIG report, each year a USDA-accredited certifying agent must verify that every organic operation they certify is complying with the USDA NOP regulations. This includes on-site inspections, both announced and unannounced. And at least five percent of an organic operations' products must be tested for residues of prohibited substances⁸.

In the past, small buyers, like us, didn't have any way of really as-

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¹Terrie is a Master Gardener and used to be a certified organic crop inspector.

²Organic Farming Part I at: <https://cals.arizona.edu/cochise/mg/sites/cals.arizona.edu.cochise.mg/files/newsletter/Mar08.pdf#page=3>

³Organic Farming Part II at: <https://cals.arizona.edu/cochise/mg/sites/cals.arizona.edu.cochise.mg/files/newsletter/Apr08.pdf#page=3>

<https://www.ams.usda.gov/publications/content/about-national-organic-program>. To learn about ongoing efforts to improve the NOP please read: <https://www.ams.usda.gov/reports/2016-peer-review-ams-national-organic-program>.

⁴U.S. Department of Agriculture, Office of Inspector General, Oversight of the National Organic Program, Audit Report 01601-03-Hy, March 2010. Id., at 2.

⁵Id., at 2. ⁶Id., at 12. ⁷Id., at 11.

⁸Organic Enforcement at <https://www.ams.usda.gov/services/enforcement/organic/>

Is That Camphorweed I Smell?

Camphorweed, *Heterotheca subaxillaris*, is one of those native plants with a misleading common name, if you want to accept the botanical definition of “weed” as “non-native plant.” It certainly has a weedy habit of growing in disturbed places and spreading quickly. And controlling it by pulling it



up by its taproot, if you are lucky enough to catch it under conditions that make it vulnerable (*i.e.* after a soaking rain), results in hands or gloves coated with a sticky secretion that attracts dirt and is resistant to soap.

Classified in the *Asteraceae* family, Camphorweed has yellow disc and ray flowers with a combined width of about 2 cm. The plant is annual or biennial, flowering from July to October. Stems may be single or multiple, the latter growth habit encouraged by mowing after the first year. Leaves are alternate

and broadly lanceolate, 4 – 6 cm long, the older ones clasp the stems. Under ideal conditions the plant may reach a height of 160 cm or more, and does well in our area with no supplemental water. It is native to the lower two thirds of the United States, as well as Mexico and Belize, at 300 to 1,650 m elevations. To complicate matters, it hybridizes with *Heterotheca grandiflora*, a species endemic to CA until recently, when it made its way to AZ, NV, and UT. *H. grandiflora*'s common name is Telegraph Weed. Theories about the reason for this designation include: it's up to 2 m tall, single stem, reminiscent of a telegraph pole; the habit of growing in lines along road ruts or drainage ditches; and its odor, suggestive of the insect repellent coating used on wooden utility poles.

Mature Camphorweed achenes originating from disc flowers can germinate immediately if conditions are appropriate. In contrast, achenes produced by ray flowers must be exposed to high temperatures following a period of dormancy in order to sprout. This dual set of germination requirements, along with the seeds' use of wind for dispersal, provide temporal and spatial flexibility for seedling establishment.

Both species produce a large variety of volatile compounds which protect the plants from attack by animals, including domestic grazers. A species of assassin bug in the genus *Apiomeris* harvests droplets of exudate from glandular hairs on leaves and stems to attach to its eggs for protection from consumption by



other insects. One study showed allelopathy (chemical inhibition of one plant species by another), which is fairly common among plants, but the inhibited plants in the study were a non-native grass and table lettuce, which brings up a variety of questions.

Sesquiterpenoids, one group of compounds produced by Camphorweed, are antibacterial and fungicidal, making them effective antiseptics. A tincture or salve prepared from the leaves, stems and flowers of Camphorweed has proven to relieve pain when topically applied to minor strains or hyperextensions.

Camphorweed appears in two books in the Cochise County Herbarium about weeds in our area, *An Illustrated Guide to Arizona Weeds* by Kittie Parker and *Weeds of the West* published by the Western Society of Weed Science. The contributors to this book define “weed” as “a plant that interferes with management objectives for a given area of land at a given point in time” inviting open interpretation.

Karen LeMay, Director of Pollinator Corridors Southwest,

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(Organic Farming continued from page 4)

sessing whether certified organic producers were truthful about their practices. The large corporations who sold products with organic inputs (e.g. organic baby food makers) would have to test inputs themselves to make sure they didn't contain prohibited substances for which they could be held responsible. Now every producer is tested by their certifier and the results are available for NOP reviewers and others.

What if "organic" producers cheat today? Continued next month!

Terrie Gent¹, Master Gardener

(Camphorweed continued from page 5)

www.PoCoSouthwest.org observed a variety of beetles and bee flies on Camphorweed flowers in an area of her yard that receives no supplemental water and decided to leave the plants in the company of tall, native grasses. In addition, the plant is host to a species of *Cucullia* caterpillars which mature into hooded owlet moths.

Whether you decide to allow Camphorweed to gain a foothold in your garden depends on your "management objectives." Keep in mind the concept of the species as part of a natural community, with relationships with a multitude of insects which in turn, have ties to other fauna and flora.

*Virginia Bealer, Guest Author
Herbarium volunteer
Photos: Virginia Bealer*

SAVE THESE DATES!

Sustainable Agriculture Producers' Forum
Wednesday, December 13, 2017 at Cochise College Benson Center, Benson, AZ.

Topics may include: production and certification, specialty crops, direct-marketing, grass-fed meat production, integrated pest management, and more!

Sponsored by
University of Arizona Cochise County
Cooperative Extension

For information:

Cochise County Cooperative Extension

The 25th Annual Master Gardener High Desert Gardening & Landscaping Conference will be held Thursday-Friday-Saturday, **March 15, 16, & 17, 2018**, in the Student Union Building of Cochise College, Sierra Vista.

Saturday, April 21. The 4th Annual Master Gardener Spring Plant Sale will run in conjunction with the 2nd UA Family Day on UA Sierra Vista campus, sponsored by the Cooperative Extension family and Water Wise.

Watch for details on the Master Gardener Web site: www.cals.arizona.edu/cochise/mg/

Colorful Cochise County!

Have you visited the Facebook page Cochise County and Its Wonders? If not, check out the beautiful pictures of our County posted by our friends and neighbors! You can find it [here!](#)

November Reminders

- ◆ This is a good time to install a drip system
- ◆ Replace summer mulch with fresh mulch
- ◆ Start a winter herb garden
- ◆ Protect plants from frost

Cochise County Master Gardener Newsletter Editor
Carolyn Gruenhagen

On this date . . .

November 9, 1990 a group of Cochise County Master Gardeners toured fascinating Biosphere II located north of Tucson, AZ. Read all about Biosphere II [here](#),

