

# From the Ground Up

A Gardening and Native Plants Quarterly

Colorado State University Extension-Pueblo County

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## FABULOUS FAMILIES

### FERNS

by Ed Roland, Native Plant Master, 2009

Most ferns inhabit cool, moist canyons in this part of Colorado, but their habitats range from arid deserts to north of the Arctic Circle. They can be found as epiphytes ("air plants" without a true root system) in the canopy of a tropical rain forest, or as tiny water-borne species in salt-water lagoons. Tree ferns, reaching over 80 feet into the air with 15-foot fronds, grow into dense thickets in many tropical habitats.

With fossils dating back to the Devonian (c. 400 MYA), ferns are viewed by paleobotanists as critical pioneer species in the development of our modern ecologies. For example, the fossil record shows that ferns dominated for millions of years after an estimated 6-mile diameter asteroid impacted the earth (at the end of the Cretaceous about 65 million years ago), making it impossible for most seed-bearing plants to survive. Long before that, ferns were so prevalent that they are the primary components of our coal deposits.

While some species of ferns in lower elevations take on a morphology more akin to a grass or clover, what I'm describing here are the "true ferns" we're more likely to encounter in our higher elevation mountain drainages. These ferns have the compound leaves we call "fronds." Fronds are typically dissected into "pinnae" and, if bi-pinnately compound, then "pinnules." (See Photo A.)

With an estimated 12,000 plus species world-wide, the vast majority of which are true ferns in the phylum (or, for botanists, "division") Filicinophyta, ferns are by far the most diverse of the seedless plants.

Unfortunately, dichotomous identification keys can lead to botanical confusion, generally grouping them with the other seedless vascular plants under "Ferns and Their Allies." Most, like Weber's Colorado Flora - Eastern Slope, mix true ferns with horsetails, whisk ferns, and club mosses (aka the "allies"), which are now often classified in separate phyla in their own right, and then leave it up to the intrepid botanist to key them out into separate families, genera and species. The classification of vascular seedless plants has been, and still is, in a state of flux. Some current resources put true ferns in their own phylum, Filicinophyta (or alternatively, Pteridophyta), and give each of the "allies" their own phylum as well.

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Photo A: Section of a bi-pinnately compound Male Fern (*Dryopteris filix-mas*) frond showing A: a pinna (pl. pinnae), and B: a pinnule (pl. pinnules). Photo from Filnorewoods Community Garden blog

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Unlike angiosperms, which produce seeds in flowers, fern spores develop in specialized organs called sporangia, which are located in clusters called sori (singular is sorus) on the underside of the fronds. (See Photo B.) Spores are similar to seeds in that they contain the necessary genes to take root and grow into a modified form when they are ejected to soil. However, unlike most seeds, they have only the DNA of the mother plant, and they contain no endosperm -- the package of starch that nourishes an incipient plant emerging from a seed until photosynthesis can take over.

The sori often have a membrane -- an extension of the plant's epidermis -- covering them called an indusium. The shape and arrangement of the pinnae (and pinnules, if applicable), the way the sori are organized, and the appearance of the indusia (if present), are usually enough to identify a true fern to species. Be sure to bring your lens along when you plan to i.d. ferns.

What all of the true ferns have in common is the need for liquid water to execute their reproductive cycle, which is why we find many species in moisture-laden environments. Spores are ejected from their protective clusters, and -- unlike angiosperms -- fertilization takes place after separation from the parent plant.

Without the advantage of flowers, water is essential for the sperm to swim to the egg. When a spore finds the soil, it grows into a small (usually less than 1/4-inch or so), heart-shaped intermediate form called a "prothallus" (plural is prothalli), which then produces both eggs and sperm. Since the sperm are almost always restricted (chemically or by differing maturities) from fertilizing their "sister eggs," they must set out on a journey to find another prothallus, often produced by a separate parent plant. (See photo C.)

There are no insects, birds or even breezes to aid in this process, but many ferns have a major advantage: they can also reproduce asexually by generating tiny "plantlets" that fall to the earth to take root and grow up with the same diploid DNA as the mother plant. Other reproductive strategies include the generation of rhizomes or stolons that give rise to communities of clones. In fact, ferns are almost as diverse in the ways they can reproduce as they are in their morphologies.

This menu of reproductive strategies is very likely a factor in the persistence, diversity and proliferation of ferns world-wide.

As noted above, in our area true ferns are usually located in moist canyons or other drainages. As is typical of the botanically-diverse Wet Mountains, I've found a good representation including the relatively rare Male Fern (*Dryopteris filix-mas*) and Lady Fern (*Athyrium filix-femina*), as well as the much more common Fragile Fern (*Cystopteris fragilis*), and Wood Fern (*Woodsia oregana*).

From my perspective, ferns are incredibly important components of our local mountain habitats. Like the fresh-water organisms in the streams and seeps near which they are usually located, their persistence is a positive sign that they are part of a healthy, viable ecosystem. 🌿



Photo B (above): Sori (sing. sorus) on the underside of a pinna. Round sporangia in which the spores develop are clearly shown, as are the crescent-shaped indusia (sing. indusium) covering each sorus. Photo courtesy of the WNMU Dale A. Zimmerman Herbarium

Photo C: The prothallus on the left is shown before fertilization. New ferns are emerging from fertilized prothalli on the right. The prothalli can easily be seen with the naked eye, but are often overlooked because they resemble moss. Prothallus photo used with permission of UW-Stevens Point Biology 103

For the details on fern reproduction, see texts such as [Introductory Plant Biology](#) by Kingsley Stern, now in its 13th edition (2013, McGraw-Hill).







## KNOW YOUR NATIVES

### **LOCOWEED: NATIVE OR WICKED? YOU DECIDE!**

by Orla O'Callaghan, Colorado Master Gardener, 2005, Native Plant Master, 2009

#### **Part 1: A Native Plant for Native Landscapes**

Locoweed is a common name given to some 300 species of the genera *Oxytropis* and *Astragalus* that produce a toxic alkaloid, swainsonine. The common name locoweed is derived from “loco” the Spanish word for crazy, because locoweeds are toxic to livestock and can cause them to act crazy (for more on the wicked aspects of locoweed, see Wicked Weeds on page 7).

Locoweed is a perennial native in the Fabaceae (Pea) family. The fruit is a green upward facing legume (pea pod) that becomes brown with age. Flower color ranges from purple and pink to white and yellow. The flower is papilionaceous (shaped like a butterfly), with five petals. The upper petal is called a banner. There are two wings, one petal on each side. The last two petals fuse to form the lower petals called the keel. The keel extends into a sharp upright point. It often encloses the pistil (female reproductive organ) and the stamen (male reproductive organ). The ovary is superior (above the petals). Flowers form on a raceme (elongated flower cluster with stalked flowers along a main axis) on multiple leafless stems. The flower is contained in a pinkish calyx of sepals that is covered with silvery hairs. Leaves are pinnately compound (divided into 9-19 leaflets), alternate (leave on each side of the stalk), and basal (at ground level). The leaflets are lanceolate (shaped like a lance) to linear (flat and narrow with parallel veins). The leaves are covered in silvery hairs that attach in the middle of the hair (like a teeter totter).



*Oxytropis lambertii*, drawing by N. L. Britton and A. Brown, 1913. Courtesy of USDA Plant Database, <http://plants.usda.gov>.

Locoweeds are native plants in Colorado. I can't describe all 300 species of locoweeds, so I will focus on the two species that are commonly found in Pueblo County, namely, *Oxytropis lambertii* (Purple locoweed, Colorado Loco or Lambert Loco) and *Oxytropis sericea* (White locoweed, Rocky Mountain Locoweed or Silky Locoweed). Identification of locoweed species can be complicated by hybridization. Purple locoweed and white locoweed easily hybridize through cross pollination. Cross breeding produces plants that range in color from white to pink or purple, and can make proper identification more difficult. But if you just want to add wonderfully adapted natives to your garden, an exact identification is not crucial. Pick a color you like, and know it may change with cross-pollination. How exciting.



*Oxytropis lambertii* (Purple locoweed). Photos courtesy of Ernie Marx, Eastern Colorado Wildflowers, <http://easterncoloradowildflowers.com/>



#### ***Oxytropis lambertii* – Purple Locoweed**

*Oxytropis lambertii* is pronounced OX-ZI-tro-pis lam-BUR-tee-eye. The scientific name comes from the Greek words “oxys” which means sharp, refers to the sour tasting leaves, and “tropis” which means keel.

**Description:** Purple locoweed grows on the plains and foothills at elevations between 4,500' and 10,000'. The plant grows up to a height of 16" and a width of 12" and forms in tufts or clumps. The flowers range in color from purple, reddish purple, to magenta, and rarely white. The fragrant flowers bloom early to mid-summer, June to September. It prefers sun and is very drought tolerant. In dry regions, it grows deep and extensive roots to capture rainfall. It grows in dry, well drained, gravelly, sandy, limestone or calcareous soils.

*Continued on page 4*



### ***Oxytropis sericea* – White Locoweed**

**Description:** White locoweed is similar to purple locoweed described above, except for these minor differences: The flowers are colored white. The keel (lower petals) may have a purple spot on it. Sericea mean silky in Greek. It refers to the silky gray hairs covering the leaves. The flower typically blooms earlier, late May to early June. The white locoweed can grow at higher elevations up to 12,000'. It grows in the plains, foothills, open-forests, sub-alpine and alpine climates and especially in disturbed soils such as road cuts.

**Landscaping uses for locoweed:** Locoweed should be used in landscaping thoughtfully; please read the Wicked Weed section before deciding to plant locoweed. Locoweed can be used in the following types of gardens: xeriscape, rock, butterfly, wildflower, prairie, or native gardens. Locoweed can be used as an accent plant in xeric borders. They can be planted under aspens, ponderosa, limber and bristlecone pines. Locoweeds are also an important source of nectar for the Broad-tailed Hummingbird. If you decide to plant locoweed in your garden, they are easily grown from seed. Nick the seed opposite the hilum (the scar on the seed where it was attached to the seed casing (pod)) and sow directly after danger of hard frost, usually mid-March. Water regularly to aid germination. Transplanting locoweed can be difficult. 🌱



*Oxytropis sericea* (White locoweed). Photos courtesy of Ernie Marx, Eastern Colorado Wildflowers, <http://easterncoloradowildflowers.com/index.htm>

**Additional plant sales in Pueblo County:**  
**Nature and Raptor Center, April 25, 9 a.m.-2 p.m., 5200 Nature Center Road**  
**Xeriscape Gardeners of Cattail Crossing, May 16, 9 a.m.-noon, Pueblo West Library**





### **Garden Tip:** Reuse Grass Clippings

Rather than bag grass clippings and send to the landfill, try reusing them in your landscape. Leaving clippings on the lawn and letting them decompose on site actually reduces or even eliminates the need for supplemental fertilization. And contrary to myth, clippings do not contribute to thatch buildup. See CSU Extension fact sheets 7.007 and 7.202 at <http://www.ext.colostate.edu/index.html> for more information on lawn care.

### **Busting Clay the Easy Way** by Greg Nolan, Native Plant Master, 2010

Busting clay soil can make the most accomplished sod buster head for a sandy beach. But rather than taking a pickaxe to your garden, how about choosing plants to help with busting clay soil?

Clay soil is made up of extremely fine particles and silts that compact very tightly as they settle and dry. The finer the particle the tighter the compaction; much like Portland cement, clay gets hard. When clay becomes compacted by heavy machinery or vehicles, it may be difficult for water, nutrients and oxygen to penetrate it. Although clay soil can be challenging, it also holds water well and can contain many nutrients. Clay can offer the gardener a very fertile pallet to paint their dreams.

The recommended way to improve clay soil is to add organic matter. But broken shovel handles and sore backs often discourage gardeners. But don't head for a beach yet, let plants do your clay busting for you. As roots grow, die, and decompose, natural compost is added to clay soil, clumping small particles together and making your more finicky plants happy along with clay loving plants.

Typically, when we think of clay busting plants, we immediately think of cover crops and green manures. However, a person living in the city or trying to landscape their yard may not want to plant agricultural crops. Clay busting plants can be selected through personal preferences and desirable traits, with the goal of letting deep or wide spreading roots break up clay soil.

Some clay busting plants can be used to fix nitrogen such as rye and alfalfa, others are edible and require more water such as peas, carrots, radishes, and dandelions. Some clay busters can be used to reclaim soils, contribute to a xeriscape landscape, and may use little water.


Recommended water-wise native grasses include: big bluestem, little bluestem, side oats grama, blue grama, and buffalo grass. Other plants can add color such as sunflowers and deep rooted perennials. Several web sites, garden catalogs, and Plant Select list clay loving (or at least clay tolerant) plants that are clay loving. If a plant loves clay soil, its roots will help increase organic matter over many years.

Beyond busting clay soil, consider what else plants can do for the landscape. If nitrogen is low, consider green manures that contribute nitrogen. Rhizobacteria and beneficial organisms associated with legumes can enrich soils. Moist soil and adequate organic matter support earthworms, which help stir and break up soil.

Some clay busters such as annual vegetables and sunflowers have shallow roots but help initially in getting the top layer of soil broken up. Once the top layer is broken up, compost can be turned into the soil more easily and water penetrates a bit better. Other clay busters, such as grasses, alfalfa, legumes, and perennial prairie flowers, can penetrate the soil up to 20 feet.

Consider what the garden needs and the time required to grow a particular clay busting crop. Alfalfa can set roots up to 20 feet deep in just one growing season and be used as green manure. Sunflowers are easy to grow, add color, and choke out weeds. Shallow rooted sunflowers could be followed by deeper rooted plants such as carrots. Or, just plant native grasses and let them bust clay for years to come.

In all cases, if the plant is allowed to set seed, more will come up next year. It is wise to remove plants such as cover crops before they seed or pull flowers prior to them dropping seed.

While there is no one best clay busting plant, there are many that will fit the conditions in your landscape and time frame. Clay busting does not have to be a dreaded chore but can provide a gardener with a unique challenge where they can exercise their creativity and extend their gardening confidence and abilities. 




## Seed Lending Library Update by Deric Stowell, Community Gardener and Colorado Master Gardener, 2014

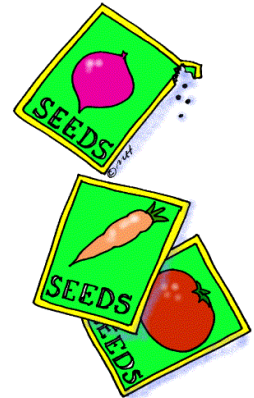
The Colorado Master Gardeners (CMG) of Pueblo County, the Pueblo City-County Library, and Keep Pueblo Beautiful have partnered to build a Seed Lending Library currently housed at the Rawlings Library. In the future, we hope to expand it to the other branches in the library system.

Pueblo County now has over 30 community and school gardens. The Seed Lending Library will become a resource for those gardens as well as the community as a whole. The CSU Extension-Pueblo County CMG's have pledged to hold educational classes at the library and to coordinate the inventory building for the seed library. The Pueblo Library has agreed to host and house the seed library and Keep Pueblo Beautiful has agreed to help support the seed library financially.

Seeds are available for local gardeners and farmers to "check out" with the agreement that they grow them out and collect some of the seed to return to the library. The seed of each new generation will better adapted to the climate in the Pueblo area, increasing resistance to disturbance and drought in our gardens and farms.

With almost one third of all Pueblo County residents receiving some kind of food assistance, and there is a growing interest and need for food security within the community. The seed lending library program assists with food security by making the seed of well adapted edible plants to local gardeners.

But, we need your help. Please consider donating leftover seeds in their original packaging or save seeds from your best performing garden plants this year and bring them to CSU Extension-Pueblo County at 701 Court Street, Suite C, or the Rawlings Library. 



### All Pueblo GROWS Seed Lending Library

At the Rawlings Library, 2nd Floor

How to use the seed lending library

1. Select seeds
2. Check out seeds
3. Grow seeds
4. Harvest seeds
5. Return seeds to the library



The mission and purpose of the All Pueblo Grows Seed Lending Library is to provide community outreach and education about the time honored tradition of saving and preserving seed.

The project is a partnership of the Colorado Master Gardeners of Pueblo County, CSU-Extension — Pueblo County, Pueblo City-County Library District and Keep Pueblo Beautiful

Visit All Pueblo Grows on Facebook or the Pueblo City-County Library website.

Colorado Master Gardeners and CSU Extension staff will hold free, one hour, gardening classes at various Pueblo City-County libraries this spring. Here is the April schedule:

**All Pueblo Grows Presents: Starting Your Garden From Scratch.** *Learn to successfully start seeds indoors. Colorado Master Gardeners will share tips on choosing containers, soil, heat mats, and lights. Learn how to time your seedlings for ideal transplant dates and how to transition your plants from indoors to the vegetable garden.*

Pueblo West Library, Friday, April 10, 11:00 a.m.

Greenhorn Valley Library, Friday, April 17, 4:00 p.m.

Rawlings Library, Saturday, April 18, 2:00 p.m.

**All Pueblo Grows Presents: From Comfort to Reality.** *Learn how to successfully transition your plants from indoor seedlings to mature, producing members of your vegetable garden. Colorado Master Gardeners will share tips on soil preparation, spring weather protection, irrigation, and mulching.*

Lucero Library, Monday, April 27, 6:00 p.m.

Lamb Library, Tuesday, April 28, 4:30 p.m.





## **LOCOWEED: NATIVE OR WICKED? YOU DECIDE!**

by Orla O'Callaghan, Colorado Master Gardener, 2005, Native Plant Master, 2009

### **Part 2: A Native Plant That Produces Wicked Results**

Noxious weeds are a concern, because they can threaten biodiversity and ecosystem stability. Noxious weeds can steal precious moisture, nutrients and sunlight from surrounding native plants. Noxious weeds can also cause financial costs to farming and agriculture. So, are locoweeds noxious weeds? No. Noxious weeds are non-native plants that grow unchecked by natural predators and enemies such as insects and disease. Locoweeds are natives that do have to deal with insect and disease. Because locoweeds are native plants, they are not listed on the Colorado State Noxious Weed Lists or Pueblo County Noxious Weed Management Plan, Chapter 8.20. Because it is not legally a noxious weed you are not required to manage or remove locoweed.

Even though locoweeds are not noxious, they certainly can be considered wicked, especially by ranchers. Locoweed is an attractive forage for livestock and wildlife because it greens up early in the spring and remains green late into the fall when other forage may be scarce or brown. This is unfortunate to say the least, since Colorado's most common species of locoweed, *Oxytropis lambertii* and *O. sericea*, are toxic. All growth stages and parts of the plant contain the toxin called swainsonine, which affects the animal's nervous system. Animals begin to act loco or crazy and they can become addicted.

Symptoms of locoism (locoweed poisoning) include depression, blindness, lack of coordination, loss of weight, tremors or seizures, paralysis, constipation, poor coat condition and abortion. Cattle that ingest locoweed have a greater chance of having high mountain brisket disease, resulting in congestive heart failure. When ingested in large quantities over an extended time (1-3 months), locoism can cause death in livestock. Locoism has been reported in elk and deer as well as livestock. Horses are particularly susceptible. There is no known treatment for locoism.

In addition to locoism, ingestion of large amounts of locoweed can also cause selenium poisoning, as locoweed absorbs selenium from the soil. While selenium in small amounts is essential for some cellular functions in animals, large amounts are toxic. A final concern about locoweed is, once established, it is hard to control. The growth and spread of locoweed can be controlled with herbicides, but its deep and extensive roots make it difficult to eradicate. The seeds can remain dormant in the soil, and remain viable for a very long time.

### **Part 3: Native or Wicked? Have you Decided Yet?**

So, is locoweed a well-adapted native worthy of planting in your garden, or is it a wicked "weed" that you want nothing to do with? That is for you to decide depending on where you live and how you use your property.

Things you should consider are:

- Do you have susceptible animals who might over-indulge and get sick?
- Do you have neighbors who have livestock?
- Do you have the right place for locoweed in your garden?
- Can you handle it when the pretty white flowers you planted are suddenly magenta due to cross pollination?

For detailed information on poisonous plants and their impact on livestock, view the recorded lecture, Poisonous Plants in Colorado by Dr. Tony Knight, CSU Clinical Science Professor, at

<https://connect.extension.iastate.edu/p4v3wpnlj13/?launcher=false&fcsContent=true&pbMode=normal>. 

If you need any special accommodation(s) to participate in any Colorado State University Extension event, please contact CSU Extension-Pueblo County at 719-583-6566. Your request must be submitted at least five (5) business days in advance of the event. Colorado State University, U.S. Department of Agriculture and Pueblo County cooperating. Extension programs are available to all without discrimination.







## GARDEN WALKS

### DEMONSTRATION GARDEN ROAD TRIP, ANYONE?

by Cheryl DeLong, Colorado Master Gardener, 2008

In spite of February's cold temperatures and strong winds, spring fever has hit me. Recent warm days and light breezes have taken hold of my desire to start visiting some Colorado gardens in other regions of Colorado. I've done some research and located some gardens that sound interesting and are near some of Colorado's special attractions or not far off the highway for a stop to stretch your legs and enjoy a break.

If you are headed toward the Four Corners region and specifically close to Mesa Verde, consider stopping at the **BLM-Anasazi Heritage Center, located at 27501 Hwy. 184 in Dolores, CO.** This is a combination of museum and gardens. The museum grounds cover about 100 acres that were first landscaped in 1988. The landscape design intentionally blends with and compliments the natural vistas of the Four Corners and Sleeping Ute Mountain. There is an informal outdoor seating area, picnic areas and paved walkways. You will find lovely stonework, natural meadows, planted flower beds and wild original forest cover.

The Anasazi Heritage Center and grounds are 7,100 feet above sea level, straddling the Pinyon/Juniper and Pine/Oak ecological zones. In the overlap of zones you will find an interesting blend of native trees, shrubs, grasses and flowers.

Denver also offers many events and areas of interest for the traveler to visit that I want to provide a garden en route and one that is historically located in the Denver area.

The first is located in the small Douglas County town of Sedalia which is located slightly northwest of Castle Rock. This garden surrounds the **Sedalia Museum located at the corner of Highway 67 and Platte Avenue.** The gardens were first created when a new fire station was built providing an opportunity to create a community garden with the surrounding property. The shared responsibility of maintaining the gardens falls to the Douglas County Master Gardener Program which cares for the plantings. The Sedalia Museum helps with funding, the Fire Department keeps the sprinkler system in good working order, and handles the lawn upkeep. Completing the concept of a community garden, local Boy Scouts have built the fence surrounding the garden and a bridge across a retention pond.

Driving further into Denver, I would urge you to stop by the **Fairmount Cemetery located at 430 S. Quebec Street (due to construction use the Alameda Parkway Entrance).** Fairmount Cemetery is the oldest cemetery in Denver and is the final resting place of many of Colorado's historical citizens. The grounds are incredible and this year they are celebrating their 125<sup>th</sup> anniversary. The reason I selected this specific location was because the grounds were originally designed to resemble a lush park. Fairmount was established in 1891 with the planting of over 4,000 saplings, 100 large trees, 220 evergreens, 200 vines and creepers, 2,000 shrubs, 280 roses and 686 herbaceous plants for a total of almost 7,500 plantings. Today, Fairmount remains Colorado's largest arboretum and includes the Heritage Roses Gallery. There are designated wildlife viewing areas from which you are likely to see diverse species of birds including owls, hawks, and Golden Eagles. Fairmount is also home to many mammals such as deer and fox.

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Sedalia Museum (left) and BLM-Anasazi Heritage Center (below) are two of the nearly 90 Plant Select® gardens in the Rocky Mountains region. You can find information and photos (including these) of Plant Select® gardens at <http://plantselect.org/>



## Native Plant Walks in Southeastern Colorado

The Colorado Native Plant Society hosts native plant walks throughout the summer. Lead by knowledgeable botanists, the 2015 schedule will take you to plant rich sites from the Comanche grasslands to near the summit of Pikes Peak. To view the schedule and register for these trips, visit the CoNPS Southeastern Chapter website at <http://www.conps.org/Chapters/southeast.shtml>.





A nearby garden that should not be missed is the **Trinidad History Museum at 312 E. Main St.** The Baca-Bloom Heritage Gardens are anchored around the Baca House. Many people are drawn to visit Trinidad and the various historical sites and Santa Fe Trail events. Geocachers are finding their way to this part of our state to search for “planted” caches. There is a kitchen garden that boasts heirloom herbs and vegetables. Those who love roses will appreciate the Victorian flowers and antique roses that surround the home. A Plant Select garden is also part of the heritage gardens and prides itself for the native flowers, cacti and grasses that help encourage the planting of water wise plants. 🌱

### **Arkansas River Basin Water Forum** by Michael Fisher, Pueblo County Extension Director

The 2015 forum is at Pueblo Community College in Pueblo, CO on Wednesday and Thursday, April 22-23, 2015.

***This year's speakers and topics are excellent.*** Get ready to:

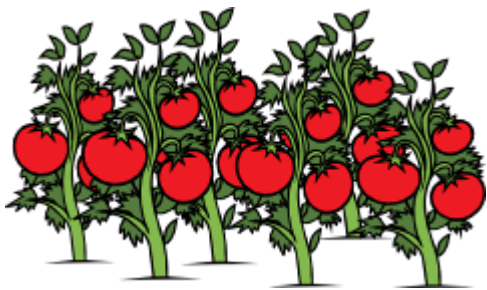
- Hear from key water experts like John Stulp, James Eklund, Michael Rupert, and Nolan Doesken.
- Get updates on all areas of practice including Fountain Creek, Colorado's Water Plan, the Arkansas River Basin's Water Plan, Arkansas River Basin Climate and Headwaters Citizen's Task Force.
- Tour Pueblo Dam and Reservoir and learn about programs such as the Fish Hatchery, the Hydroelectric Power Plant, the Arkansas Valley Conduit Project, and the Southern Delivery System.



Don't miss it! Connect with professionals across the Basin, learn more about the Arkansas River, and *Celebrate the Age of Water.*

Review our program agenda and register here: <http://arbwf.org/> 📄

### **Choosing the Right Tomato For Your Garden** by Linda McMulkin, CSUE



Successful tomato production in the home landscape starts with good soil, adequate light, and sufficient water, and the conditions change from one garden to another. With proper care, any tomato cultivar can produce fruit. But have you ever tasted that one fruit that makes your taste buds sit up and take notice? That type of success starts with choosing the best cultivars to purchase or grow from seed.

Carol O'Meara, CSU Extension Horticulture Entomologist from Boulder County and an avid tomato grower, gives talks on the best tomato cultivars in her garden and the community favorites from their

tomato taste off, held during peak harvest in the summer. I've reviewed her list with Kata Schmidt, Colorado Master Gardener and avid tomato grower, to see what does well in Pueblo and surrounding towns. Here is their list of great cultivars to try:

**Cherry types:** Sungold, sweet million, Green Doctors, Yellow Pear, Chocolate Cherry, Italian Ice  
**Salad slicers:** Early Girl, Better Boy, Green Zebra, Oregon Spring, Celebrity  
**Canning/paste:** San Marzano, Amish Paste, Roma, Goliath Roma, Principe Borghese  
**Beefsteak types:** Brandywine, Gold Medal, Cherokee Purple, Aunt Ruby's German Green, Big Beef, Beefsteak, Black Krim

Colorado Master Gardeners Kata and Tashia will be selling seedlings of these and other great tomatoes for Pueblo at the Zootastic Plant Sale on May 2. For more information on growing tomatoes, check out CMG GardenNotes #717 at <http://www.ext.colostate.edu/mg/Gardennotes/717.pdf> and CSU Extension fact sheet 2.949 Recognizing Tomato Problems at <http://www.ext.colostate.edu/pubs/garden/02949.pdf>. 📄



## CSU Extension Classes and Events

**Save  
the  
Date!**

- Saturday, April 4, **Food Safety for Cottage Food Producers**, 9:00-11:30 a.m., CSU Extension  
Register by March 31, tuition \$20
- Saturday, April 11, **Growing Vegetables**, 9:00 a.m.-2:00 p.m., Southeastern Colorado Water  
Conservancy District. Register by April 6, tuition \$15 or \$25 for couple sharing materials
- Friday, April 17, **World Cultures Through Food-Romania**, 5:30-8:30 p.m., CSU Extension  
OR Monday, April 20, **World Cultures Through Food-Romania**, 5:30-8:30 p.m., CSU Extension  
Register for either date by April 13, tuition \$20 and includes meal
- Wednesday, April 22, **Food Safety for Cottage Food Producers**, 3:00-5:30 p.m., CSU Extension  
Register by April 18, tuition \$20
- Saturday, April 25, **Arbor Day Tree Festival**, 10:00 a.m.-2:00 p.m., City Park, free and open to all
- Saturday, May 9, **Essential Botany for Plant Identification**, 9:00 a.m.-2:00 p.m., SE Colorado Water Conservancy  
District. Register by May 4, tuition \$15 or \$25 for couple sharing materials
- Saturday, May 2, **Zootastic Plant Sale**, 8 a.m.-1 p.m., Pueblo Zoo Mandari Shelter House
- Saturday, June 6, **Xeriscape Garden Tour in Pueblo**, 9:00 a.m.-3:00 p.m., free, maps will be available in May
- Sunday, June 7, **Xeriscape Garden Tour in Pueblo West**, 9:00 a.m.-3:00 p.m., free, maps will be available in May
- For more information or to register for classes, contact CSU Extension-Pueblo County at 719-583-6566. Or visit us on  
the web at <http://pueblo.colostate.edu/> or at CSU Extension Pueblo County Horticulture Program on Facebook.

### Garden Tip: New in 2015

It's always fun when Plant Select® introduces a plant from our area or a hybrid of a local native plant. In 2014, Goldhill golden-aster was one of the introductions in the petites line. One of the parents of this hybrid is our own *Heterotheca villosa* or hairy golden aster.

On the plains and in the foothills of Pueblo County, *H. villosa* is a common roadside plant that blooms from late spring to frost. It is heat and drought tolerant and can withstand hail, neglect, and even mid-summer mowing. If the hybrid is half as tough as the parent, it will be a great addition to your dry garden.



### GOLDHILL GOLDEN-ASTER

*Heterotheca jonesii* × *villosa* 'Goldhill'









**HEIGHT:** 1-2"

**WIDTH:** 5-10"

**BLOOMS:** Spring to fall

**SUN:** Full sun is best

**WATER:** Dry to xeric

**HARDINESS:** USDA zones 5-8

**CULTURE:** Well-drained soil

**INTRODUCED:** 2015

**PERENNIAL**

Tufted grey "scatter rugs" of fuzzy foliage make dense mounds in a sunny garden, clothed from late winter to fall with cheerful yellow daisies. This natural hybrid flourishes in containers as well as rock gardens. The small perennial is resistant to deer and attracts a wide range of pollinators.







[www.plantselect.org](http://www.plantselect.org)

### Garden Tip: Controlling Annual Weeds in the Home Landscape

Annual plants germinate from seed each year and complete their life cycle in a single growing season. Some annuals come up in the fall and finish their life cycle in the early spring (cheat grass, red stem filaree), while others come up in the spring and complete their life cycle before frost in the fall (crabgrass, Russian thistle, puncturevine). For all annual weeds, the goal is to prevent the beginning of the life cycle (germination) and end of the life cycle (seed production before death).

In lawns, mowing high will prevent seed germination by shading the soil (most seed needs light to germinate). In beds, mulch provides the same shade protection. Pre-emergent herbicides can be used, but must be timed properly and watered in for good results. After germination in all settings, hand pulling, hoeing, or mowing before seed set are economical ways to prevent the next generation, and next year's headaches.





## INTERESTING INSECTS

### **STRESS PUTS TREES AT RISK** by Linda McMulkin, CSU Extension-Pueblo County

Insects that infest woody landscape plants are always a concern for homeowners and public property managers. Whether the insect chews, sucks, or bores into the wood, our trees and shrubs are susceptible to a variety of insect pests. And any plant under stress is more susceptible than one that is well maintained and healthy.

Plant stress comes from a wide range of environmental factors. In urban landscapes, perhaps the most common stressors happen below the ground. Compacted soil, small rooting space, competition with other plants, poor drainage, high salts, lack of water, nutrients, or oxygen, or too much water or nutrients, are factors that decrease root health and increase plant stress. Bare soil can become very warm and impact root function. Often, multiple soil problems occur at the same time, making it extremely difficult to determine what changes to make to improve the health of the root system.

Above ground stressors are often easier to spot but no easier to avoid. Weather plays a huge role in the health of shoots, leaves, flowers, and fruit. Drought, flood, wind, hail, snow, and extreme temperature fluctuations all impact plant health. The intensity of our high elevation light can have both a positive and negative impact on tree and shrub health, depending on whether the plant is correctly sited in the landscape. Heat can be a source of summer stress and influences dormancy in both the spring and fall.

People, unfortunately, can be the biggest challenge to woody plants. Improper plant selection for the site and poor planting technique are two of the most common causes of plant stress, along with planting too deep, not removing burlap and twine, and poor irrigation practices during establishment. Tree and shrubs can be damaged by lawnmowers, string trimmer, and trenchers. Many trees and shrubs in Pueblo are poorly pruned or topped. Plants may be subjected to improperly applied herbicides or insecticides.

And sometimes we just love our plants too much, drowning them with water or over fertilizing them in the hopes of forcing growth or improving health. Unfortunately, too much of a good thing can actually increase stress to plants and may send marginal trees and shrubs into irreversible decline.

Perhaps the most recent stressors for woody landscape plants have been years of drought and abrupt temperature changes in the spring and fall. Years of poor growth due to drought, even in irrigated landscapes, has weakened many trees and shrubs. Water placement rather than water frequency causes plant damage when irrigation coverage does not provide moisture to the entire root zone.

For stressed plants, insect infestation becomes a bigger problem than on healthy plants. Aphids or mites that suck plant sap reduce the amount of water reaching the leaves, thus reducing photosynthesis and limiting the production of the sugars needed for growth and winter storage. Heavily fertilized trees are actually more attractive to sucking insects, since tender new growth is easy for the mouthparts to pierce. Plants under drought conditions produce fewer or smaller leaves, making any loss by chewing insects such as elm leaf beetle or pine tip moth an additional stress. And dry plants are unable to muster their natural defenses when bark boring insects such as Ips beetle or lilac/ash borer attack.

What can you do to protect your landscape investment? Choose plants wisely, install them properly, care for them according to their needs, and watch for insect infestations. Remember that healthy plants can tolerate some insect pests and that damaging insects are often followed by their predators (beneficial insects and birds).


The saying “knowledge is power” is certainly true when dealing with pests in the landscape. A very helpful resource for predicting when certain insects will appear in the landscape is the Checklist of Common Insect Related Events-Pueblo/Fremont Counties, available at <http://bspm.agsci.colostate.edu/files/2013/03/PuebloFremont-Insect-Calendar1.pdf> (selected area calendars are available on the CSU Bioagricultural Sciences and Pest Management website). Once you know what to look for, learn more by reading fact sheets from CSU Extension or by visiting with your local CSU Extension agent or Colorado State Forest Service forester. 



Photo courtesy of W. Cranshaw



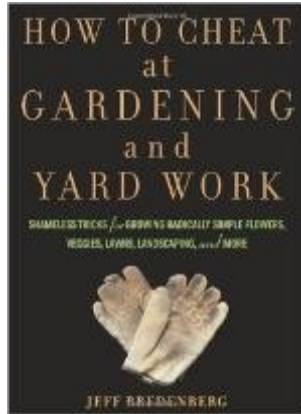




## **HOW TO CHEAT AT GARDENING AND YARD WORK**

by Georgi Lipich, Colorado Master Gardener, 2007


As Master Gardeners or professionals in the gardening industry, we pride ourselves on knowing how best to garden, whether it is trees, flowers, veggies, grasses, native plants or lawns. What we DON'T always do is think about the fact that some shortcuts can be made that will save us time, energy, money, stress, achy muscles and stiff backs.



"How to Cheat at Gardening and Yard Work" is chockfull of these tips! One of my personal favorites is the very first one mentioned in the book. Say you've just had a new tree delivered. You've scoped out your yard, dug your hole, argued with your spouse and chased the cat out of the hole...truck arrives with your tree, and if you're lucky, they don't just dump it in your driveway. Beg, plead and pay off the delivery man, but ask him to bring the truck as close to the designated spot as possible. Most of us would be happy with that, right? Great! Now you have a couple of hundred pounds of wood and dirt that needs to be maneuvered into the hole and then slowly turned until the designated "Boss" decides it is facing in the correct direction. But wait! BEFORE you and your helpers wrestle that monster into its hole, FILL the hole two-thirds of the way with water. Now you have a slightly "floating" root ball that can be turned to your heart's content, or at least until your helpers throw up their hands, walk away and all the water is absorbed. What a simple idea!! Why didn't I think of that?

This great book reminds me of my grandmother's old cookbooks. You know the ones...the ones that first told you to "butter" your hands when kneading, to remove your rings before rolling balls of cookie dough, how to boil eggs that will peel easily, how to season a cast iron frying pan and make the best cup o' Joe.

Tucked into this book is a "Cheat Sheet" called "Weeds Give Clues About Soil". We all know we SHOULD take soil samples into be tested. But, do we all do that? Just paying attention to the weeds in your soil can yield tons of information about it. According to the author, soils abundant with dandelions are usually acidic, whereas alkaline soil is great for chickweed and thistles. These are facts that, for me, got lost somewhere in all the information presented in training. Having it presented in "real people-speak" will help.

I plan on taking my time with this book, taking notes, highlighting, and enjoying all the wonderful time & money saving tips Jeff Bredenberg presents. "How to Cheat at Gardening and Yard Work" is a gem! 

### **If You're Growing Plants, You're Probably Growing Polyploids** by Ed Roland

A "polyploid" is just another way to say that a plant has more than two complete "sets" of chromosomes. (The number of chromosomes in each set varies widely.)

Before becoming a polyploid, a flowering plant species would get one set of chromosomes from the male reproductive cell (in the form of pollen), and one set from the female parent in an unfertilized egg located in the ovary. When one set of chromosomes is contributed by each parent, whether plant or animal, fertilization takes place when the chromosomes from the male cell line up with the chromosomes contributed by the female in the egg. The nucleus in the new fertilized egg cell then "reads" the DNA of the two aligned sets of chromosomes to build an embryo. Because each parent plant has two sets of chromosomes, and the new embryo receives two sets (one from each parent), the term "diploid" ("di -" meaning two) is used to describe their chromosomes.

Unlike mammals -- where an extra chromosome or two (much less an entire extra set) typically produces a non-viable fetus -- plants not only tolerate "accidents" that provide extra chromosomes, but can actually benefit from them. In fact, plant physiologists estimate that 40% to 70% of angiosperms (flowering plants) are actually polyploids. So, as the title of this article indicates, if you are growing plants, odds are you're growing polyploids.

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When a plant gets extra sets of chromosomes, it also gets the genes that come with them. Genes are just segments of chromosomes that are "expressed" in the plant as its characteristics. They can be thought of as giving the plant "doses" of things like its flower color, the tissues that make up its leaves, stems and other parts, etc. So, when a polyploid plant gets additional chromosomes, it can get more doses of everything, including growth hormones. In effect, it becomes like a plant on steroids. Very often you can actually see a significant difference between a plant that has extra chromosomes and the diploid species that produced it. (See Figure A.)

In my propagation classes, I usually include a slide of some blue and purple petunias. These plants were grown intermingled in trays, so inputs like water, light, soil, etc., were identical. The diploids were typical of the species, while the polyploids were almost twice the size, with a much more robust appearance and deeper colors showing that their embryos received additional doses of color pigment, growth hormones, etc., from the genes on their extra chromosomes. The larger size is also a result of cells that must be larger to make room for the additional chromosomes.

Another example of the "power of polyploids" is the wheat grown for flour (used in our bread and other baked goods). *Triticum aestivum* is a polyploid, specifically a hexiploid, which means it has 6 sets of chromosomes. Its extra sets of chromosomes (and genes) makes this wheat highly productive, exceptionally cold tolerant, and extremely adaptable -- so it can be successfully grown over a wide section of the central United States, an area iconically described as our "breadbasket."

In addition to wheat, many other crop plants were cultivated as polyploids because they are larger and higher-yielding than diploids. This includes oats, cotton, potatoes, peanuts, sugar cane and strawberries. Ornamentals like marigolds, lilies and hyacinths (among many others) have also been hybridized as polyploids to produce larger and longer-lasting flowers.

A polyploid that's literally closer to home is in my front yard. The buffalograss I established there a few years ago is a cultivar called "Bowie," a tetraploid hybrid developed by the University of Nebraska. The prefix "tetra-" means it has 4 sets of chromosomes. Research shows that buffalograss, *Buchloe dactyloides*, was originally a "south-of-the-border" warm season grass with two sets of chromosomes that evolved as a polyploid as it migrated into our colder climates. So, if I want to go with the evolutionary flow, knowing its ploidy (the term used by botanists) and genetic history helps me choose a grass that will survive our coldest winters, green up early (compared to other warm season species), have a late fall dormancy, and generally thrive in this area.

### How do polyploids happen?

Plants get extra sets of chromosomes in three ways:

1. When a plant's cells divide for growth or to produce pollen or eggs for reproduction, a mutation takes place that fails to divide the chromosomes. As a result, the pollen or egg it contributes for reproduction will have twice the chromosomes it ordinarily would have. So, even if it receives pollen from a "normal" male flower or plant, a female plant with extra chromosomes will produce a polyploid seed.
2. Alternatively, if a normal female plant is fertilized with pollen that has extra chromosomes, it will produce a polyploid seed.
3. Finally, it's also possible that the pollen and the egg from two different plants or flowers could both have extra chromosomes and combine them in one seed.

Research shows that this kind of "doubling up" mutation happens in about 0.6% of uncultivated flowering plant reproductive cells. That may seem like a very small incidence -- and it is -- but in the context of many generations over thousands of years it's easy to see why

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Figure A: Both trees were propagated at the same time and grown under the same conditions a few meters apart. The tree on the left is from the diploid parent stock while the tree on the right is a polyploid produced by duplicating its sets of chromosomes. Images courtesy of PolygenomX, <http://www.polygenomx.com>.



biologists see polyploids as one of the major forces driving evolution.

You may have noticed that the examples above all have even numbers of chromosomes. That's because, in order to have viable seeds, each chromosome in each set must align with the equivalent (same basic genetic information and length) chromosome in another set. However, while chromosome alignment is essential, the genes that express characteristics on those chromosomes can be very different. A chromosome from one parent may have a gene that calls for a white flower, but the gene on the corresponding chromosome may be coded for red. Obviously, if a polyploid is a true hybrid it will have more of these gene differences than if its extra chromosomes came from the same species or even the same plant. And, like most true hybrids, it will likely be a more successful new plant because of "hybrid vigor," while the plant with the same or very similar chromosomes will likely suffer from typical "inbreeding depression."

Since the most common mutation is when individual plant parents double their chromosome number from 2 (a normal diploid) to 4 during cell division, "tetraploids happen." Since a tetraploid seed is fertile (because 4 is an even number and all chromosomes can align), tetraploids are by far the most common polyploids found in nature.

An interesting aspect of all this polyploid reproduction is that, after many generations, polyploids tend to regress back to diploid status. The new chromosomes they acquired through polyploidy, and especially the genes that came with them, become so differentiated over time due to ongoing mutations that they once again become unique contributors to the plant's genome. So, for plant scientists, trying to determine whether a plant was once a polyploid, or has always been diploid, can be a real challenge. This partly explains why the percentage of polyploids in nature is such a widely varying estimate. It's often a case of the polyploid being "in the eye of the botanist."

### When Chromosomes Don't Align

Potential plant parents that contribute an odd number of chromosome sets which, as a result, can't align in the fertilized egg will almost always produce a small, infertile seed -- a reproductive "dead end." But some plants have been purposely bred as triploids (i.e., with three sets of chromosomes) so that chromosomes can't align to produce viable seeds. (See Figure B). Triploid "seedless" watermelons and grapes are common in our supermarkets, not to mention triploid bananas, which in the original diploid state have large, inedible seeds. Without viable seeds, these valuable "crop" triploids can only be reproduced as genetic clones by using vegetative techniques, such as tissue cultures or cuttings.

### Conclusion

Polyploids in plants are the result of chromosome mutations that take place during cell division. In a natural environment, a very small percentage of cell divisions "misfire" to produce a duplicate set of chromosomes. (See Figure C). However, over many generations these mutations add up to be a major force for evolution.

When duplicated chromosomes with somewhat different, but related, genes align in a fertilized egg, the new polyploid embryo can grow into a plant that's essentially "on steroids." It will be bigger, stronger and have more of everything it needs to be superior. Left to nature, the "survival of the fittest" principle comes into play and the new polyploid plant and its offspring grow to dominate its existing habitat, and will likely extend its range. And, eventually, one of its descendants may even wind up in your garden as "best of show."

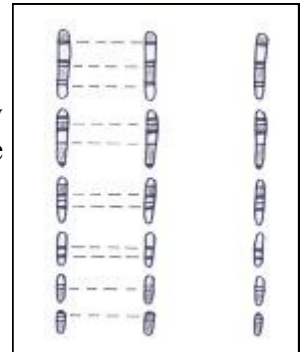


Figure B (above): This schematic shows a non-viable triploid seed with 3 sets of chromosomes. Since one of the chromosome sets is unable to align with a corresponding set, this seed will likely be a reproductive "dead end."

Figure C (below): This is a schematic of how a normal growth cell produces duplicate sets of chromosomes: a. chromosomes align, b. the spindle apparatus (shown as fine lines) attaches to duplicated chromosomes, c. the spindle apparatus pulls duplicated chromosomes apart into two new cells. Polyploids often occur when the chromosome sets are duplicated but the spindle apparatus fails to separate them.

